ADDIS ABABA UNIVERSITY

FACULTY OF INFORMATICS and FACULTY OF MEDICINE (JOINT)

HEALTH INFORMATICS PROGRAMME

EXPLORING THE POTENTIAL OF WEB-BASED DRUG INFORMATION SYSTEM IMPLEMENTATION AMONG PHARMACIES AND DRUG STORES IN ADDIS ABABA

By

Elias Alemayehu (B. Sc.)

June 2010

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ACRONYMS

AACARHB – Addis Ababa City Administration Health Bureau

AAU – Addis Ababa University

ADR – Adverse Drug Reactions

AOR – Adjusted Odds Ratio

COR – Crude Odds Ratio

DACA – Ethiopian Drug Administration and Control Authority

DIS – Drug Information System

DIS Center – Drug Information Service Center

DRO – Drug retails Outlets

DTC – Drugs Therapeutics Committee

EDF – Ethiopian Drug Formulary

EDL – Essential Drug List for Ethiopia

ETA – Ethiopian Telecommunications Agency

FMoH – Federal Ministry of Health

HSDP – Health Sector Development Program

HMIS – Health Management Information System

ICT – Information and Communications Technology

IT – Information Technology

ITU – International Telecommunications Union

NDL – National Drug List of Ethiopia

NDP – National Drug Policy

NGO – Non-governmental Organization

PFSA – Pharmaceutical Fund and Supply Agency

SPSS – Statistical Package for Social Sciences

WHO – World Health Organization

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ABSTRACT

Background: Web-based drug information system will provide a multifaceted benefit in terms of providing up-to-date, impartial and scientific drug information to health professionals as well as allow health professionals where patients can find drugs on their prescription. The study of the potential implementation of such a system in Addis Ababa will provide insights into the status and availability of the premises onto which such a system can be implemented.

Objective: The objective of the study was to identify the prospects of implementing a web-based drug information system in Ethiopia, considering the country's unique pharmaceutical sector. The study used IT infrastructure availability, knowledge and attitude of respondents, as well as level of government commitment as outcome variables.

Methodology: A cross-sectional survey of 265 pharmacies and drug stores in Addis Ababa was conducted to gather information about their IT infrastructure and the knowledge and attitude of their chief pharmacists and druggists towards the prospective implementation of web-based drug information system. Key informant interviews with designated government officials were also conducted. The responses to the survey questions were analyzed using SPSS software v16.0 whereas thematic classification was used to analyze and interpret the interviews.

Important Findings: The survey revealed that 117 (44.2%, N=265) Drug Retail Outlets (DROs) have at least one computer in their store. Thirty-three (12.5%) DROs have Internet connection. An additional, 58 (21.9%) and 51 (19.2%) DROs indicated that they have planned to acquire computers and internet connection to their store respectively. In terms of knowledge and attitude, 66% of the respondents had satisfactory knowledge while 73% had a favorable attitude about using web-based DIS in Ethiopia. The study also identified the need for training and continuous education to upgrade the knowledge and skills of health professionals.

Conclusion: The majority of respondents have the required knowledge and attitude to use a web-based drug information system. However, more training and continuous education should be provided to health professionals in the field alongside promoting up-to-date drug information use to more drug retail outlets. There is an enabling environment for the commencement of implementing a web-based drug information system in Ethiopia.

CHAPTER ONE

1.1 INTRODUCTION

Ethiopia's health system is overstrained with a high prevalence of preventable communicable and infectious diseases due to widespread poverty, low education levels, inadequate access to clean water and sanitation facilities and poor access to health services (1). In its efforts to improve this situation, the government of Ethiopia has launched a series of five-year strategic plans for the health sector called Health Sector Development Programme (HSDP I, II, III, IV). Currently, this program is on the final year of the third stage and beginning the IV stage at the end of June 2010, (HSDP-III; from 2005/6 – 2009/10). Among the major objectives and strategic issues of this program has been the Pharmaceutical Service.

In this regard, the government acknowledged that a well functioning pharmaceutical service is the foundation for any worthwhile health service. It also emphasized that strengthening this intervention must target ensuring regular and adequate supply of essential drugs in an effective, safe and affordable manner, and ensuring their rational use (1). The Ethiopian Drug Administration and Control Authority (DACA) and the Pharmaceutical Fund and Supply Agency (PFSA) are the two regulatory bodies of the government's in the pharmaceutical sector. DACA is responsible for the overall policy implementation and administration of the sector while PFSA is responsible for the procurement and supply of medical equipment and drugs to health institutions (1).

The fact that there is a scarcity of health professionals in the health system, particularly those knowledgeable enough to provide specialized care, as practically observed, requires that health professionals be either equipped with the best possible tools for providing useful and timely information about drugs, or specialized pharmacists or druggists be available in cases the need arises for consultancy. In the rest of the world, pharmacists are being equipped with technological solutions – tools such as Internet-based drug information – so that they contribute to quality health care delivery.

Hence, it becomes apparent that in a health system overstrained by high prevalence of preventable diseases and acute shortage of health professionals, bringing technology to support

the rational use of drugs and regular and adequate supply of essential drugs in an effective, safe and affordable manner is of paramount importance.

The Internet provides a multifaceted benefit when considering with what type of technology the pharmaceutical sector should be supported. Some of these benefits are its low-cost availability, and the fact that it provides a window to the latest drug information, including adverse drug reactions (ADRs), to lists of outdated drugs, good dispensing as well as prescribing practices, etc. that professionals can use continuously to upgrade their knowledge in their profession.

Therefore, it is possible to design and develop a web-based drug information system for Ethiopia by considering the unique requirements of the pharmaceutical sector. Such a design will be participatory of its users in addition to allowing the preservation and promotion of the best practices the sector has maintained so far.

1.2 Objectives of the Study

1.2.1 General Objective

The main objective of this research is to study the potential of a web-based drug information system implemention in Addis Ababa.

1.2.2 Specific Objectives

The specific objectives of this study are to:

1. explore knowledge and attitude of health care providers practicing in pharmacies and drug stores in Addis Ababa about a web-based drug information system;
2. identify the availability of the necessary IT infrastructure in pharmacies and drug stores in Addis Ababa to use a web-based drug information system; and
3. explore the level of government commitment towards implementing a web-based drug information system

1.3 Rationale of the Study

In a country where the majority of the population has a low-income status, there is a pressing need that drugs be safe, affordable and dispensed rationally and equitably. Drug information surpasses the implied meaning of information about a certain drug and its formulary, brands and its manufacturer. It also encompasses the location of stock of that specific drug in drug retail outlets (DROs – pharmacies and drug stores) at a specific point in time. Such information helps low-income patients get the appropriate drug brands and in the nearest DRO, without them spending extra amount to go out and about the city/town looking for drugs on their prescription.

The effect of not getting a prescribed drug on time can be fatal, as witnessed in several occasions in the past. Introducing technological solutions such as the implementation of web-based drug information systems might help alleviate a significant proportion of the problem.

1.4 Scope of the study

A prospective implementation of web-based drug information system in Addis Ababa is supposed to work when the national DIC at DACA provides up-to-date, scientific and impartial drug information to health professionals; DIS centers in health facilities provide technical support to DROs, and health professionals share stock-out information with each other.

Since there are very few rural drug vendors in Addis Ababa (less than 4 in 2010, according to a DACA official), this study does not include rural drug vendors in Addis Ababa. The participants of the survey and the inclusion and exclusion criteria are described in chapter four of this thesis.

Pharmaceutical wholesalers, importers and manufacturers are not included in the study because they do not distribute drugs to the public. Since the objective is to improve, the amount of information available to the consumer (including patients) while reducing stock-outs and expiry of drugs, there is minimal interest in including these parties in this particular study.

This study also considers health professionals involved in drug dispensing activities (pharmacists, druggists and pharmacy technicians) to be the primary users of a web-based drug information system along with DIC personnel at different levels concerned with drug information generation, dissemination and use. However, it does not consider other health professionals to be the primary

users of the system and hence the scope of the study is limited to health professionals in the pharmaceutical sector, particularly in drug dispensary activities in Addis Ababa.

1.5 Significance of the study and Research Question

The question that will be answered by the result of this study is "**What prospects does the implementation of web-based drug information system in Ethiopia has in terms of being realized by DACA, health facility level DIS centers, and Pharmacies and Drug stores in Addis Ababa under current settings?**" The answer to this question reveals the premmises onto which such a system can be implemented, the improvements required, or if such a system cannot be implemented at all. The current settings refer to government's commitment and policy support, knowledge and attitude of health professionals, and the current IT infrastructure availability among DROs in Addis Ababa.

1.6 Operational Definitions

Pharmaceutical drug: also referred to as medicine, medication or medicament, can be loosely defined as any chemical substance intended for use in the medical diagnosis, cure, treatment, or prevention of disease.

Drug Information System: It is an information system comprising of DACA, Drug Information Centers (DICs), Pharmacies and Drug Stores, and Pharmacy professionals - pharmacists, druggists and pharmacy technicians.

Web-based information systems: It is an information system based on the Internet and that allows its components to communicate using browser software. A browser is a special computer software that allows users to access information stored in a central location from different places using different computers and other similar devices. Web-based systems are always associated with connection to the Internet.

Health Professional: A pharmacist, druggist or pharmacy technician who has a professional license issued and renewed by DACA, and who works for a pharmacy or drug store/shop in Addis Ababa

Drug Retail Outlet (DRO): A pharmacy or drug store that is located in Addis Ababa (that can be located within one sub city) and having a renewed license of operation from DACA.

Pharmacy: is a drug retail outlet established by a pharmacist with at least 5 years experience as a pharmacist, in accordance with the guideline for establishing pharmacies published by DACA.

Pharmacist: is one who has a pharmacy degree from an accredited university/college, has at least 5 years experience, and has his/her operational license renewed by DACA.

Drug Store: is a drug retail outlet that is run by a druggist – one that has a diploma in pharmacy, has at least 5 years experience, and whose operational license is renewed by DACA.

Druggist: is one who has a pharmacy diploma or equivalent from an accredited university/college, has at least 5 years experience and has his/her operational license renewed by DACA.

Rural Drug Vendor: can be set up and run by a pharmacy technician having at least three years of experience as a pharmacy technician, and having a license of operation provided from the DACA.

Pharmacy Technician: is one who has a pharmacy diploma or equivalent from an accredited university/college and has his/her operational license renewed by DACA.

IT Infrastructure: The presence and functioning of computers and/or Internet connection in a pharmacy, drug store or drug information center

Knowledge about computers and Internet: refers to respondents' level of awareness on computers and the Internet. The minimum level for having knowledge on computers and the Internet refers to knowing basic terminologies related to computer hardware and software, communication tools, and Internet services.

Attitude towards computers and Internet-based information systems: refers to respondents feeling, opinion or perception towards accessing and using of computer, Internet and electronic documents in general and web-based DIS in particular.

Satisfactory Knowledge about computers and the Internet: Respondents who scored equal to or above the second quartile ($\geq$ 50%) score for a set of nine basic knowledge questions.

Unsatisfactory Knowledge about computers and the Internet: Respondents who scored less than the second quartile (≥ 50%) score to a set of nine basic knowledge questions.

Favorable attitude: Respondents who scored the second quartile (≥ 50%) and above for a set of nine questions of attitude towards computers and Internet-based information systems are considered to have a favorable attitude.

Unfavorable attitude: Respondents who scored below the second quartile (≥ 50%) for a set of nine questions of attitude towards computers and web-based drug information systems are considered to have unfavorable attitude.

Have IT Infrastructure: Drug retail outlets having computers and Internet connection or planned to have computers and Internet connection are classified as having the necessary IT infrastructure required to use a web-based DIS in Ethiopia.

Do Not Have IT Infrastructure: Drug retail outlets that do not have computers and Internet connection or have not planned to acquire them in the near future are classified as not having the necessary IT infrastructure required to use a web-based DIS in Ethiopia.

1.7 Organization of this Thesis

This thesis is organized six chapters. The first chapter discusses the objective, the relevance and list of operational definitions. The second chapter introduces the reader about the whole concept of a web-based DIS in Ethiopia and the Ethiopian pharmaceutical sector. The third chapter presents the literature review that has been made prior to and during the conduct of this research thesis. The fourth chapter discusses the methodology employed to conduct this thesis. The fifth chapter describes analysis of the findings in terms of Results and Discussion. The final chapter provides the conclusion, recommendation, and strengths and limitation of the study. References and Annexes are also part of this thesis.

CHAPTER TWO

WEB-BASED DRUG INFORMATION SYSTEM

2.1 Concept and Definition

In order to give a definition of a web-based drug information system, a look at the definitions of what a system and an information system are is essential. Muneesh Kumar defines a system to be a collection of components that work together to achieve a common objective (2). An information system is also defined as "*an integrated effort to collect, process, report and use ...information and knowledge to influence policy-making, programme action and research*" (2). In this definition, it is also stated that an information system is composed of behavioral and technological subsystems. The behavioral subsystem consists of people, procedures, processes, information use culture, and activities that make up the processes. The technological subsystem consists of hardware, software, networks and data, which can be converted to information that is usable for decision-making purposes through processes. The interaction between these two sub systems makes up for an integrated system capable of achieving its objective. Hence, the essence of any information system relies on what objective, scope and amount of investment outlay is available to realize it; an information system can be unique wherever it is implemented (2).

The use of the term web-based is widely popular after the Internet flourished in the 1990s. It stems from the term World Wide Web (as in **www.**<websitename>.com and hence the term **web-based**), which is the major of the service being provided by the Internet. It is usually used to indicate an information system that uses the Internet as its backbone communication network. The definition of a web-based drug information system is best presented when it is associated with a specific context. In this study, the specific context used is the Ethiopian pharmaceutical system. Accordingly, a web-based drug information system for Ethiopia is an information system based on the Internet where

- DIS centers, Pharmacies, Drug Stores and Rural Drug Vendors use to provide and receive information about drugs, their formularies, and brands of drugs,
- Pharmacies, Drug Stores and Rural Drug Vendors share list of drugs that are sold-out from their store (stock-out information exchange) at a specific point in time,

- DIS centers, Pharmacies, Drug Stores and Rural Drug Vendors use to report in detail about Adverse Drug Reactions (ADRs) to DACA instantly,
- Pharmacies, Drug Stores and Rural Drug Vendors use to register their drug stock, maintain their drug stock balance by setting the minimum, maximum and reorder quantities and receiving notifications when these levels are reached, and
- Pharmacies, Drug Stores and Rural Drug Vendors use to receive notifications about drugs in their stock that are approaching their expiry dates

2.2 The Ethiopian Pharmaceutical Sector

The following diagram depicts the structure of the Ethiopian pharmaceutical sector. The lines between the boxes indicate the various reporting and communications channels.

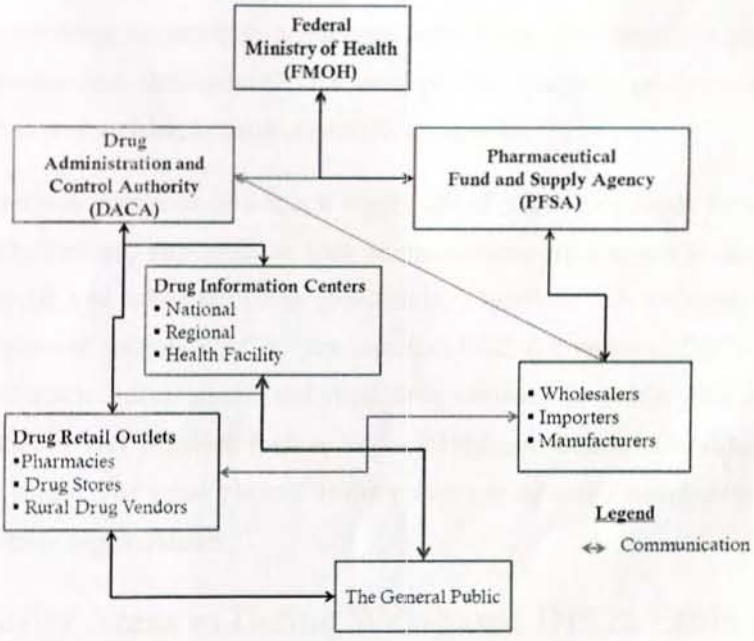

Figure 1: The Ethiopian Pharmaceutical Sector Arrangement

In a guideline published by DACA in December 2004, there are three types of DROs in the Ethiopian Pharmaceutical sector. These are Pharmacies, Drug stores, and Rural drug vendors. These types of DROs may acquire license to dispense animal or human drug only, or a combination of them. (3)

DACA's role in the sector is to devise the National Drug Policy (NDP), the Ethiopian Drug Formulary along with good dispensing and prescribing practices, and licensing and regulating manufacturers, wholesalers and DROs. Its role also includes implementation of the NDP, and the various guidelines and standards it sets. Specifically, DACA has identified Drug Lists for various level health facilities such as Health Posts, Health Centers, Zonal/District Hospitals and Referral Hospitals. Therefore, DROs belonging to such health facilities are authorized to distribute only those drugs. (1)

The main reason why a NDL for Ethiopia is required is to register and approve drug imported from different manufacturers in different countries, and to check their quality in relation to them being safe. Therefore, DACA also approves purchase orders of wholesalers and importers on the types of drugs they intend to import into the country. This implies that the ADR-related drug information is vital to wholesalers and importers. (1)

DACA is also planning to establish a national level Drug Information Center (DIC), which coordinates regional and facility-level DIS centers. The purpose of these departments is to manage routine as well as specific drug information requests. (3)

Since pharmaceuticals comprise of a much bigger set of items, this study focuses only on drug information. Wholesalers, importers as well as manufacturers are not included in this study because of financial and other resources constraints. Therefore, a web-based drug information system in Ethiopia will include DACA - the national DIC, the regional DICs, facility-level DIS centers, and pharmacies, drug stores, and rural drug vendors. In Addis Ababa, the presence of rural drug vendors is very minimal (below ten in 2010), and hence rural drug vendors are not included in this study. The other players in the sector are assumed beneficiaries of information generated from these organizations.

2.3 Key Priority Areas to Define Web-based DIS in Ethiopia

The key priority areas that describe the essential characteristics of a web-based drug information system in Ethiopia are derived from

- policy statements,
- policy implementation guidelines, and

- identified facts in government strategies

The policy statements and identified facts in government strategies can be found in the HSDP III document. In this document, the policy of the Ethiopian Government towards the pharmaceutical sector and objectives, goals and targets that the government aims to achieve are clearly stated.

Policy Statements and Identified Facts in Government Strategies

HSDP III is developed in consideration with the existing policy frameworks in the different sectors such as the National Population Policy, Health Service Extension Programme, Rural Development Policy and Strategy, etc (1). However, the National Drug Policy (NDP) is the appropriate document that should be reviewed here.

The NDP specifies 13 general strategies that specify the government's position in the following areas (8). Some of the strategy areas that are relevant for discussion are:

- Selection of appropriate drugs for Ethiopia,
- Supply of the selected drugs,
- Stock management and distribution of drugs,
- Administration and control of these drugs,
- Professional training and utilization,
- Drug information and promotion,
- Rational drug use, and
- Other areas

The policy entrusts a National Drugs Advisory Committee, which is responsible for listing of the appropriate drugs for the country in the form of a National Drug List of Ethiopia (NDL), and making sure it is updated in a reasonable time interval. Following the implementation of the policy, the NDL is now in the fifth edition – published September 2007 (7).

Implementation measures for the supply, administration and control of the selected drugs are enforced through establishment of independent organizations. The supply includes procurement of drugs on the NDL in light of the basic principles behind of the Ethiopian pharmaceutical sector, which is to safety, efficacy, quality and affordability (price) of drugs. The administration activities include issuing of registration certificates, quality checks, professional and institutional license renewals, etc (7).

The stock management section reveals some important facts that make up the priority areas of the definition of web-based drug information system in Ethiopia. The following two points, in particular, are the most important:

- Enforcement of stricter drug inventory control, supervision and data exchange to
  - enhance a more accurate forecasting of drug demands,
  - ensure wastage is prevented, and
  - ensure shortage is avoided
- Enforcement of distribution policy, which specifies, "*Distribution of drugs shall be carried out in accordance to a standard list of drugs appropriate for the level of the health institution and retail enterprise*" (7)

These two points indicate that the definition of web-based drug information system in the Ethiopian context would not be complete without enforcing drug inventory control that incorporates **forecasting, quantification and stock-out information exchange**. In addition, the web-based system should be designed by considering the standard list of drugs appropriate for the level of health institutions and retail outlets.

Following the implementation of this policy, standard lists of drugs are in use for each type of health institution and retail outlet – for Zonal hospitals and above, for health centers, for rural drug vendors, for animal pharmacies and drug stores. A drug store that is found selling drugs that are not authorized for its level will be in violation of this policy.

Regarding professional training and utilization, the policy states that on-the-job trainings are part of the plan the government devised to upgrade professionals in the sector. In order to conduct

formal trainings on usage and implementation of web-based drug information system for professionals, their **knowledge and attitude** have to be discovered (7).

Another strategic area identified by the policy is the drug information and promotion area. Here, the policy states the necessity of monitoring the content and distribution of drug information. It also mentions that **current and accurate drug information** and reference materials should be published and distributed to the professionals in the field. Following the implementation of the policy, DICs are being established in public hospitals and health centers for this purpose. The Internet is apparently the most appropriate medium of achieving this objective (7).

Among the many opportunities presented by implementing a web-based drug information system are allowing professionals to direct customers to the nearest pharmacy or drug store in cases they cannot provide their prescriptions. This can save customers' time, money and sometimes lives.

Regarding rational use of drugs, the policy states that **prescription formats** should be standardized and that a list of prescription and non-prescription drugs should be prepared. Furthermore, **use of generic drug names** (as identified scientifically, without relating to brand names) is a preferred practice during drug prescription and dispensing. In light of these specifications, a web-based drug information system would improve on providing a standard prescription form that can be designed and changed in one place and is immediately available for use. It is also possible to present both brand and generic drug names when listing drugs so that the professional will have easy time selecting the correct drug for the customer. Drug-specific information is also possible to be presented whenever required by the professional (7).

Although the NDP specifies the above strategy areas, it did not provide an implementation guideline – one that specifies the plan, the budget and the responsibility of implementing it, as criticized by the FMoH and WHO in their assessment report of October 2003 (26).

The Guideline for the Establishment and Operation of Drug Information Centers affirms that the knowledge about drugs is constantly changing and that health professional should be equipped with the latest accurate information about drugs and their formularies (3). Web-based DIS implementation provides the ideal opportunity to implement this guideline.

Another guideline "Guideline for Adverse Drug Reaction (ADR) Reporting" published by DACA emphasizes that "*information about the harmful and beneficial effects of drugs shall be collected*

from health professionals and patients, relevant data compiled and analyzed and the findings be publicized at national and international level". It also adds that the aim is to generate new knowledge about early drug complications as soon as possible, complementing the regular way (using clinical trials). Furthermore, the guideline states, "*the limited pre-marketing evaluation of drugs cannot guarantee absolute safety of drugs*". Hence, the role of ADR reporting system can be up to saving lives and avoiding unnecessary pain and complications on patients. In this regard, through a web-based drug information system, it is possible to facilitate the current reporting mechanism of ADRs. This is possible by posting the ADR reporting form, which is standardized, onto the system (8).

In addition to the NDP and guidelines supporting it, the implementation of Health Management Information System (HMIS), generates another set of specifications that must be incorporated in the definition of web-based drug information systems. Standardized indicators of HMIS specify two indicators that should be reported by pharmacies and drug stores under health institutions. These are (9):

- Essential drugs availability, and
- Average stock-out duration

The dispensary units in hospital and health center DROs should report these data. Tracking such data can also be done in a web-based drug information system.

Therefore, to make a more complete definition of a web-based drug information system in Ethiopia, the following data should be available to dispensers:

- Listing of drugs appropriate for the level of the health institution and retail outlet,
- Forecasting and quantification of drugs for DROs,
- Good dispensing practices and the Ethiopian Drug Formulary,
- Detail drug information from an accurate, current and scientific source,
- Standardized prescription formats,
- Standardized ADR reporting format, and

- The list of pharmacies and drug stores – including their location, for the drugs they are authorized to dispense

The following data should be made available by the dispenser in return:

- List of available drugs with their generic as well as different brand names, and their amount, and
- Stock-out data (which drugs, and the corresponding brands of those drugs, from the standardized list are currently unavailable)

2.4 Prerequisites for the Implementation of Web-based DIS in Ethiopia

In order to identify factors that affect the implementation of web-based drug information system in Ethiopia, pointing out the characteristics of web-based information systems is essential. According to Muneesh Kumar's description of the elements of an information system, the components required to implement a computer-based information system are hardware, software, people, data, and procedures (2). In case of a web-based DIS, the only addition to the components of computer-based information system is networking, a component which is provided by the presence of the Internet.

These components of a web-based information system are prerequisites to implementing such a system. During implementation, internet-based drug information software will be designed to handle the data and procedure components. The hardware component includes the computers that users of the system are able to work on. The people component includes the users of the system. The data component includes but is not limited to the actual drug information that is supposed to be shared between DACA, DICs and DROs. The procedure component includes guidelines, standards, and recommended practices relating to the use of the system or general practice of the profession.

Hence, when translating these prerequisites to the Ethiopian pharmaceutical system, the following factors are identified to be the major determinants for implementation of web-based drug information systems in Ethiopia:

- Availability of IT infrastructure, which consists of the following items:
    - Hardware – consisting of personal or laptop and server computers,
    - Software – operating systems, application packages such as word processing, spreadsheet systems, etc and custom software, which in this case can be the web-based drug information software,
    - Networking – internetworking of the computers and the server with each other through the server, including connection to the Internet or an intranet
- Knowledge about and attitude towards web-based drug information system use and implementation on the part of the prime users of the system, which are:
    - Health professionals – pharmacists, druggists or pharmacy technicians working in the retail drug outlets, and
    - DIC staff – which will play a key role in making the system up-to-date with content and providing technical support to retail drug outlets
- Commitment of DACA, which is the regulatory authority that will be the owner of the system, in providing guidelines, standards, and recommended practices

Although the system can have a much wider scope and many more stakeholders, the essential components are the ones mentioned here. In summary, in order to implement a web-based drug information system in Ethiopia, the following assumptions should hold true:

- DACA is committed to the implementation of the system,
- Professionals have the basic knowledge and positive attitude to accept and use the system,
- Pharmacies and drug stores have computers and Internet connection, and
- DIS centers have computer-trained staff, computers and Internet connection

CHAPTER THREE

LITERATURE REVIEW

3.1 The Role of the Internet to implement Drug Information Systems

The internet is a network of computer networks connected worldwide. In the past two decades, it has grown into a major world phenomenon, changing the lives of billions of people all over the world. It has provided a window for everyone to keep in touch and do much more than was possible before. For example, there are now electronic commerce organizations doing their business by relying solely on the Internet. There are also other similar organizations providing services and goods via the Internet.

One such example can be the emergence of Online Pharmacies. These are pharmacies and drug stores operating over the Internet. They are very much similar to community pharmacies except that the method of requesting and receiving medications is different. Customers send their prescriptions online and their medications are delivered to their home address or intended destination like any other delivery (10).

Among the many services offered by the Internet is the World Wide Web, where information of any sort is exchanged between Internet users. One such type of information that can be exchanged between Internet users is Drug Information. Hence, the Internet can serve as a backbone to a web-based drug information system. Implementing such an information system has many envisaged benefits such as it is easy to post drug information and make it automatically available to all its intended users, to access it anytime any day from anywhere in Ethiopia, to maintain it from a single central location and hence to manage it from a centralized location.

In light of these benefits provided by the Internet, implementing a web-based drug information system in Ethiopia seems to provide a tangible and significant benefit in the way patients are cared by health professionals and subsequently in the improvement of the health care system in general. From the very nature of drugs, the question of how much tangible and significant are the benefits of web-based drug information system is straightforward – saving lives.

3.2 ICT Infrastructure Availability

For using web-based drug information systems or other types of information systems, the presence of ICT infrastructure among DROs and at national, regional, and health facility level DIS centers is essential. The types of ICT infrastructure required in these institutions are categorized into three as hardware, software and network infrastructure (2).

Several sources suggest that ICT infrastructure availability is increasing in several African countries. In a survey conducted by the National Institute of Statistics of Rwanda in November 2008, the PC and Internet coverage of the urban part of the country has reached 0.89%, with plans to establish 800 cyber cafes (65% in Kigali, its Capital City). This survey also indicates that 100% of public and private sector health institutions use computers and 24.2% and 42.1% of them have access to the Internet respectively (11).

In another survey conducted by ITU and ETA in 2008, the number of Internet subscribers in Ethiopia increased sharply over the past five years, now reaching to 350,000 subscribers. The study also depicted that ICT infrastructure in Ethiopia is largely skewed towards major cities and towns, particularly Addis Ababa. The study also affirms that while the Internet and other forms of information and communications technology are readily available in Addis Ababa, limited access to ICT in rural parts of the country continues to undermine the nation-wide figure (12).

These and other studies confirm that ICT coverage is expanding in resource poor countries like Ethiopia and Rwanda. This is partly due to the governments in these countries are streamlining ICT into their main development agendas. The role that ICT play in the pharmaceutical sector will therefore be increased in the coming years ahead.

3.3 Knowledge and Attitude towards Web-based DIS

For using web-based DIS, the users need to have proper knowledge of using computers and internet-based systems. In addition to having proper knowledge, health professionals and other users of a web-based DIS should have a favorable attitude towards such systems. Several studies conducted to assess the knowledge and attitude of health professionals provide a concrete evidence of this fact.

In a survey conducted to explore the use of the Internet and e-mail by practicing clinicians in twelve hospitals in Pakistan in 2007, all the respondents disclosed that they have access to the Internet and e-mail at home or at work. According to this study, only 16% (CI: 13.17% – 19.41%) were connected to the Internet daily whereas 31% (CI: 27.90 – 35.78%) were connected only rarely or never. Regarding the respondents' opinions, the study showed that 69% (CI: 64.63% – 72.49%) strongly agreed or agreed that use of e-mail has the potential to reduce unnecessary visits to a doctor. The study also showed that 69% (CI: 64.63% – 72.49%) strongly agreed or agreed that e-mail can help increase patient compliance, 56% (CI: 51.38% – 59.78%) strongly agreed or agreed that using e-mail with their patients would lessen their personal relationships with them. Furthermore, 54% (CI: 49.90 – 58.32%) strongly agreed or agreed that physicians would not use e-mail to communicate with their patients unless they were paid for their time. Regarding use of the Internet, the above study also showed that 80% (CI: 76.58% – 83.36%) of the respondents strongly agreed or agreed that the Internet can be useful in providing patient education, but 56% (CI: 51.82% – 60.22%) also strongly agreed or agreed that there are few websites providing trustworthy health information (13).

This study also highlighted the practice of the respondents, revealing how they viewed the potential of the Internet and e-mail for providing care and communicate with patients. It stated that despite the fact that all respondents had access to the Internet and e-mail, 70% (CI: 66.94% – 74.64%) said that they rarely or never used the Internet or e-mail to communicate with patients regarding their current medical issues. When asked whether patient confidentiality was a reason for clinicians not using e-mail to communicate patient-related information, 31% (CI: 27.04% – 34.86%) of the respondents strongly agreed or agreed whereas 36% (CI: 31.97% – 40.09%) disagreed or strongly disagreed (13).

In another study conducted to identify pharmacists' computer skills in Canada in 2004, it was found that Forty-five (79%) of 57 respondents had received no formal computer training. Fifty-two respondents (93%) owned a home computer. Thirty (52%) respondents used their home computers as much as 5 hours per week, and 23 (40%) respondents used their computers 6 to 15 hours per week. Only 12 (21%) respondents had completed some formal computer training. This study also found that of the six general types of software packages, the Pharmacists who provided the response, 47 (81%) used e-mail software at least once daily, and 20 (35%) used word processing software daily. The vast majority (>90%) of respondents did not use any statistical

analysis or presentation software (14). Regarding their Internet skills, the study found that the majority (46, 81%) of respondents rated themselves as "4" or greater (in a 5-point scale) in terms of their ability to access Web sites by typing the URL. Thirty-five (60%) rated themselves as "4" or greater in terms of ability to maintain a list of Web sites using the Web browser bookmark feature, and 12 (21%) rated themselves as a "1" (no ability). Thirty-one (54%) respondents rated themselves as "4" or greater in terms of ability to download files from online sources (14).

Another study conducted to identify needs of pharmacy students' computer skills in USA in 1996, students' software knowledge and frequency of use indicated that only 18.5% of the respondents said they have no knowledge of software, even word processing packages while the majority indicated they have some knowledge of word-processing programs. When asked about their attitudes about working with computers, 97% of the study participants indicated that they are comfortable working with computers at work. The study also indicated that the male (80.9%) and female (90.5%) respondents agreed or strongly agreed to the statement that *"pharmacists should have a workable knowledge of word-processing software"*, male (70.3%) and female (84.8%), to the statement that *"a computer course should be part of the pharmacy curriculum"*, and disagreed or strongly disagreed to the statement that *"computers in the pharmacy will increase the workload on the pharmacist"* (male – 65.5% and female – 82.5%) (15).

Studies mentioned here depict that knowledge and attitude of health professionals contribute significantly to the successful implementation of Internet-based information systems.

3.4 Government's Commitment to implement Web-based DIS

In order to implement citywide or nation-wide information system, whereby the owner of the system is the government, there needs to be a strong leadership by the government in order to push for the system's realization despite the various implementation hurdles that will come along the way and despite the reluctance of some participating health facilities.

In a WHO guideline issued in 1998 to aid drug regulatory authorities of its member states in automating their drug registration systems, it has outlined the following processes as **sequential and necessary** for a smooth transition from the manual to computerized system (23):

- Secure Political Support,

- Review Enabling Legislation and Regulations,
- Identify Needs, Define Enabling Objectives, and Establish Priorities,
- Identify Funding and Support Requirements and Sources,
- Appoint Technical Coordinator and Define Time Schedule,
- Review Forms, Procedures, and Correspondence,
- Update Forms and Certificates, as Required,
- Prepare Data and Decide How to Handle Data Entry,
- Train Staff in Software System and New Procedures,
- Begin Computerization, and
- Operate and Maintain Computer-Assisted Drug Registration System

All of these sequential activities require national drug regulatory bodies of governments to show their commitments and take leadership positions in realizing such systems. These points can be summarized into two core requirements – review of the National Drug Policy and the Government's Initiatives in realizing a web-based drug information system. In order to implement a web-based DIS in Ethiopia, with pharmacies and drug stores as the major stakeholders, DACA[1] has to have the level of commitment that should lead the way to the realization of such systems.

3.5 Previous Researches in the Area

This study emphasizes the Ethiopian Healthcare System in general and the Ethiopian Pharmaceutical sector in particular. To the knowledge of the researcher, studies carried out to introduce computer-based information systems are non-existent.

[1] DACA is the sole drug regulatory body of the Ethiopian government. It is empowered with the authority to issue license of professionals as well as DROs, approve drug imports, issue guidelines and standards on establishment and operation of DROs, DICs, and drug manufacturers, etc.

However, from the very few studies conducted elsewhere and found to be relevant for review is the study made in rural Haiti by Elisabeth J Berger et al. entitled, "*Implementation and evaluation of a web-based system for pharmacy stock management in rural Haiti*" (24). This study evaluates the implementation of web-based pharmacy-stock management system, supporting nine clinics in rural Haiti. The researchers used standardized WHO stock cards to develop the system. The system allows pharmacy staff at all clinics to enter stock levels and also to request drugs and track shipments. The source of internet connection used was via satellite. The major achievements of the system are that it:

- is a widely accepted by its users,
- is based on WHO standard stock cards,
- is the *de facto* source of stock information in those clinics, and
- that drug stock-outs have fallen from 2.6% to 1.1% over a period of one year

The limitations of this system are that it has no drug-information provision component and that it only supports nine clinics.

The implications of this study to this research are that

- even when scope is limited to stock management, this system has gained user acceptance due meeting the following requirements:
    - easy-to-use system design,
    - multi-language support,
    - ability to support and backup the system in remote sites, and
    - overview of stock at all warehouses
- the presence of diseases such as TB and HIV/AIDS contributed to the acceptance and usage of the system by users,
- it is possible to implement web-based systems even in remote areas if computers, computer-trained personnel, and internet connection are not interrupted,

- piloting the system in a small area with limited users and sharing the success to other regions improves user acceptance and system realization

Another study relevant to be reviewed here is the study made in the UK entitled, "*Taking pharmacy services to a new level with the intranet*" (25). This is a qualitative study undertaken to explore the opportunity presented by the Intranet – a type internet for a specific community, in this case for the pharmacy community in the Bart's and The London NHS Trust hospitals. This study presents the selected pharmacist services that are deemed appropriate for publishing on the intranet. According to Tugwell, the following pharmacy activities can be made available on the intranet system:

- Prescribing guidelines
- Pediatric formulary
- Pharmacy bulletins
- Policies on medicines
- Drug information systems
- Status of newly marketed drugs
- Forthcoming events
- Summaries of conferences and seminars
- Clinical trials information, and
- Therapeutic drug monitoring and physiological levels

The major achievement of the system is that it depicted the real possibilities in tapping the potential of intranet technology use. In addition, it showed how health professionals in the pharmaceutical sector could benefit from web-based systems, particularly in the provision of drug information. The limitations of this study are that it is not generic – it is limited to British NHS Trust hospital pharmacies.

The implications of this study are that:

- It is possible to make up-to-date information about drugs and their formulary on a system for professionals' use,
- Web-based system are easy to maintain – since the maintenance of the system is done at the server and all users immediately access the changes,
- It is possible to make Adverse Drug Reaction (ADR) information available to dispensing professionals from clinical trials conducted every time,
- It is possible to make pharmacy bulletins, prescription and dispensing guidelines, and related information available on a web-based system

These two studies show that web-based drug information system can be implemented if the users are computer-trained, if the facilities have the required computers and Internet connection, and the regulatory agency along with pharmacies, drug stores, and DIS centers are committed to its implementation. However, the mere opportunity presented by implementing web-based drug information systems does not guarantee successful implementation. In fact, it can lead to failures and frustration on the part of professionals, not only on the system but also against other systems. Hence, with careful analysis and discussion, the results of this research can be compared partially with these researches.

3.6 Conceptual Framework

The conceptual framework for this research is derived from the above descriptions of the major determinant factors that are considered relevant for implementing a web-based drug information system in Ethiopia. It is depicted in the following diagram:

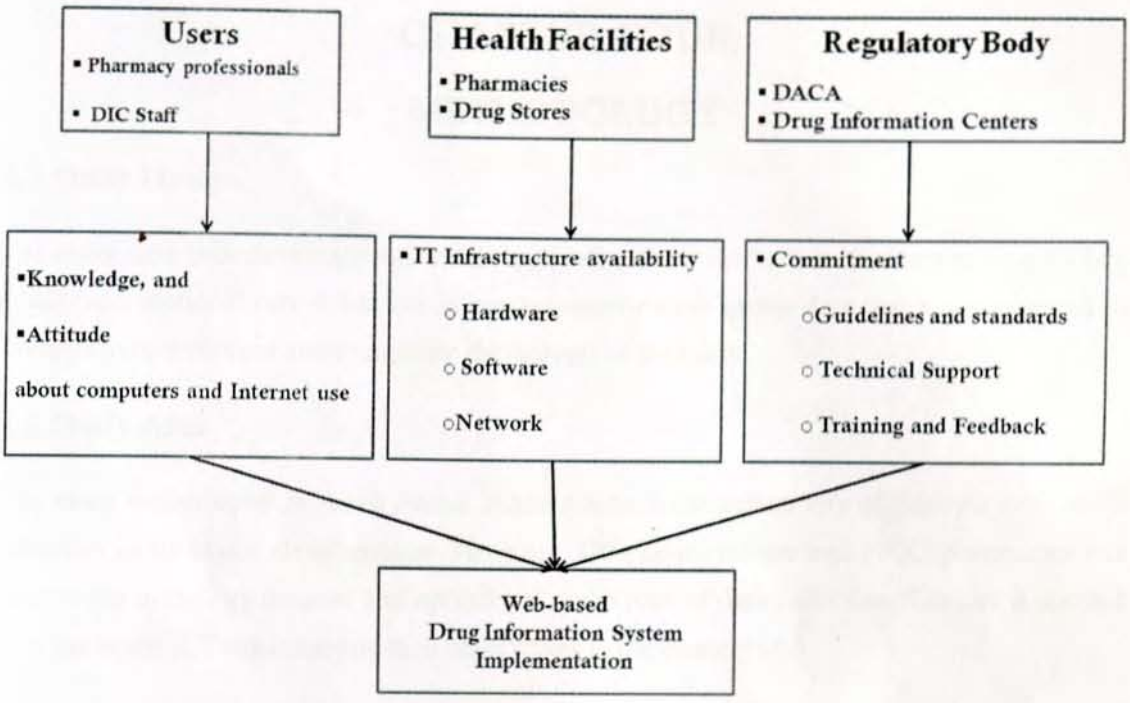

Figure 2: Conceptual Framework of the research

3.7 Related Works in Ethiopia

To the knowledge of the researcher, no study has been found that analyzed the prospects of implementing a web-based drug information system in Ethiopia or in Addis Ababa. Hence, this study will try to contribute new knowledge about what prospects lie currently in order to implement a web-based drug information system in Ethiopia in general and in Addis Ababa in particular.

CHAPTER FOUR

METHODOLOGY

4.1 Study Design

The study used both quantitative as well as qualitative study methods in the form of drug facility-based cross-sectional survey and key informant interviews to gather data that is not captured by the quantitative method and triangulate the findings of the study.

4.2 Study Area

The study is conducted in Addis Ababa. Addis Ababa is the capital city of Ethiopia and has 10 sub-cities as its major classifications. There are 320 public, private and NGO pharmacies and drug stores in the city licensed and operational at the time of data collection. The city is selected as it has better ICT infrastructure than other towns in the country (4).

4.3 Source and Study Population

The source populations are all licensed pharmacists and druggists working in public, private, and NGO pharmacies and drug stores in Addis Ababa. The study populations or the sampling frame of this study comprise of the chief pharmacists and druggists, or administrators of these pharmacies and drug stores.

The inclusion criteria in this study are:

- The DRO should have a renewed license of operation,
- The DRO should be located in Addis Ababa,
- The DRO should deal with dispensing of human drug

The exclusion criterion in this study is that the DRO should not be a rural drug vendor.

4.4 Sampling Procedure

This study used a survey of all the 320 pharmacies and drug stores in Addis Ababa that have a renewed operational license. For the qualitative study part, Key Informant Interviews with four designated officials from DACA, St. Paul and Black Lion hospital DICs were performed.

4.5 Variables in the Study

The study has the following dependent and independent variables.

Dependent

- IT Infrastructure availability in DROs,
- Basic IT Knowledge of respondents/professionals,
- Attitude of respondents about web-based drug information system,

Independent

- Socio-demographic Characteristics (such as age and sex of respondents),
- Professional Category (Pharmacist or Druggist)
- Service Year of respondents,
- Location of Health Facility (Sub-City),
- Health Facility Type (Pharmacy or Drug Store),
- Type of Ownership of Health Facility (Public, NGO or Private),
- Availability of Computers in the DRO, and
- Completion of formal computer training

4.6 Data Collection Procedures

Both quantitative and qualitative techniques of data collection methods were employed in the study. In the survey part, questionnaires were distributed to DROs in the 10 sub-cities of Addis Ababa. The list of DROs used in the study is provided in ANNEX 1.

Primary data is used in the study. A self-administered questionnaire is developed by using as a model the Professional Practice Standards of the Pharmaceutical Society of Australia (5), and the WHO guideline to develop a knowledge, attitude and practice survey (6). The questions include Yes or No type questions, 5-point Likert Scale and a few close-ended questions.

The questionnaire covers four aspects of the study:

- Socio-demographic characteristics,
- IT Infrastructure availability questions,
- Knowledge about computers and Internet-based systems, and
- Attitude about computers and Internet-based drug information systems

The questionnaires were distributed to and collected from chief pharmacists or chief druggists of the 320 pharmacies and drug stores in the 10 sub-cities of Addis Ababa by hiring six (6) data collectors.

Key informant interviews were also conducted with designated officials from DACA, St Paul and Black Lion hospital DIS centers. The interviews were conducted using separate interview guide for each Interviewee. The interviews were made by the principal investigator. Tape recorder could not be used because of the refusal of the key informants to be recorded. Rather, responses to interview guide questions were manually recorded. After the data collection is completed, data entry, cleaning, and analysis were made using SPSS v16.

4.7 Data Analysis Procedures

Frequency tables, proportions and crosstabs were used for the descriptive analysis. For the data presentation, tables and different type of graphs were employed. Associations among

independent variables and outcome variables were seen using Odds Ratio and Binary Logistic Regression when it is appropriate. For multivariate analysis, the necessary adjustment was done for the possible confounding factors to identify the predicting factor for the outcome variables. Hence, internal comparison between the variables was done based on adjusted odds ratio. In line with this statistical significance was observed using 95% Confidence Interval.

Responses to the qualitative data (exploring the level of government's commitment towards web-based DIS implementation) are organized based on their thematic area. The responses of the interviews were summarized into six thematic areas. Responses of each key informant were then merged to these thematic areas.

Status of basic knowledge of respondents about computers and the Internet was analyzed by a set of nine questions. Continuous scores from these categories were dichotomized into "Satisfactory Knowledge" and "Unsatisfactory Knowledge". Respondents who scored more than the second quartile (≥ 50%) score were categorized as having satisfactory knowledge while those who scored below the median score were categorized as having unsatisfactory knowledge. Similarly, attitude of respondents about internet-based DIS implementation was analyzed by a set of nine questions. Continuous scores from these categories were dichotomized into "Favorable Attitude" and "Unfavorable Attitude". Respondents who scored above and below the second quartile (≥ 50%) score were categorized as having favorable and unfavorable attitude respectively.

IT infrastructure availability among DROs was analyzed by a set of six questions, comprising topics about the presence or absence of computers and Internet connection, the level and frequency of their use, and the affordability of computers and Internet connection by the DROs at the time of the survey. Planning to acquire computers and Internet connection was also used to analyze the availability of IT infrastructure in DROs. Responses to these questions were then dichotomized into "Have IT Infrastructure" and "Don't Have IT Infrastructure" categories. DROs which, reported as having computers and Internet connection or have planned to acquire them, are categorized as having the required IT infrastructure. Those who reported as not having computers, not affording to acquire computers, or not planning to acquire computers are categorized as not having the required IT infrastructure.

4.8 Data Quality Control

Since all the pharmacies and drug stores in Addis Ababa are participants of the study, in order not to contaminate the study population, the questionnaire was pre-tested at Nazereth town and refinements, in terms of clarifying vague or ambiguous questions, were made from the feedback gained. The questionnaire was further developed and enriched by reviewing additional literature.

The final working version of the questionnaires was then translated into Amharic so that respondents get comfortable answering the questions. In order to minimize translation errors, the Amharic version was then back translated to English by an independent professional and the original Englisht and the back-translated English versions were compared for consistency.

Data collectors were also oriented on data collection techniques and tools. Moreover, random visits to DROs, half and full day reports of problems encountered over telephone, exchange of information via SMS, and experience-sharing and problem-solving meetings half way in the data collection period helped maintain the quality of the data collected.

4.9 Ethical Consideration

Ethical clearance was obtained from Addis Ababa University, Joint Academic Commission of the Faculties of Informatics and Medicine. Following the issuance of the ethical clearance, the proposal was provided to Addis Ababa City Administration Health Bureau for obtaining a permit to collect data from the respective pharmacies and drug stores.

The objective of the study is clearly put on the Information Sheet preceding the questionnaire and Interview guides. Participants were also asked about their consent to participate in the study orally as well as via a consent letter. The information sheet and consent letter are presented and described to participants, both in the questionnaire and orally for the interviews to be conducted before any kind of consultation is initiated. The discussants of the key informant interview were told that their responses are confidential and shall be used merely for the purpose of the research work.

4.10 Dissemination of Results

The findings of the study will be presented to the Joint Academic Commission of Faculty of Informatics and Faculty of Medicine, AAU, as a thesis in partial fulfillment of Master of Science degree (M. Sc.) in Health Informatics. The findings of the study will also be submitted to Ethiopian Drug Administration and Control Authority (DACA) and interested development partners of FMoH and DACA. In addition, the results may also be presented in various conferences.

CHAPTER FIVE

ANALYSIS OF RESULTS AND DISCUSSION

5.1 RESULTS

5.1.1 Socio-demographic characteristics of respondents

Among the 320 questionnaires distributed to an equivalent number of respondents in each DRO, only 265 questionnaires were filled and collected, making an overall response rate of 83%.

One hundred sixty one (61%) of the respondents were males while 103 (39%) were females. The age of respondents ranged from 19 to 68 years with median age being 30 years and the Mean (±SD) age 33.8 (10.94). From 265 respondents who participated in the study, 105 (39.8%) were Pharmacists, 148 (56.1%) were Druggists, and 11 (4.2%) were Pharmacy Technicians. The survey also revealed that 130 (49%) of the respondents worked in Pharmacies whereas 135 (51%) of them worked in Drug Stores. As shown in Figure 3, these pharmacies and drug stores are fairly distributed throughout the 10 sub-cities of Addis Ababa.

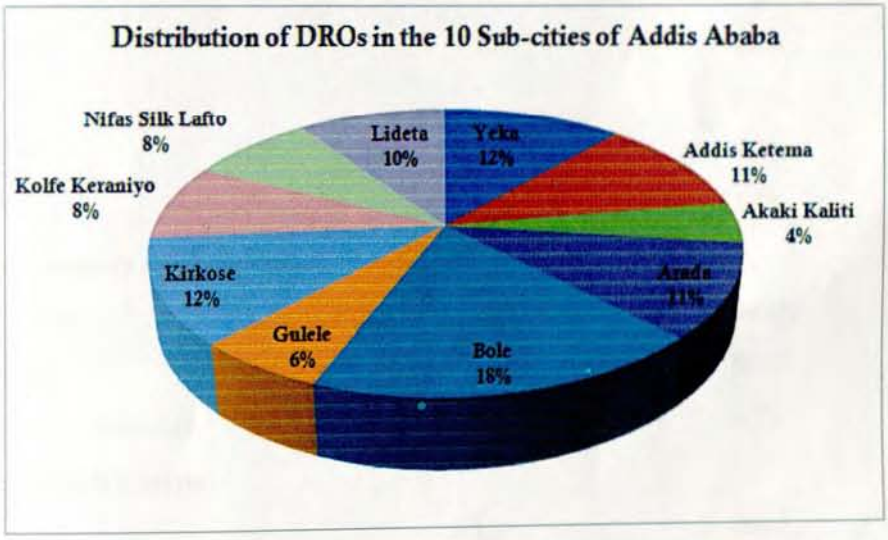

Figure 3: Distribution of DROs among the 10 sub-cities of Addis Ababa, April-May, 2010

Table-1 – Socio-demographic characteristics of respondents, Addis Ababa, March-April, 2010

Characteristic	N=265 Frequency	Percent (%)
Sex		
Male	162	61.1%
Female	103	38.9%
Age distribution of respondents (Years)[2]		
≤ 22	12	5.0%
23 - 27	**106**	**40.0%**
28 - 32	**48**	**20.1%**
33 - 37	30	12.6%
38 - 42	17	7.1%
43 - 47	15	6.3%
48 - 52	20	8.4%
53 - 57	7	2.9%
58 – 62	7	2.9%
63 +	3	1.3%
Professional Category of Respondents		
Pharmacist	105	39.6%
Druggist	149	56.2%
Pharmacy Technician	11	4.2%
Type of Drug Retail Outlets		
Pharmacy	130	49%
Drug Store	135	51%

[2] Categorization for age distribution is done using Sturges rule (K= 1+3.22 (log n)) and W= (L-S)/K. where K is number of classes and W is class width.

(Table-1 Cont'd)

Sub-city distribution of respondents		
Addis Ketema	29	10.9%
Akaki Kaliti	12	4.5%
Arada	28	10.6%
Bole	49	18.5%
Gulele	16	6.0%
Kirkose	31	11.7%
Kolfe Keraniyo	22	8.3%
Nifas Silk Lafto	21	7.9%
Lideta	26	9.8%
Yeka	31	11.7%
Ownership of DRO		
Public/Governmental	22	8.3%
Private	237	89.4%
NGO	6	2.3%
Total Work Experience of Respondents[3] (Years)		
≤ 5	**131**	**49.4%**
6 - 10	53	20.0%
11 - 15	22	8.3%
16 - 20	23	8.7%
21 - 25	17	6.4%
26 - 30	9	3.4%
31 +	10	3.8%

[3] Categorization for Total Work Experience of respondents is done using Sturges rule (K= 1+3.22 (log n)) and W= (L-S)/K. where K is number of classes and W is class width.

5.1.2 IT Infrastructure Availability in DROs

IT infrastructure availability in DROs was assessed by a set of six questions. Accordingly, One hundred seventeen (44.2%) of the 265 DROs surveyed reported that they have at least one computer in their store. Another 58 (28.7%) of the DROs reported they are planning to acquire computers for their store. Thirty-three (32.7%) DROs reported that they have Internet connection. Another 51 (19.2%) DROs indicated that they are planning to acquire Internet connection for their store. In terms of having the financial capacity of acquiring computers and Internet connection, 127 (47.9%) of DROs reported that they can afford to acquire a computer and Internet connection for their stores. Table 2 depicts summary of responses to selected IT Infrastructure questions.

Table 2 – IT Infrastructure Availability in Drug Retail Outlets, Addis Ababa, March-April, 2010

	N=265	
Category	**Frequency**	**Percent**
Computer Available in DRO		
Yes	117	44.2%
No	148	55.8%
Computer Planned for DRO		
Yes	58	28.7%
No	144	71.3%
Computer Affordable for DRO		
Yes	127	47.9%
No	138	52.1%
Internet Available in DRO		
Yes	33	12.5%
No	232	87.5%
Internet Planned for DRO		
Yes	51	19.2%
No	214	80.8%
Internet Affordable for DRO		
Yes	127	47.9%
No	138	52.1%

One hundred thirty five (51%) of the DROs are categorized as having the required IT infrastructure while the remaining 130 (49%) fall short of meeting these requirements. Figure 4 and 5 depict computer and Internet availability and affordability in DROs.

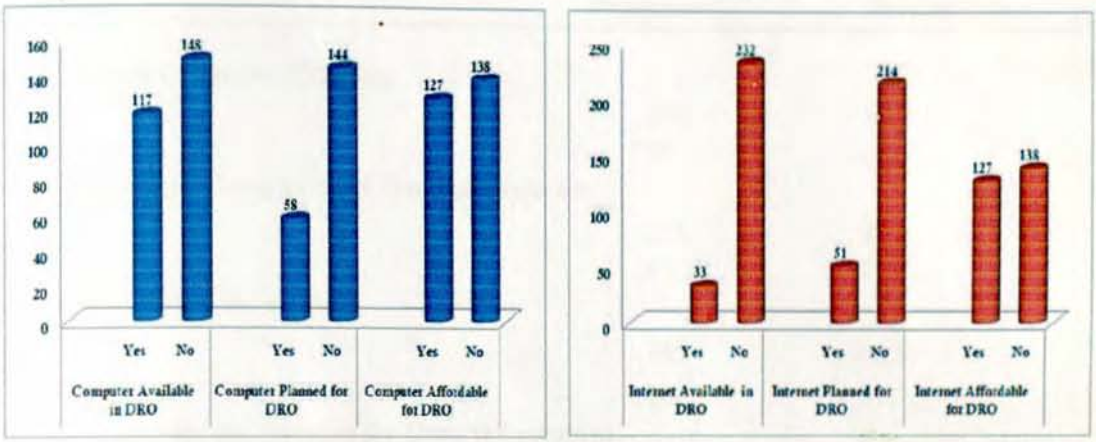

Figure 4: Computer and Internet Availability of DROs in Addis Ababa, April-May, 2010

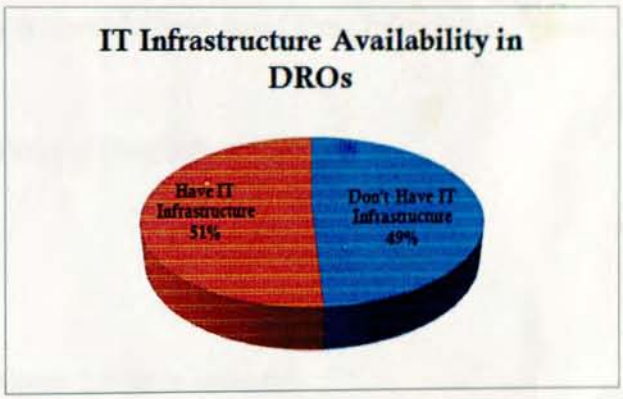

Figure 5: IT Infrastructure Availability in DROs, Addis Ababa, March-April, 2010

5.1.3 Knowledge about computers and the Internet

One hundred ninty (71.7%) of the respondents have completed formal computer trainings whereas 218 (82.3%) of them reported they know about computerized database systems.

Regarding the Internet, 165 (62.3%) and 94 (35.5%) of the respondents reported that they use the Internet and know about Internet-based drug information systems respectively. Table 3 presents results to the basic knowledge questions.

Table 3 – Basic knowledge of respondents about computers and the Internet, Addis Ababa, March-April, 2010

Category	Frequency	Percent (%)
Taken Formal Computer Training		
Yes	190	71.7
No	75	28.3
Knowledge about Computerized Database Systems		
Yes	218	82.3
No	47	17.7
Respondents Using the Internet		
Yes	165	62.3
No	100	37.7
Respondents using the Internet for Drug Information		
Yes	192	72.5
No	73	27.5
Respondents who Know about Internet-based Drug Information System		
Yes	94	35.5
No	171	64.5
Frequency of Internet use for Drug Information		
Daily	10	3.8
Monthly	17	6.4
Weekly	7	2.6
Rarely	158	59.6
Never	73	27.5
Relevance of Drug Information from Internet		
Very Important	187	70.6
Important	69	26.0
Not Enough	5	1.9
Irrelevant	2	0.8
Wrong	2	0.8
Computer Use for Stock Management		
Yes	48	18.1
No	217	81.9

Of the DROs which reported using computers, 66% of them revealed that they use their computers for email communication, 34% for document processing and 30% for drug-related work. However, these numbers are not exclusive to the choices presented here as those who use computers for email communication might also use them for document processing and drug – related work. Table 4 presents the results to purpose of computer use questions.

Table 4 – Purpose of computer use in DROs, Addis Ababa, March-April, 2010

		Email		Document Processing		Drug-related work		Other activities	
Purpose of Computer use	Yes	175	66%	90	34%	81	30.6%	28	10.6%
	No	90	34%	175	66%	184	69.4%	237	89.4%

Basic knowledge of respondents about using computers and the Internet was assessed based on a set of twelve questions. Accordingly, 174 (65.7%) of the respondents scored the second quartile score (≥ 50%) and above and hence are categorized as having "Satisfactory Knowledge" whereas those who scored below the median value are labeled as having "Unsatisfactory Knowledge".

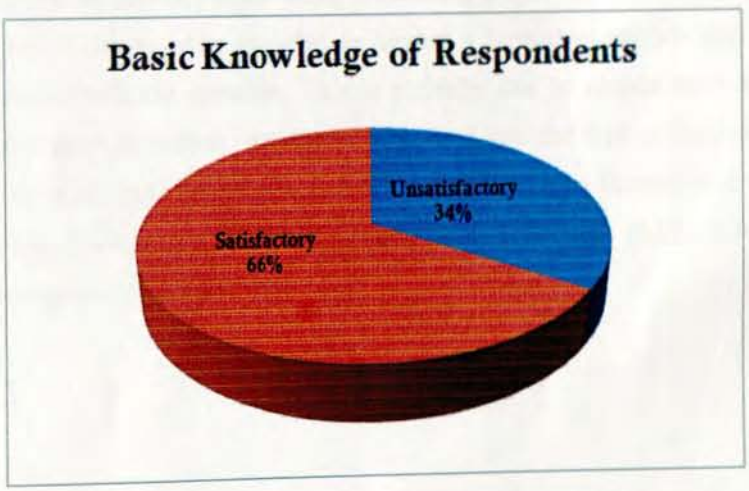

Figure 6: Basic Knowledge of Respondents about computers and the Internet, Addis Ababa, March-April, 2010

5.1.4 Attitude of Respondents about Web-based DIS Implementation

Two hundered fifty four (95.9%) of the respondents reported to "Agree" or "Strongly Agree" to the statement that detailed information about different drugs and their brands is important for daily operations. (96.2%) 255 of the respondents reported to "Agree" or "Strongly Agree" to the statement that computer-based information systems are important for stock management and for avoiding stock-outs. (83.4%) 221 reported to "Agree" or "Strongly Agree" to the idea that computer-based information systems will help improve the reporting of Adverse Drug Reactions (ADRs). (80%) 212 reported to "Agree" or "Strongly Agree" to the idea that computer-based information systems are important to exchange stock-out information exchange between DROs. (83.4%) 221 reported to "Agree" or "Strongly Agree" to the idea that computer-based information systems will help locate where a specific drug can be found at any one time.

Despite these optimistic opinions of respondents, only 199 (75.1%) of the DROs reported that they are ready to use a web-based drug information system. However, the majority of respondents (249 = 94%) confirmed that providing training on how to use computers and the Internet helps implement Internet-based Drug Information System. There is a significant gap between the number of respondents regarded as having a favorable attitude and the individual responses to the major attitude question. This is partially due to respondents agreeing to the major attitude questions than in their overall score. To look into the factors that resulted in such a difference better and to analyze the significance of relationship these factors have on the attitude of respondents, the predictors of attitude should be explored. Table 5 shows a summary of the responses to attitude assessment questions.

Table 5 – Attitude of Respondents about Internet-based Drug Information System in Ethiopia, Addis Ababa, March-April, 2010

Category	N=265 Frequency	Percentage (%)
Detail Information about different drugs and their brands is important for daily operations		
Strongly Agree	214	80.8
Agree	40	15.1
Undecided	10	3.8
Strongly Disagree	1	0.4
Computer-based Information systems are important for stock management and avoid stock-outs		
Strongly Agree	203	76.6
Agree	52	19.6
Undecided	7	2.6
Disagree	2	0.8
Strongly Disagree	1	0.4
Computer-based Information Systems are important for better reporting ADRs		
Strongly Agree	140	52.8
Agree	81	30.6
Undecided	29	10.9
Disagree	13	4.9
Strongly Disagree	2	0.8
Computer-based Information Systems are important for exchanging stock-out with other DROs		
Strongly Agree	134	50.6
Agree	78	29.4
Undecided	34	12.8
Disagree	18	6.8
Strongly Disagree	1	0.4
Computer-based Information Systems are important for locating where a specific drug can be found		
Strongly Agree	139	52.5
Agree	82	30.9
Undecided	27	10.2
Disagree	16	6.0
Strongly Disagree	1	0.4

(Table 5 - Cont'd)

Implementing Internet-based Drug information System helps to exchange information with DACA		
Strongly Agree	158	59.6
Agree	87	32.8
Undecided	12	4.5
Disagree	5	1.9
Strongly Disagree	3	1.1
DRO is ready to use Internet-based Drug Information System		
Strongly Agree	124	46.8
Agree	75	28.3
Undecided	64	24.2
Disagree	1	0.4
Strongly Disagree	1	0.4
Providing Training on Computer and Internet use helps implement Internet-based Drug Information System		
Strongly Agree	161	60.8
Agree	88	33.2
Undecided	10	3.8
Disagree	6	2.3
DRO affords to use computer and Internet service		
Strongly Agree	125	47.2
Agree	97	36.6
Undecided	40	15.1
Disagree	3	1.1

Attitude of respondents about web-based DIS implementation was assessed based on a set nine Likert-scale questions. The responses to these categories were dichotomized into "Favorable Attitude" and "Unfavorable Attitude" based on the second quartile score. Respondents who scored above and below the second quartile score (8.0) are categorized as having a favorable or unfavorable attitude towards web-based DIS.

Accordingly, 193 (72.8%) of the respondents have a favorable attitude whereas 72 (27.2%) of the respondents have unfavorable attitude towards web-based drug information system implementation. Figure 7 depicts the attitude of respondents towards web-based DIS in Ethiopia.

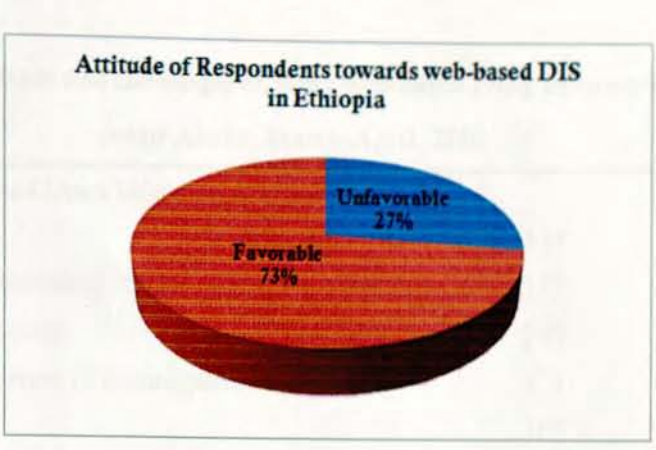

Figure 7: Attitude of Respondents towards web-based DIS in Ethiopia, Addis Ababa, March-April, 2010

Respondents also identified the challenges the DROs face in using a prospective web-based DIS by agreeing to a set of possible factors identified from the literature. Table 6 presents their responses.

Table-6 – Challenges of DROs in using web-based Drug Information System, Addis Ababa, March-April, 2010

DRO's challenges to use web-based Drug Information System	Yes	No
Computer Unavailable	108	157
Computer Training Unavailable	62	203
Internet Unavailable	155	110
Lack of Intention	32	233
Factors not specified	39	226

According to the responses, unavailability of computers (108) and the Internet (155) in the DRO are the major challenges the respondents identified. The respondents also identified advantages and challenges that they think will be presented by implementing a web-based DIS in Ethiopia. Table 7 depicts the summary of the responses.

Table-7 – Advantages and challenges of using web-based Drug Information System, Addis Ababa, March-April, 2010

Advantages of web-based Drug Information System		
	Yes	**No**
Improved Information handling	185	80
Up-to-date drug Information	234	31
Providing better information to clients/patients	171	94
Avoiding stock-outs	169	96
Improving ADR reporting	171	94
Other	20	245
Challenges of web-based Drug Information System		
Misunderstanding database systems	43	222
Not specifying stock-outs to other DROs	12	253
Cost of Internet	167	98
Computer unavailable	64	201
Other	33	232

Although the respondents agree with most of the perceived advantages of a web-based DIS, the cost of subscription to Internet service has been a significant factor as it is reported by 167 respondents.

The numbers and percentages described above indicate the primary findings of the survey. For more analysis of each of these data and their relationship, predictors of relationship between the outcome variables and the possible factors are presented below.

Predictors of Information Technology Infrastructure Availability

The predictors for IT infrastructure availability in DROs were seen using a set of three variables, Location (Sub-city), Type and Ownership of DROs. Accordingly, only the Type of DRO is found to have a significant effect in the availability of IT infrastructure, with Pharmacies less likely to have the required IT infrastructure as compared to Drug stores [OR (95% CI) = 0.44 (0.26,0.76)].

Table 8 presents the results of multivariate logistic regression of the three variables in relation to IT infrastructure availability in DROs.

Table-8: Multivariate logistic regression of selected variables in relation to IT Infrastructure Availability in DROs, Addis Ababa, March – April, 2010

Variables	Have IT Infrastructure	Don't Have IT Infrastructure	Crude OR	Adjusted OR
Location of DRO (Sub-City)				
Addis Ketema	16(51.6)	15(48.4)	1.33(0.48,3.69)	1.35(0.47,3.86)
Akaki Kaliti	17(58.6)	12(41.4)	1.88(0.47,7.54)	1.96(0.47,8.20)
Arada	8(66.7)	4(33.3)	0.94(0.34,2.60)	1.10(0.38,3.21)
Bole	14(50.0)	14(50.0)	0.76(0.31,1.88)	0.95(0.37,2.42)
Gulele	22(44.9)	27(55.1)	0.73(0.22,2.45)	0.69(0.20,2.40)
Kirkose	7(43.8)	9(56.2)	0.68(0.25,1.85)	0.82(0.29,2.33)
Kolfe Keraniyo	13(41.9)	18(58.1)	0.78(0.26,2.34)	0.76(0.25,2.33)
Nifas Silk Lafto	10(45.5)	12(54.5)	1.88(0.60,5.91)	2.05(0.63,6.71)
Lideta	14(66.7)	7(33.3)	1.09(0.39,3.11)	1.30(0.44,3.85)
Yeka§	14(53.8)	12(46.2)	1.00	1.00
Type of DRO				
Pharmacy	55(42.3)	75(57.7)	**0.50(0.31,0.82)***	**0.44(0.26,0.76)***
Drug Store§	80(59.3)	55(40.7)	1.00	1.00
Ownership of DRO				
Private	119(50.2)	118(49.8)	2.01(0.36,11.22)	1.72(0.28,10.72)
Public/Governmental	14(63.6)	8(36.4)	3.5(0.52,23.56)	4.14(0.55,31.06)
NGO§	2(33.3)	4(66.7)	1.00	1.00

*Significant at P-value <0.05 §Reference Group

Predictors of Knowledge about computers and the Internet

In order to predict the significant factors affecting the knowledge of respondents about computers and Internet connection, Sex, Age Group, Professional Category, Type of DRO in which they work in, and Ownership of DROs were used as the determinant factors. In addition to these, presence of computers and Internet connection are used to identify the factors having the most effect on the knowledge of respondents. The effect of each of these independent variables on the knowledge of respondents is analyzed by making a multivariate logistic regression shown on Table 9.

Table-9: Multivariate logistic regression of selected variables in relation to Respondents' knowledge about computers and the Internet, Addis Ababa, March – April, 2010

Variables	Satisfactory (%)	Unsatisfactory (%)	COR (CI: 95%)	AOR (CI: 95%)
Sex				
Male	98(60.5)	64(39.5)	**0.54(0.32,0.93)***	0.81(0.39,1.66)
Female§	76(73.8)	27(26.2)	1.00	1.00
Age Group				
Younger Age	92(78.0)	26(22.0)	**2.81(1.63,4.83)***	2.02(0.86,4.74)
Older Age	82(55.8)	65(44.2)	1.00	1.00
Professional Category				
Pharmacist	75(71.4)	30(28.6)	1.54(0.91,2.62)	**3.92(1.46,10.55)***
Druggist§	99(61.9)	61(38.1)	1.00	1.00
Professional Experience[4]				
< 5 Years	93(75.6)	30(24.4)	**5.21(2.67,10.18)***	2.85(0.77,10.55)
6 - 10 Years	45(73.8)	16(26.2)	**4.73(2.17,10.29)***	2.04(0.72,5.78)
11 - 15 Years	14(63.6)	8(36.4)	**2.94(1.07(,8.13)***	1.95(0.68,5.62)
> 15 Years§	22(37.3)	37(62.7)	1.00	1.00
Location of DRO (Sub-City)				
Addis Ketema	16(55.2)	13(44.8)		
Akaki Kaliti	6(50.0)	6(50.0)		
Arada	19(67.9)	9(32.1)		
Bole	36(73.5)	13(26.5)		
Gulele	11(68.8)	5(31.2)		
Kirkose	19(61.3)	12(38.7)		
Kolfe Keraniyo	14(63.6)	8(36.4)		
Nifas Silk Lafto	14(66.7)	7(33.3)		
Lideta	18(69.2)	8(30.8)		
Yeka§	21(67.7)	10(32.3)		
Type of DRO				
Pharmacy	92(70.8)	38(29.2)	1.57(0.94,2.61)	0.47(0.17,1.30)
Drug Store§	82(60.7)	53(39.3)	1.00	1.00
Computer Available in DRO				
Yes	93(79.5)	24(20.5)	**3.21(1.84,5.57)***	**2.08(1.00,4.31)***
No§	81(54.7)	67(45.3)	1.00	1.00
Taken Formal Computer Training				
Yes			**14.53(7.61,27.74)***	**14.56(6.71,31.62)***
No§			1.00	1.00

*Significant at P-value <0.05 §Reference Group

[4] 5 years is required to have a druggist or pharmacist license

The data presented on Table 9 is rearranged to gain understanding of the factors affecting the knowledge of respondents. The rearrangements are made on the age grouping as well as on professional experience. The age grouping is done by taking the median age of 27 as a cut off point for younger age and older age professionals. The professional experience is also rearranged in 5 years interval. The COR and AOR values for sub-cities is not presented because no statistically significant relationship exists between knowledge of respondents and the location in which they work.

Among the possible factors that may have contributed to the knowledge status of respondents, one of the significant factors in having a better knowledge is the type of profession which the respondents have, with pharmacists having better knowledge than druggists [OR (95% CI) = 7.38(1.22, 44.77)]. Another significant factor is the availability of computer in the DRO in which the respondent works [OR (95% CI) = 2.19(1.05, 4.57)]. Though it seems obviously, taking formal computer training is also a significant factor in having a better knowledge than the reference group [OR (95% CI) = 15.94(7.30, 34.83)].

Predictors of Attitude of Respondents about Web-based Drug Information System

Among the possible factors assumed to have effect on the respondents' attitude towards web-based DIS implementation, only Age is found to be significant, with younger age groups having more favorable attitude than older age ones [2.18(1.03,4.61)]. This implies that none of the factors is more significant than the other factors in contributing to the favorable or unfavorable attitude of respondents about web-based DIS implementation in Ethiopia. The same data rearrangement used for the analysis of factors affecting the knowledge of respondents is also used here.

Table 10 depicts some of the results of the degree and significance of the relationship between selected variables in relation to respondents' attitudes.

Table-10: Multivariate logistic regression of selected variables in relation to Respondents' attitude about web-based drug information system, Addis Ababa, March – April 2010

Variables	Favorable (%)	Unfavorable (%)	COR (CI: 95%)	AOR (CI: 95%)
Sex				
Male	116(71.6)	46(28.4)	0.85(0.49,1.49)	0.86(0.46,1.61)
Female§	77(74.8)	26(25.2)	1.00	1.00
Age Group				
Younger Age	90(76.3)	28(23.7)	0.70(0.43,1.15)	**2.18(1.03,4.61)***
Older Age§	103(70.1)	44(29.9)	1.00	1.00
Professional Category				
Pharmacist	76(72.4)	29(27.6)	0.96(0.55,1.67)	0.64(0.28,1.47)
Druggist	109(73.2)	40(26.8)	1.00	1.00
Professional Experience				
< 5 Years	93(75.6)	30(24.4)	1.02(0.52,2.00)	0.44(0.17,1.17)
6 - 10 Years	45(73.8)	16(26.2)	2.73(0.76,9.77)	1.07(0.42,2.70)
11 - 15 Years	14(63.6)	8(36.4)	0.98(0.50,1.93)	2.71(0.68,10.84)
> 15 Years§	22(37.3)	37(62.7)	1.00	1.00
Location of DRO (Sub-City)				
Addis Ketema	20(69.0)	9(31.0)		
Akaki Kaliti	7(58.3)	5(41.7)		
Arada	20(71.4)	8(28.6)		
Bole	33(67.3)	16(32.7)		
Gulele	13(81.3)	3(18.7)		
Kirkose	26(83.9)	5(16.1)		
Kolfe Keraniyo	15(68.2)	7(31.8)		
Nifas Silk Lafto	13(61.9)	8(38.1)		
Lideta	21(80.8)	5(19.2)		
Yeka§	25(80.6)	6(19.4)		
Type of DRO				
Pharmacy	98(75.4)	32(24.6)	1.29(0.75,2.22)	1.45(0.61,3.44)
Drug Store§	95(70.4)	40(29.6)	1.00	1.00
Computer Available in DRO				
Yes	88(75.2)	29(24.8)	1.24(0.72,2.15)	1.12(0.60,2.10)
No§	105(70.9)	43(29.1)	1.00	1.00
Taken Formal Computer Training				
Yes	140(73.7)	50(26.3)	1.16(64,2.10)	1.16(0.58,2.32)
No§	53(70.7)	22(29.3)	1.00	1.00

*Significant at P-value <0.05 §Reference Group

5.1.5 Qualitative Results

Four key informant interviews were conducted with designated officials from DACA, and the two operational Drug Information Service (DIS) centers – St. Paul Hospital DIS and Black Lion Hospital DIS. The issues raised in these interviews are summarized into the following thematic areas.

The National Drug Policy and Drug Information Service

Mentioning the National Drug Policy of Ethiopia, which is developed in November 1993, the interviewed DACA official stressed that technology support for the Ethiopian pharmaceutical sector has been given due emphasis. Specifically, issues like drug information and promotion, stock management and distribution, and rational use of drugs along with training and utilization of health professionals in the field of pharmacy have been given due attention by the government, according to the DACA official. Therefore, the development of a web-based DIS in Ethiopia should be seen as an important support activity to implement the policy objectives and strategies.

The DACA official also stated that the existing drug information system is "almost non-existent", although new initiatives are showing encouraging results. Drug information to professionals is not being properly delivered. There are new initiatives being started, however, such activities have not met the demand for proper drug information. Moreover, professionals acquire drug information with their own efforts, according to an interviewee from the St. Paul Hospital DIS center.

Stating the major reasons for the poor status of drug information service prevailing thus far, the DACA official raised the following points:

- Health professionals' perception of drug information services has been low in terms of considering it as a specialization area,
- Resource limitation, particularly budget constraint, has been hindering government health facilities from institutionalizing drug information services,
- Curriculums in pharmacy education in government and private universities and colleges have not included courses on drug information so far,

- Lack of trainings to health professionals on finding drug information from different sources, such as the Internet, and
- Turnover of highly trained staff

However, drug information, in connection with the rational use of drugs and in providing quality medicines to the public at large, is getting much more attention by the government, according to the DACA official. Hence, technological solutions to improve the existing drug information system in Ethiopia are highly acceptable according to the interviewed DACA official.

Government's Initiatives towards an improved Drug Information System

According to the DACA official, the government is taking the following initiatives to improve the existing drug information system in Ethiopia. These are:

- The establishment of Drug Information Service centers,
- Training of DACA staff as Training of Trainers (TOT) to avail at least one pharmacist and one medical doctor in every health facility,
- Provision of drug information sources such as the Ethiopian Drug Formulary, the American National Formulary, pharmacopoeia, etc, and
- Preparation of standard treatment guidelines, drug information establishment guideline, etc

Regarding the establishment of DIS centers, DACA is planning to establish a National Drug Information Center as a coordinating body for the regional and facility-level DIS centers.

When these drug information service centers become fully operational, then it will be easier to think of a web-based drug information system in Ethiopia, according to the DACA official. Currently, DACA has issued a guideline for the establishment and operation of Drug Information Center in Ethiopia. However, institutionalizing these DIS centers has not been started yet.

The DACA official also stated that funds for the establishment and operation of DIS centers are being acquired from DACA's development partners. In addition to fund raising, DACA is also

requesting technical assistance in the scaling up DIS centers in the country. Alongside development partners, professional associations such as the Ethiopian Pharmaceutical Association (EPA) are also providing supporting DACA's such efforts.

These and other initiatives that DACA is undertaking are encouraging signs of an improved drug information system in Ethiopia for the years ahead. The addition of web-based drug information system will strengthen such efforts and achieve better policy implementation.

Role of Drug Information Service centers at Health Facilities

The role of the national and regional DICs and facility-level DIS centers is to facilitate and make sure health care providers and the general public get accurate, timely and impartial drug information that allow delivering quality healthcare to the public at large, according to the DACA official interviewed.

All of the interviewees strongly emphasized that DIS centers at Black Lion and St Paul Hospitals are doing promotional activities. As part of such endeavors, they are collecting information needs of pharmacists in the hospitals as well as answering inquiries raised from professionals.

All of the interviewees agreed strongly to the statement that web-based drug information system in Ethiopia would significantly help them achieve the objectives for which they are established. They emphasized that a drug information service in general and web-based drug information system in particular create as many new jobs for increasing number of professionals by creating a specialization area. The interviewees discussed of the practice used in other countries, where specialized pharmacists are providing consultancy services at every ward – renal pharmacist, pediatrics pharmacist, etc.

Another opportunity being offered by the school of pharmacy of AAU is the inclusion of "Drug Informatics" course in its degree program, which allows new generation of pharmacists and druggists to be informed about the field. In connection with training, the interviewees emphasized that this course should be given to all practicing pharmacists and druggists so that they can use the services provided by DIS centers as well as sources from the Internet to own an up-to-date knowledge. The interviewees also underlined that professional associations should work more to motivate professionals to make themselves up-to-date with the current and impartial drug information.

Yet another opportunity that the interviewees sought was the presence of sources from the Internet such as **Micromedex**, **Clinical Pharmacology**, **RxList**, etc. Currently, the hospital-based DIS centers are using these sources for drug information. As described by interviewees, these sources provide a much comprehensive drug information, up-to-date and impartial. The interviewees also added that the subscription of such expensive services describes the attention that DACA has given to drug information service.

In addition to the above opportunities, the interviewees also listed out the following opportunities of the prospects of implementing a web-based drug information system in Ethiopia:

- It provides a good opportunity to implement stock-out information exchange between DROs,
- It allows to make up-to-date, impartial and scientific drug information more accessible to health professionals at all times,
- It is easy to make updates on the system and make those updates immediately available to professionals at remote locations, and
- It is easy to manage and maintain the system centrally, such as posting the latest information about adverse drug reactions or about a new medicine

The interviewees also emphasized the following challenges:

- The current cost of subscribing to Internet service does not encourage many DROs,
- The system requires that each DRO should update their stock-outs as soon as practical, however, if this cannot be done by the majority of the users of the system, then it will not meet its major objective, and
- Professionals currently do not see drug information service as one area of specialization, and hence it has become difficult to get a qualified trained professional on drug information service provision

5.2 DISCUSSION

This study tried to assess the Ethiopian pharmaceutical sector. As no previous study has been found, which assessed the prospects of a web-based drug information system in Ethiopia, this study provides new information on the challeneges and opportunities, the implementation of such a system will face. With careful consideration and caution, the results of this study will be compared with studies made in the rest of the world. The discussion is presented in three sections relating to the objectives of the study.

Knowledge and attitude of respondents

This study revealed that 65.7% of the respondents had a satisfactory knowledge about computers and the Internet whereas 57.3% of the respondents had a favorable attitude about a web-based DIS implementation in Ethiopia. The study also revealed that 71.7% of the respondents had completed formal computer training. When compared to the finding of the study conducted to identify pharmacists' computer skills in Canada in 2004, where only 21% of the respondents reported completing formal computer training, this result shows much more computer-trained respondents (14).

This study revealed that 62.3% of the respondents use the internet for various purposes. This study is to some extent comparable with the study conducted to identify pharmacists' computer skills in Canada in 2004, where 81% reported using the Internet for email communication (14).

This study also disclosed that 66% of the respondents used their computers for email communication whereas 34% reported using it for various document processing. This study is also to some extent comparable with the findings of the study conducted to identify pharmacists' computer skills in Canada in 2004, where 81% used their computers for email communication and 35% used their computers for document processing (14).

This study indicated that 59.6% of the respondents agreed or strongly agreed to the statement that implementing Internet-based Drug information System helps to exchange information with DACA. This result is consistent with the one conducted in Pakistan in 2007, where 69% strongly agreed or agreed that use of e-mail has the potential to reduce unnecessary visits to a doctor (13).

This study indicated that 60.8% of the respondents agreed or strongly agreed that providing training on computer and Internet use helps implement Internet-based drug information system. This result is somehow consistent with the study made in Pakistan in 2007, where 80% agreed or strongly agreed to the statement that the Internet is useful for providing patient education (13).

IT Infrastructure availability

This study indicated that among the 265 DROs surveyed, 44.2% of the DROs have at least one computer in their store whereas another 58 (28.7%) of the DROs are planning to acquire computers for their store. This figure is significantly lesser than that indicated on the Rwandan survey, which reported that 100% of public and private health institutions in Kigali, Rwanda use computers (11).

This study also identified that 33 (12.45%) of DROs have Internet connection whereas another 51 (19.24%) have planned to acquire Internet connection to their stores. This result is still lesser than the one indicated on the Rwandan survey (11).

In this regard, more promotional activities need to be done by DACA, professional associations such as the Ethiopian Pharmaceutical Association and local and international developmental partners of DACA in order to highlight the importance of having the necessary IT infrastructure to use a web-based drug information system.

Level of government's commitment

Regarding the government's level of commitment towards realizing a web-based drug information system in Addis Ababa, the establishment of a national, regional as well as health facility-level DIS centers can be considered a very significant step forward. However, budget constraint, lack of awareness on the part of professionals about drug information service delivery and use as well as turnover of highly trained and experienced staff were mentioned as major bottlenecks towards realizing a web-based drug information system.

In order to tackle these challenges, various measures are being taken by the government such as asking cooperation of development partners to avoid budget constraint, providing training to overcome turnover of highly experienced staff, etc. Even if these measures are a significant step

forward, more needs to be done to ensure web-based DIS achieve their objectives and improve the quality of healthcare provided by health facilities and professionals.

5.3 Answers to the Research Question

The research question was "**What prospects does the implementation of web-based drug information system in Ethiopia have in terms of being realized by DACA, facility-level DIS centers, and DROs in Addis Ababa under current settings?**"

The results of the survey show that the majority of the respondents have a satisfactory knowledge (66%) and favorable attitude (73%) towards web-based DIS implementation in Ethiopia. However, only (33)12% of the DROs surveyed have Internet connection in their store. This implies that the current infrastructural availability is low. Despite the low IT infrastructure availability, the majority of respondents indicated that they are ready to accept and use a web-based DIS. Moreover, another 51 (19.2%) DROs have planned to acquire Internet connection to their store.

The results of the key informant interviews reveal that training on the field of Drug Informatics course should be expanded to all professionals, whether in-service or joining the group. They also revealed that DACA should scale up the institutionalization of facility-level DIS centers and avail renowned drug information sources (such as Micromedex) from the Internet.

These results indicate that currently, it is possible to start the implementation of web-based DIS in Addis Ababa. Since the implementation of web-based DIS in Ethiopia is a process that might take several years, more and more DROs will join the users of a web-based DIS in Addis Ababa as these years go by. The most important factor that leads to such conclusion is that all the major users (DACA, DIS centers, and DROs) of a prospective web-based DIS in Ethiopia have shown positive approach to the realization of such a system. The next activities after initiating the implementation will be to add more DROs and DIS centers into users list of the system.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATION

6.1 CONCLUSION

In order to implement a nation-wide web-based drug information system, status of the determinant factors needs to be identified. Based on such empirical investigation, the sequence of tasks and priorities become visible at a higher level. Decisions based on such investigation can ultimately result in saving lives.

The findings of this study depict a way forward in the implementation of a web-based drug information system in Addis Ababa, and ultimately in Ethiopia. They are as follows:

- The majority of health professionals working in DROs in Addis Ababa have a satisfactory knowledge about computers and the Internet,
- The majority of health professionals working in DROs in Addis Ababa have a favorable attitude towards a web-based DIS implementation in Ethiopia,
- More than half of the DROs surveyed have the required IT infrastructure,
- DACA has the level of commitment that allows to start the implementation of web-based DIS in Ethiopia – as has been witnessed by the establishment of health facility-level DIS centers, and establishment of standards and guidelines to setup these DIS centers
- Drug Stores as compared to pharmacies have a better IT infrastructure,
- Cost of the Internet is a major challenge for DROs not to use a prospective web-based DIS in Ethiopia,
- Web-based DIS allows to share stock-out information among DROs and hence allows better serving patients/clients,
- Web-based DIS allows to make up-to-date, impartial and scientific drug information more accessible to health professionals at all times, and

- It is easy to make updates on a web-based DIS and make those updates immediately available to professionals at remote locations

6.2 RECOMMENDATIONS

Based on the study findings and the above conclusions, the following short term and long-term recommendations are forwarded.

Short term

- Drug Informatics course should be scaled up across private colleges and all governmental universities,
- Conducting training and continuous education on drug informatics is important to upgrade the skills of on the job health professionals, and
- Reduced cost of the Internet should be acquired from Internet service providers in Ethiopia[5]
- More promotional activities need to be carried out in order to
    - encourage DROs to acquire the required IT infrastructure that allows them to use a web-based DIS,
    - encourage professionals to acquire drug information from the Internet to narrow the current gap,
    - introduce the role of drug information service (delivery and use) to health professionals, so as to allow them pursue it as a specialization area

Long term

- A web-based drug information system should be designed and developed, participating all the major stakeholders, including piloting it in Addis Ababa

[5] Currently, the Ethiopian Telecommunications Corporation is the sole provider of Internet service in Ethiopia

- Deployment and scale up of web-based drug information system should be conducted in parallel with training and the required IT infrastructure support to regions and health facilities
- Development of adequate trained staff should be conducted to support Web-based DIS implementation
- Further research should be conducted to investigate the role of a web-based DIS in automating and standardizing prescription formats, and the possibility of extending the use of web-based DIS to prescribers
- A more comprehensive research should be conducted to assess the prospects of implementing a web-based DIS in Ethiopia, to find facts that have not surfaced in this study
- A feedback collection and analysis mechanism should be developed in order to improve the web-based drug information system

6.3 STRENGTHS & LIMITATIONS OF THE STUDY

6.3.1 Strengths of the study

- Being a survey, this study has covered all DROs in Addis Ababa, and hence has gained insight into the IT infrastructure, and knowledge and attitude of one representative professional (chief pharmacist or chief druggist), and
- This study also provides a baseline information for further research

6.3.2. Limitations of the study

- Similar studies have not been found in Ethiopia, which makes it difficult for benchmarking the results,
- Literature relevant on the topic is very limited, which has not created the opportunity for a more rich literature backing of the determinant factors in implementing web-based DIS in Ethiopia, and

- Presence of incomplete questionnaires compromises the power of the information generated from the survey

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ANNEXES

ANNEX 1: List of Drug Retail Outlets in Addis Ababa, March - April 2010

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
1.	አለፍሪ መ/መደብር	ክ/ቀራንዮ	04	657	0916821470		
2.	ኤች ቢ ኢ መ/መደብር	ክ/ቀራንዮ	02/03	-	0113481514		
3.	ካራቶሬ ሕዝብ መ/መደብር	ክ/ቀራንዮ	04	1884	0912061973		
4.	ሚራጅ መ/መደብር	ክ/ቀራንዮ	15/16	919	0911070287		
5.	ናሆም መ/መደብር	ክ/ቀራንዮ	-	434	0911343402		
6.	ብርሃኑ መ/መደብር	ክ/ቀራንዮ	15/16	530	0911408279		
7.	ናቤሬ መ/መደብር	ክ/ቀራኒዮ	05	2367	0113484999		
8.	ትግስት መ/መደብር	ክ/ቀራንዮ	15/16	282	0112700144		
9.	ባታ መ/ቤት	ክ/ቀራንዮ	13/14	709	0116552134		
10.	ኤፍራም መ/መደብር	ክ/ቀራንዮ	01	1014	0115707566		
11.	ጣና መ/ቤት	ክ/ቀራንዮ	06	-	0911805496		
12.	ፍላጎት መ/መደብር	ክ/ቀራንዮ	06	አዲስ	0911046193		
13.	በአምነት መ/መደብር	ክ/ቀራንዮ	01/05	474	0911468250		
14.	አቲ መ/መደብር	ክ/ቀራንዮ	07	1198	0913876265		
15.	ቀራንዮ መ/መደብር	ክ/ቀራንዮ	07	183	0911781830		
16.	ቤተል ሆ/ል መ/ቤት	ክ/ቀራንዮ	07	2181	-		
17.	ሄልዝ ኬር መ/መደብር	ክ/ቀራንዮ	06	አዲስ	0116540063		
18.	ጎዶልያስ መ/መደብር	ክ/ቀራንዮ	13	አዲስ	0913135633		
19.	ህይወት በር መ/መደብር	ክ/ቀራንዮ	03	3661	0113484239		
20.	አለም ባንክ መድ/ ቤት	ክ/ቀራንዮ	05	269	0911375589		
21.	ጤና አዳም መ/መደብር	ክ/ቀራንዮ	05	-	0113481136		
22.	ፍሬህይወት መ/መደብር	ክ/ቀራንዮ	10/11	096/ለ	0911667584		
23.	አሚ መ/መደብር	ክ/ቀራንዮ	10/11	-	-		
24.	ቤተ አማኑኤል መ/ቤት	ክ/ቀራንዮ	10	097	0116543577		
25.	ሳይ መ/መደብር	ክ/ቀራንዮ	06	KBG92/F#3	0113494566		
26.	ጀሞ መ/መደብር	ክ/ቀራንዮ	07	K185 F3	0911209683		
27.	ሳሮን መ/መደብር	ክ/ቀራንዮ	06	አዲስ	0113499547		
28.	ጤና ለሁሉም መ/መደብር	ክ/ቀራንዮ	12	644	0112795840		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
29.	ሌዊ መድ/ቤት	ክ/ቀራንዮ	09	011	0112793147		
30.	አሰፋ መ/መደብር	ክ/ቀራንዮ	12	1011	0911300774		
31.	ሙሉ መ/መደብር	ክ/ቀራንዮ	12	042/ለ	0112798613		
32.	ፅዲ መ/መደብር	ክ/ቀራንዮ	04	732	0911477431		
33.	ህብረት መድ/ቤት	ክ/ቀራንዮ	03	06415	0113480342		
34.	አርሴማ መ/መደብር	ክ/ቀራንዮ	03	1402			
35.	ቴዎድሮስ መ/መደብር	ክ/ቀራንዮ	04	662	0116530459		
36.	ያቤጽ መ/መደብር	ክ/ቀራንዮ	02	2739	0112320319		
37.	ዛማሊክ መ/ቤት	ክ/ቀራንዮ	03	1109	0112715641		
38.	አለርት ሆ/ል መ/ቤት	ክ/ቀራንዮ					
39.	ፊስቱላ ሆ/ል መ/ቤት	ክ/ቀራንዮ					
40.	ዮሚ መ/ቤት	ን/ላፍቶ	12	415/0325	0114431911		
41.	አቢጌል መ/መደብር	ን/ላፍቶ	08	075/ሀ	0116670849		
42.	ብሌን ምናሴ መ/መደብር	ን/ላፍቶ	16/17	076	0911402800		
43.	በለስ መ/መደብር	ን/ላፍቶ	15	3750	0911203378		
44.	ናማሊያ መ/መደብር	ን/ላፍቶ	15	2433	0115524417		
45.	ቅ/ጊዮርጊስ መ/መደብር	ን/ላፍቶ	09/14	279	0116524502		
46.	ሀሌ ሉያ መ/መደብር	ን/ላፍቶ	15	3327	011419651		
47.	ሸገር መ/መደብር	ን/ላፍቶ	12/13	906	0114409534		
48.	ልደት መ/ቤት	ን/ላፍቶ	04	1380	0113724102		
49.	አቢሲኒያ መ/ቤት	ን/ላፍቶ	09	385	0911241985		
50.	ሮሆቦት መ/መደብር	ን/ላፍቶ	09	470	0114169827		
51.	ፍቅርአለም መ/መደብር	ን/ላፍቶ	-	-	-		
52.	ሰላም መ/መደብር	ን/ስ/ላፍቶ	10/18	2023	0115525654		
53.	ሰዋሰው ብርሃን ቅ/ጳውሎስ መ/መደብር	ን/ስ/ላፍቶ	16	አዲስ	0911457608		
54.	ብስራተ ገብርኤል መ/መደብር	ን/ስ/ላፍቶ	03	514	0911333706		
55.	ታምሩ መ/መደብር	ን/ስ/ላፍቶ	09	394	0114164819		
56.	አክሱም መ/ቤት	ን/ላፍቶ	18	812	0116431571		
57.	ኢንተርናሽናል የልብና ልብ መሰል ሆ/ል መ/ቤት	ን/ላፍቶ	11	1262	0116613836		
58.	ድል ገበያ መ/ቤት	ን/ላፍቶ	04	529	0114203411		
59.	ክነማ መ/ቤት ቁ5	ን/ላፍቶ	09	047	0114653339		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
60.	ህሊና መ/ቤት	ን/ላፍቶ	09	041	0114665118		
61.	ከነማ መ/ቤት	ን/ላፍቶ	11	618	0114423175		
62.	አብይ መ/መደብር	ን/ስ/ላፍቶ	06	1720	01132022284		
63.	እየሱስ መ/መደብር	አ/ከተማ	12	1918	0112751170		
64.	ፍጹም መ/መደብር	አ/ከተማ	01/05	አዲስ	0911026053		
65.	ግራር መ/መደብር	አ/ከተማ	06/07	063	0116545204		
66.	አዋሽ መ/መደብር	አ/ከተማ	03	665	0112130707		
67.	ኢብን ሲና መ/ቤት	አ/ከተማ	14/21	አዲስ	0911204012		
68.	ቅዱስ ላሊበላ መ/መደብር	አ/ከተማ	10	557	0113139509		
69.	ቅዱስ ሩፋኤል መ/መደብር	አ/ከተማ	12	043	01127500949		
70.	ሕዝብ መ/ቤት	አ/ከተማ	12	167	0112763581		
71.	አዲስ አጠቃላይ ሆ/ል መ/ቤት	አ/ከተማ	12	711	0111132859/60		
72.	አፋል መ/ቤት	አ/ከተማ	08	407/ሀ	0112797660		
73.	ኮከብ መ/መደብር	አ/ከተማ	04	496	-		
74.	ሰይክ መ/ቤት	አ/ከተማ	12	582/ለ	-		
75.	ጥሩ መ/ቤት	አ/ከተማ	16	541	0112775677		
76.	እየሩስ መ/መደብር	አ/ከተማ	12	1097	0112771982		
77.	ሐረር መ/ቤት	አ/ከተማ	11	005	0112750227		
78.	አለም ጤና መ/ቤት	አ/ከተማ	20	068/9	0115545733		
79.	ኑር መ/መደብር	አ/ከተማ	10/11/12	380	0911631055		
80.	መከታ መ/መደብር	አ/ከተማ	02	883/02	0111117531		
81.	አግሪን የሰዉና የእንስሳት መ/መደብር	አ/ከተማ	13	065	0112771420		
82.	ሀዊራ መ/መደብር	አ/ከተማ	15	329	0116540199		
83.	ናሂም መ/መደብር	አ/ከተማ	19	156	0112130284		
84.	ኤደን መ/መደብር	አ/ከተማ	13	062	0112132655		
85.	ቅዱስ ጴጥሮስ ቲቢ ስፔሻላይዝድ ሆ/ል መ/ቤት	አ/ከተማ	07/17	-	0912143687		
86.	ሕይወት መ/መደብር	አ/ከተማ	-	852	0112763690		
87.	ሚና መ/መደብር	አ/ከተማ	18	086	0112762588		
88.	መሳለሚያ መ/መደብር	አ/ከተማ	16/17	691	0112135116		
89.	ቃል መ/መደብር	አ/ከተማ	18	096	0911314116		
90.	ስካይ መ/መደብር	አ/ከተማ	13	338	0112766511		
91.	ከነማ መ/ቤት ቁ5	አ/ከተማ	12	1045	0112132006		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
92.	ብሌን መ/መደብር	አዲስ ከተማ	18	332	0112135922		
93.	ኢትዮ ጠቢብ መለስተኛ ጠቅላላ ሆ/ል መ/ቤት	አዲስ ከተማ	18	564	0112139292		
94.	ይብራይስጥ መ/ቤት	አዲስ ከተማ	12	1975/03	0112775016		
95.	ሀዋርያት መ/ቤት	አዲስ ከተማ	13	783	0112760232		
96.	መሰረት መድሃኒት መደብር	ቂርቆስ	10	042	0911100194		
97.	ቅዱስ ጳውሎስ መ/መደብር	ቂርቆስ	11	266	0114163439		
98.	አሚር መ/ቤት	ቂርቆስ	06	020/02	0116666391		
99.	አክሱም መ/መደብር	ቂርቆስ	15	014	0911692684		
100.	ገልአድ መ/ቤት	ቂርቆስ	01/02	806/9	0911237410		
101.	ኤልሮስ መ/ቤት	ቂርቆስ	21	520	0114161274		
102.	ቤተሳይዳ መ/መደብር	ቂርቆስ	20/21	479	0911800070		
103.	ገነት መ/መደብር	ቂርቆስ	10	415	0111511688		
104.	አዲስ መ/መደብር	ቂርቆስ	02/03	021	0911448666		
105.	ቅዱስ ሚካኤል መ/መደብር	ቂርቆስ	01/09	121	0111226075		
106.	ሰምሰም መ/ቤት	ቂርቆስ	10	268	0115534845		
107.	ጣና መ/መደብር	ቂርቆስ	12	869	0115156305		
108.	ገነት መ/ሆ/ል መ/ቤት	ቂርቆስ	10	183	0115576768		
109.	ኖህ መ/ቤት	ቂርቆስ	04	170	0114167673		
110.	አስክዋል መ/መደብር	ቂርቆስ	15	432	0115545612		
111.	አክሱም መ/ቤት ቁ1	ቂርቆስ	02	490/5	0115518626		
112.	ዘውዲቱ ሆ/ል ከነማ ልዩ መ/ቤት ቁ12	ቂርቆስ	16	-	0115518085		
113.	ዘውዲቱ ሆ/ል መ/ቤት	ቂርቆስ	16	-	0115518085		
114.	ጥቁር አንበሳ ሆ/ል መ/ቤት	ቂርቆስ					
115.	ፔሊካን መ/ቤት	ቂርቆስ	01	396	0115521790		
116.	ከነማ መ/ቤት ቁ10	ቂርቆስ	18	አዲስ	0115509064		
117.	ሮዝ መ/ቤት	ቂርቆስ	15	442	0115509237		
118.	ግዮን መ/ቤት	ቂርቆስ	01/02	394/1	0115518606		
119.	ደስታ መ/መደብር	ቂርቆስ	15	112/04	0115156666		
120.	ብሩክ መ/ቤት	ቂርቆስ	17	482	0115153695		
121.	ፋርማ ስታር መ/መደብር	ቂርቆስ	20	523	0115520716		
122.	ናይል መ/ቤት	ቂርቆስ	02/03	-	0911122632		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
123.	ቅዱስ ኡራኤል መ/ቤት	ቂርቆስ	18	076	-		
124.	እንዶድ መ/መደብር	ቂርቆስ	01/09	አዲስ	0911336539		
125.	ቅድስት መ/ መደብር	ቂርቆስ	17	177	011514454		
126.	ቢ.ጂ.ኤም የእናቶችና የህፃናት ሆ/ል መ/ቤት	ቂርቆስ	02	198	0115511767		
127.	ዘግዶም መ/ቤት	ቂርቆስ	07	330/08	0115523777		
128.	ቤተ ዛታ አጠቃላይ ሆ/ል	ቂርቆስ	15	363/365	0115535981		
129.	አሸተን መ/ቤት	ቂርቆስ	02	333	0115534052		
130.	ላንድማርክ ሆ/ል መ/ቤት	ቂርቆስ	10	355	-		
131.	ሉቃስ መ/ቤት	ቂርቆስ	05	353	0114161560		
132.	ላንቻ መ/ቤት	ቂርቆስ	02/03	070	0114655780		
133.	ግሸን መ/ቤት ቁጥር2	ቂርቆስ	15/16	389	0115540679		
134.	አልያን መ/መደብር	ቂርቆስ	16	1098	0115527522		
135.	ካዛንቺስ መ/ቤት	ቂርቆስ					
136.	ግሩም ሆ/ል መ/ቤት	ጉለሌ	19/20	791	0911426825		
137.	ሰንቢር መ/መደብር	ጉለሌ	21	303	0112772756		
138.	ቴዎድሮስ መ/መደብር	ጉለሌ	04	662	0116530459		
139.	ኮሰብ መ/መደብር	ጉለሌ	13/14	256	0911692002		
140.	የሮሃም መ/መደብር	ጉለሌ	10/11	621/ሀ	0917804005		
141.	ኤም ዲ መ/መደብር	ጉለሌ	03/04	320/ሀ	0118101103		
142.	ፍቅረማርያም መ/መደብር	ጉለሌ	12	036/ለ	0911117980		
143.	ወዲጆ መ/መደብር	ጉለሌ	09/15	995/ሀ	0911157822		
144.	ሎዛ መ/መደብር	ጉለሌ	08/16	180	0911889910		
145.	ጉለሌ መ/መደብር	ጉለሌ	16	118/ሀ	0111277090		
146.	ከነማ መድሃኒት ቤት	ጉለሌ	16	06211	0111121595		
147.	ሚኪ መ/መደብር	ጉለሌ	04/05	124	0911736576		
148.	መድሃኒዓለም መ/መደብር	ጉለሌ	02	361	0111236780		
149.	ዳናሚስ መ/መደብር	ጉለሌ	10	431	0111222798		
150.	ሴንትራል መ/መደብር	ጉለሌ	10	557	0116545852		
151.	ጥሩወርቅ መ/መደብር	ጉለሌ	11	650	0112756184		
152.	ኢትዮ ጀርመን መ/ቤት	ጉለሌ	12	449/ሐ	0112591404		
153.	ቅዱስ ጳውሎስ ሆ/ል መ/ቤት	ጉለሌ					
154.	ራስ ደስታ ሆ/ል መ/ቤት	ጉለሌ					

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
155.	ዘምባባ አጠቃላይ ሆስፒታል መ/ቤት	አቃቂ ቃሊቲ	13	941/ለ	0116431994		
156.	ጤና መ/ቤት	አቃቂ ቃሊቲ	14	485	0114431344		
157.	ቃሊቲ መ/ቤት	አቃቂ ቃሊቲ	10	1269/01	0114391010		
158.	ፍሬአብ መ/ቤት	አቃቂ ቃሊቲ	13	1706	0114423589		
159.	ከ.ጎ.ማ መ/ቤት ቁ.1	አቃቂ ቃሊቲ	09	018/ሐ	0114342250		
160.	ተንሲ. መ/ቤት	አቃቂ ቃሊቲ	13	30819	0114407489		
161.	ከ.ጎ.ማ መ/ቤት ቁ.6	አቃቂ ቃሊቲ	05	003	0114340377		
162.	ቤተል መ/መደብር	አቃቂ ቃሊቲ	09	134/ለ	0114343042		
163.	ገሊላ መ/መደብር	አቃቂ ቃሊቲ	09	አዲስ	0911431473		
164.	ማቲ መ/መደብር	አቃቂ ቃሊቲ	12/13	1112	0116526892		
165.	ሀብር መ/ቤት	አቃቂ ቃሊቲ	12/13	አዲስ	0911746345		
166.	ዳንኤል መ/መደብር	አቃቂ ቃሊቲ	12/13	1108	0911475931		
167.	ይስሀክ መ/ቤት	ቦሌ	01	1426	0116260715		
168.	አባድር መ/ቤት	ቦሌ	03	606/ሀ	0116624397		
169.	አዲስ ህይወት ሆ/ል መ/ቤት	ቦሌ	06	088	011623915		
170.	ጥያ መ/መደብር	ቦሌ	03/05	707/ሀ	0911634513		
171.	ላይፍ መ/መደብር	ቦሌ	05	382/ለ	0116639448		
172.	ብስራት መ/ቤት	ቦሌ	05	840/መ	0911679074		
173.	ኢዮቤፅ መ/መደብር	ቦሌ	10	0192	0911618832		
174.	ቦሌ መድሃኒአለም መ/ቤት	ቦሌ	05	153	0116184269		
175.	ታቦር መ/ቤት	ቦሌ	10	3881	0911100110		
176.	ኤሚ መ/መደብር	ቦሌ	11	አዲስ	0911605583		
177.	ገርጂ መ/መደብር	ቦሌ	11	541	0113293242		
178.	ሴሊሆም መ/መደብር	ቦሌ	10	2067	0911392146		
179.	ኮከ. መ/መደብር	ቦሌ	10	1335	0911625518		
180.	ቤተ ኡራኤል መ/ቤት	ቦሌ	04/06	አዲስ	0115500206		
181.	የረር መ/መደብር	ቦሌ	12/13	317/4	0911209547		
182.	ሃያት ሆ/ል መ/ቤት	ቦሌ	-	-	-		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
183.	ሂሩት መ/መደብር	ቦሌ	11	6315	0116460777		
184.	መስከርም መ/ቤት	ቦሌ	02	577	0116614321		
185.	አድነው መ/መደብር	ቦሌ	11	6475	0911117980		
186.	ካዲስኮ አጠቃላይ ሆ/ል መ/ቤት	ቦሌ	01	አዲስ	0116298756		
187.	አዲስ ሕይወት ሆ/ል መ/ቤት	ቦሌ	06	088	0116623915		
188.	ሚሊ መ/መደብር	ቦሌ	14/15	2029	0116465048		
189.	ፊንታዬ መ/መደብር	ቦሌ	14	2152	0116450273		
190.	ጎህ መ/ቤት	ቦሌ	05	373/ለ	0116631472		
191.	ጎሮ መ/መደብር	ቦሌ	15	212	0911696656		
192.	መሪ መ/መደብር	ቦሌ	20/21	አዲስ	0116605603		
193.	ሐጌ መ/መደብር	ቦሌ	16	አዲስ	0116605313		
194.	ዳሽን መ/ቤት	ቦሌ	13/05	B252	09130836		
195.	ሰሀሊትምህርት መ/ቤት	ቦሌ	13	-	-		
196.	ከነአነ መ/መደብር	ቦሌ	,	1795	0116459444		
197.	ጵዮን መ/መደብር	ቦሌ	-	1734/ሠ	0911402018		
198.	አልታድ ሚካኤል መ/ቤት	ቦሌ	-	-	0116478646		
199.	በፀጋህ የዕንስና ማህፀን ልዩ መ/ቤት	ቦሌ	04	297	0115545559		
200.	ዮናስ መ/ቤት	ቦሌ	16	673	0115572855		
201.	ባቲ መ/መደብር	ቦሌ	11	አዲስ	0911169949		
202.	ራማ መ/ቤት	ቦሌ	11	አዲስ	0911134043		
203.	ቅዱስ ብስራት መ/ቤት	ቦሌ	10	3900	0911535837		
204.	ቅዱስ ገብርኤል ሆ/ል መ/ቤት	ቦሌ	15	376	0116613622		
205.	ሰም መ/ቤት ቁ 2	ቦሌ	12/13	-	0115502466		
206.	ፕራይም መ/ቤት	ቦሌ	06	419/ለ	0116624595		
207.	አዶናይ መ/መደብር ቁ2	ቦሌ	07	126	0911754676		
208.	ጽናት መ/መደብር	ቦሌ	07	482	0116633330		
209.	አዲስ የልብ ሆስፒታል መ/ቤት	ቦሌ	02	አዲስ	0111243274		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
210.	ብራስ የእናቶችና የህፃናት ሆ/ል መ/ቤት	ቦሌ	03	2301/4	0116632031		
211.	አዶናይ መ/መደብር	ቦሌ	08/09	878	0116633476		
212.	ቢንያም መ/መደብር	ቦሌ	11	5260	0911341252		
213.	ምህረት መ/ መደብር	ቦሌ	16	-	0911618116		
214.	ኢትዮ ሚሊየም መ/ቤት	ቦሌ	17	1212	0116263442		
215.	ወምብሌይ መ/መደብር	ቦሌ	01	3142	0913548399		
216.	ጉርድ ሾላ መ/መደብር	ቦሌ	14/15	357	0116515514		
217.	ያኔት መ/መደብር	ቦሌ	13/14	485	0116533709		
218.	ቅዱስ ያሬድ አጠቃላይ ሆ/ል መ/ቤት	ቦሌ	12/12	643/645	0116454606		
219.	አባድር መ/ቤት ቁ.2	ቦሌ	01	819	0911221942		
220.	ቦሌ መ/ቤት	ቦሌ	02	1854/ሀ	0116612153		
221.	ኢምፔሪያል መ/ቤት	ቦሌ	05	1005	0911464325		
222.	ማኪስታ መ/መደብር	ቦሌ	12/13	531/2	0911103008		
223.	ተምናሴራ መ/ቤት	ቦሌ	03/05	088	0911138524		
224.	ተዘንአ ሆ/ል መ/ቤት	ልደታ	02	1377	0113711208		
225.	ዮርዳኖስ ሆ/ል መ/ቤት	ልደታ	12	574	0115545733		
226.	ተክለሃይማኖት መ/መደብር	ልደታ	12	265	0111113637		
227.	እንጉዳይ መ/መደብር	ልደታ	02/03	1797/ለ	0911001104		
228.	ቸቸላ መ/መደብር	ልደታ	12	599	0116559180		
229.	ስምረት መ/መደብር	ልደታ	15	107	0115504747		
230.	እንዶድ መ/ቤት	ልደታ	17	450	0115531702		
231.	እመቤት መ/መደብር	ልደታ	05/08	524	0911743019		
232.	አርሴማ መ/መደብር	ልደታ	03	140/2	-		
233.	ቤተል ሆ/ል መ/ቤት	ልደታ	-	996	0113728380		
234.	ማቴዎስ መ/መደብር	ልደታ	02/03	10	0113714320		
235.	ትንሳኤብርኃን መ/ቤት	ልደታ	04/06	1883/ሀ	0112752070		
236.	አብነት መ/ቤት	ልደታ	08	977	0112755911		
237.	ኤልያስ መ/ቤት	ልደታ	05	083	0112755121		
238.	አዳም መ/መደብር	ልደታ	12	056	0115504110		
239.	ኮኔል መ/መደብር	ልደታ	09	-	-		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
240.	ዳልጋ አንበሳ መ/ቤት	ልደታ	14	485	0115523187		
241.	አክሱም መ/ቤት ቁ4	ልደታ	14	WBC	-		
242.	ሆሳ መ/መደብር	ልደታ	08	216	0115151190		
243.	አማኑኤል መ/መደብር	ልደታ	14	112	0115519150		
244.	ኢትዮጵያ መ/ቤት	ልደታ	18	018/ሀ	0115516820		
245.	ፍቱን መ/ቤት	ልደታ	12	386	0111568936		
246.	ሮያል መ/መደብር	ልደታ	12	794	0111557364		
247.	ዲካ መ/ቤት	ልደታ	12	539	0115159832		
248.	ተስፋ መ/መደብር	ልደታ	05/08	072	0112770186		
249.	እናት መ/ቤት	ልደታ	11	081	-		
250.	አድዋ መ/ቤት	ልደታ	13	177/2	-		
251.	ያቤፅ መ/መደብር	ልደታ	02	2379	0112320319		
252.	ዛማሊክ መ/ቤት	ልደታ	03	1109	0112715641		
253.	ክነማ መ/ቤት ቁ8	ልደታ	17	አዲስ	0111566018		
254.	ኢንተርናሽናል መ/ቤት	ልደታ	53	909/02	-		
255.	ባልቻ ሆስፒታል መ/ቤት	ልደታ					
256.	ጥበቡ መለስተኛ ጠቅላላ ሆ/ል መ/ቤት	አራዳ	03	685	0111561024		
257.	አበበች ጎበና ልዩ የእናቶች እና ህጻናት ሆ/ል መ/ቤት	አራዳ	06	078	0111553622		
258.	ቤዛ መ/መደብር	አራዳ	12	1544	0111575672		
259.	ቅብአ ቅዱስ ሰፈዉስ መ/መደብር	አራዳ	12	1153	0111222826		
260.	ቅዱስ ስላሴ መ/መደብር	አራዳ	17	169/21	0111116674		
261.	ከ.ነ.ማ መ/ቤት ቁጥር 14	አራዳ	11	-	0116646154		
262.	ከ.ነ.ማ መ/ቤት ቁጥር 13	አራዳ	05	431	0111550444		
263.	ራስ ደስታ ሆ/ል ከ.ነ.ማ መ/ቤት ቁጥር 16	አራዳ	07		0111579964		
264.	ስፕሪንግ መ/ቤት	አራዳ	10	608	0111552343		
265.	ከ.ነ.ማ መ/ቤት ቁጥር 4	አራዳ	17	992/07	0111566987		
266.	ከ.ነ.ማ መ/ቤት ቁጥር 2	አራዳ	02	356	0111560728		
267.	ፍኖተ መ/ቤት	አራዳ	05	490	0111579260		
268.	ሳራ መ/መደብር	አራዳ	06	344	0111113539		
269.	ቅዱስ ዮሃንስ መ/መደብር	አራዳ	03/09	389	0112574676		
270.	ሆሳእና መ/መደብር	አራዳ	03	606	0111112411		
271.	ሜሮን መ/ቤት	አራዳ	09	023	-		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
272.	የኢትዮጲያ ቀይመስቀል አ/አ ቅርንጫፍ መ/ቤት ቁ2	አራዳ	09	751/ለ	0111572118		
273.	አልያም መ/ቤት	አራዳ	-	-	011552187		
274.	ጉመሪ መ/ቤት	አራዳ	02		0911200195		
275.	ጋንዲ ሆ/ል መ/ቤት	አራዳ	15		0115518185		
276.	ጋንዲ ሆ/ል ከነማ ቁ.15 ልዩ መ/ቤት	አራዳ	15	-	0115518185		
277.	አዲስ የእናቶችና የህጻናት ሆ/ል መ/ቤት	አራዳ	13/14	455	0111245348		
278.	ኢትዮ-ጠቢብ የእናቶችና የህጻናት ሆ/ል መ/ቤት	አራዳ	01/02	214	0111110063		
279.	አፍሪካ መ/መደብር	አራዳ	03	429	-		
280.	አስክንድር መ/መደብር	አራዳ	05	003	0112763624		
281.	ሐሊናስ መ/ቤት	አራዳ	08	1145	0111119127		
282.	ሸዋ መ/መደብር	አራዳ	08	661	0115579296		
283.	ሰሜን መ/መደብር	አራዳ	08	682/00	0111110611		
284.	መስቀለ ኢየሱስ መ/መደብር	አራዳ	13	771	0111232920		
285.	አንበሳ መ/ቤት	አራዳ	01	158/ሃ	0111551893		
286.	ከነማ መ/ቤት ቁ.3	አራዳ	-	-	-		
287.	አሜን መ/መደብር	አራዳ	07	080/ሐ	0111565940		
288.	አትላንቲክ መ/መደብር	አራዳ	02	አዲስ	0911898547		
289.	የካቲት 12 ሆስፒታል መ/ቤት	አራዳ					
290.	ዮናስ መ/ቤት	አራዳ					
291.	አንበሳ ጊቢ መ/ቤት	አራዳ					
292.	ምህረት መ/መደብር	የካ	16	-	-		
293.	አስግደች የእናቶችና የህጻናት ሆ/ል መ/ቤት	የካ	14	-	0116622049		
294.	የካ ሚካኤል መ/መደብር	የካ	13	070	-		
295.	ለም መ/ቤት ቁ1	የካ	14	03	0116615824		
296.	ሸላ መ/መደብር	የካ	13/14	846	0911341073		
297.	ሆሊ መ/መደብር	የካ	10	222	0115509063		
298.	ገዳ መ/መደብር	የካ	17	644	0911638595		
299.	ከነማ መ/መደብር ቁ2	የካ	19	2356	0116600150		
300.	የአብስራ መ/መደብር	የካ	01/19	1328	0116607112		
301.	ሔልሱ መ/መደብር	የካ	09	993	0116467198		
302.	መ·ሰ·ብርሃን መ/መደብር	የካ	13/14	291	0911303078		

ተራ ቁ.	የድርጅቱ ስም	አድራሻ				"√"	"√"
		ክ/ከተማ	ቀበሌ	የቤት/ቁ	ስልክ/ቁ	የተሰጠ	የተመለሰ
303.	ሕሊና ስላሴ መ/መደብር	የካ	13/14	847	0116626066		
304.	ናሽናል ሆ/ል መ/ቤት	የካ	13/14	005	0116620479		
305.	ኮተቤ መ/መደብር	የካ	17	1563	0116463898		
306.	ጽዮን መ/ቤት	የካ	14	739	0116627195		
307.	ሰንሰት መ/ቤት	የካ	14	126/ለ	0116615699		
308.	ግሽን መ/ቤት ቁ1	የካ	14	367/ለ	0116611717		
309.	ሀና ወኢያቄም መ/ቤት	የካ					
310.	ሩት መ/መደብር	የካ	17	102	0112760062		
311.	ባምላክ መ/መደብር	የካ	19	አዲስ	0911164898		
312.	ድንበራ የማህጸንና ፅንስ ሆ/ል መ/ቤት	የካ	14	1019	0116611112		
313.	ሚዩንግሱንግ አጠቃላይ ሆ/ል መ/ቤት	የካ	11	-	0116628428		
314.	በር ሚሊኒየም መ/መደብር	የካ	19	256	0111198215		
315.	ሲድራቅ መ/ቤት	የካ	11/12	457	0913926098		
316.	አለም መ/መደብር	የካ	14	599/ሠ	0116633186		
317.	ሮማን መ/መደብር	የካ	17	አዲስ	0116518996		
318.	ሚኒሊክ ሆስፒታል መ/ቤት	የካ					
319.	ሴሎ መ/መደብር	የካ					
320.	ፍራኦል መ/ቤት	የካ					

ANNEX – 1: Information Sheet and Consent Form

Good Morning / Afternoon Questionnaire No _____

My Name is _____. I came here today to collect data for Elias Alemayehu - a postgraduate student at Addis Ababa University, Health Informatics Programme. He is conducting his thesis research entitled:

"Exploring the potential of Web-based Drug Information System Implementation among Pharmacies and Drug Stores in Addis Ababa"

A Web-based Drug Information System for Ethiopia is a computer-based information management and exchange medium between DACA, Drug Information Centers (DICs), and pharmacies and drug stores, and which uses the Internet technology as the communication medium. The information to be managed includes drug stock management. The information to be exchanged includes information about drugs, their formularies, and the different brands, adverse drug reaction reporting, stock-out information etc.

The objective of this questionnaire is therefore to collect data from all pharmacies and drug stores in Addis Ababa, private, public and NGO. Accordingly, you have been selected to be included in this study. Your active participation and providing genuine information is very important to the results of the research.

I would like to assure you that, the information that you provide on this questionnaire is completely confidential and will be used only for the research purpose. No personal identification is required and therefore you will not be asked about personal identification data. You do not have to answer any question if you do not want to. You have right to stop filling this questionnaire at any time. However, the information that you will provide is very useful to achieve the objective of this study.

Considering this assurance, I would greatly appreciate your co-operation in responding to this questionnaire and the time that we need is about **15-20 minutes** to fill it.

Thank you for your willingness to participate in this study.

Name of data Collector _____ Name of Supervisor_____

Signature_____ Date_____ Signature_____ Date_____

Do you agree to participate in this research? (Indicate by making a "√" mark)

Yes _____

No _____

ANNEX 2: Questionnaire for the Survey – English Version

Addis Ababa University

Faculty of Informatics and Faculty of Medicine (Joint)

Health Informatics Program

Name of health facility_____

Date_____

Section I. Demographic Characteristics

Instruction: Please circle the number(s) for your answers.

S. No.	Question	Response	Code
101	What is your age? (In completed Years)	_____	
102	What is your sex?	1. Male 2. Female	1 2
103	Select your professional category	1. Pharmacist 2. Druggist 3. Pharmacy Technician	1 2 3
104	Your current position in the health facility [select all that apply]	1. Owner/Manager 2. Chief Pharmacist/Druggist 3. Pharmacy Professional	1 2 3
105	How many years have you been working in this health facility?	_____	
106	How many years have you been working in a pharmacy or drug store in general?	_____	

Section II. IT Infrastructure availability in Health Facilities

S. No.	Question	Response	Code	Skip to
201	The type of health facility is	1. Pharmacy 2. Drug Store	1 2	

202	The type of ownership of the pharmacy/drug store is	1. Public/Governmental 2. Private 3. NGO	1 2 3	
203	Do you have a computer in the pharmacy/drug store?	Yes No 1 2		If **No** →208
204	Do you use the computer in the pharmacy/drug store?	Yes No 1 2		If **No** →208
205	How often do you use a computer in the pharmacy/drug store?	1. Daily 2. Weekly 3. Monthly 4. Rarely 5. Never	1 2 3 4 5	
206	Do you have computer software for processing drug information?	Yes No 1 2		
207	Do you have Internet connection in the pharmacy/drug store?	Yes No Don't Know 1 2 3		If **No** →210
208	Can you afford to buy a computer for the pharmacy/drug store?	Yes No Don't Know 1 2 3		If **No** →210
209	Have you planned to buy a computer for the pharmacy/drug store?	Yes No Don't Know 1 2 3		
210	Can you afford to install an Internet connection for the pharmacy/drug store?	Yes No Don't Know 1 2 3		If **No** →301
211	Have you planned to install an Internet connection for the pharmacy/drug store?	Yes No Don't Know 1 2 3		

Section III. Knowledge Questionnaire

Instruction: Please <u>circle</u> the number(s) for your answers.

S. No.	Question	Response	Code	Skip to
301	Have you had formal computer training?	Yes No Don't Know 1 2 3		
302	Why do you use a computer? (Select all that apply)	1. E-mail communication 2. Writing & reading personal documents 3. Drug/pharmacy-related work 4. For other purposes _____	1 2 3 4	
303	Do you know about computerized database systems?	Yes No Don't Know 1 2 3		
304	Do you use the Internet?	Yes No 1 2		If No →401
305	Do you use the Internet to search for drug-related information?	Yes No Don't Know 1 2 3		
306	Do you know Internet-based drug database systems?	Yes No Don't Know 1 2 3		
307	How often do you use the Internet for Drug-related information?	1. Daily 2. Weekly 3. Monthly 4. Rarely 5. Never	1 2 3 4 5	
308	How do you evaluate drug information available from the Internet or Internet-based Drug database systems?	1. Very helpful 2. Helpful 3. Satisfactory (not enough) 4. Unhelpful/irrelevant 5. Confusing/wrong	1 2 3 4 5	

309	Do you use computer for stock management?	1. Yes 2. No		

Section IV. Attitude Questionnaire

Instruction: Please circle the number(s) for your answers.

S. No.	Question	Response	Code	Skip to
401	Do you agree with the idea that detail information about drugs and brand medicines is important for your day-to-day operations?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
402	Do you agree with the idea that using computer-based systems improves drug stock management and reduces stock-outs?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
403	Do you agree with the idea that using computer-based systems improves Adverse Drug Reaction (ADR) reporting?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
404	Do you agree with the idea that using computer-based systems it is possible to exchange information with other pharmacies and drug stores when stock-outs of specific drugs occur?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	

405	Do you agree with the idea that using computer-based systems it is possible to locate pharmacies and drug stores that have stock-outs of specific drugs instantly?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
406	Do you agree with the idea that using web-based drug information systems, it is possible to exchange drug- and ADR-related information between drug information centers of DACA and pharmacies and drug stores in Addis Ababa?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
407	Do you agree that your health facility is ready to use a web-based drug information system?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
408	What possible factors do you think will prohibit your health facility (Pharmacy or Drug store) from using a web-based drug information system in Addis Ababa? Please mention factors.	1. Not having a computer training 2. Not having a computer 3. Not having Internet access 4. Not having intention to use 5. Other factors _____		
409	Do you agree that trainings on computers and web-based drug information systems will improve the use of web-based drug information system in Addis Ababa pharmacies and drug stores?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	

410	Do you agree that it is feasible to acquire computers and the Internet for your health facility?	1. Strongly Agree 2. Agree 3. Neither Agree or Disagree 4. Disagree 5. Strongly Disagree	5 4 3 2 1	
411	What do you think are the advantages of using web-based drug information systems in Addis Ababa Pharmacies and Drug stores? (You can select more than one)	1. Improved information handling 2. Getting up-to-date drug information 3. Providing quality drug information to customers 4. Avoiding stock-outs 5. Better reporting of Adverse Drug Reactions (ADRs) 6. Others _____		
412	What do you think are the challenges of using web-based drug information systems in Addis Ababa Pharmacies and Drug stores? (Please mention the challenges)	1. Misunderstanding computerized database systems 2. Unable to update stock-out information 3. Cost of the Internet 4. Not having computer 5. Others _____		

This is the end of this questionnaire.

Thank you very much for your patience and co-operation to complete this questionnaire!

ANNEX - 3: Key Informant Interview (Guide Questions)

To: Ethiopian Drug Administration and Control Authority (DACA)

Addis Ababa

Addis Ababa University

Faculty of Informatics and Faculty of Medicine (Joint)

Health Informatics Program

Date_____

Respondents: The participants in these Key Informant Interviews are the designated staff of the Drug Information Centers (DICs) establishment and coordination division of the Drug Administration and Control Authority (DACA).

Introduction: My name is Elias Alemayehu. I am a postgraduate student of Health Informatics at Addis Ababa University. I am currently doing research for my thesis entitled

"Exploring the potential of Web-based Drug Information System Implementation among Pharmacies and Drug Stores in Addis Ababa."

I am asking your esteemed organization for your invaluable support in responding to the attached Interview guide. The Interview guide is designed for collecting data about implementing a web-based drug information system in Ethiopia.

A Web-based Drug Information System for Ethiopia is a computer-based information management and exchange medium between DACA, Drug Information Centers (DICs), and pharmacies and drug stores, and which uses the Internet technology as the communication medium. The information to be managed includes drug stock management. The information to be exchanged includes information about drugs, their formularies, and the different brands, adverse drug reaction reporting, stock-out information etc.

Consent Form

I, the undersigned, am informed that the Key Informant Interview is conducted to gather information concerning the prospects of implementing a web-based drug information system in Ethiopia. The responses are to be used as inputs to the research work entitled

"Exploring the potential of Web-based Drug Information System Implementation among Pharmacies and Drug Stores in Addis Ababa"

Moreover, confidentiality of the response will be maintained herewith.

Name of the Interviewee: _____

Profession: _____

Designation/ role: _____

Date: _____

Signature: _____

Interview Guide Questions

Area 1: On the implementation of the National Drug Policy

1. How do you see the implementation of the National Drug Policy so far?
2. What opportunities do you see on the National Drug Policy for the prospective implementation of web-based drug information system in Ethiopia?
3. What challenges do you see on the National Drug Policy for the prospective implementation of web-based drug information system in Ethiopia?
4. What considerations do you think should be made when the prospective implementation of web-based drug information system in Ethiopia is conceived?

Area 2: On the performance of the existing drug information system in Ethiopia in general and in Addis Ababa in particular

1. How do you see the existing drug information system?
2. What are challenges of the existing drug information system?
3. What measures are being taken to overcome these challenges?

Area 3: On the level of commitment of DACA to implement a web-based drug information system in Ethiopia

1. What activities have been planned by DACA to realize a web-based drug information system for Ethiopia, in terms of:
    - Envisioning the system,
    - Acquiring funds,
    - Coordinating stakeholders' contributions,
    - Preparation and issuing of guidelines and standards,
    - Conducting training, and
    - Collecting feedback from trainees
2. Are there activities that are currently being undertaken from the above points?
3. What other points should be raised here which depict the commitment of DACA towards the implementation of web-based drug information system in Ethiopia?

Area 4: On the implementation strategies adopted to realize web-based drug information system in Ethiopia

1. Are the types of technological architectures for implementing web-based drug information system identified? For example, the type of Internet connection to be used by pharmacies/drug stores to use the system.
2. Has DACA planned to request the cooperation of Ethiopian telecommunications Corporation (ETC)[6] to make Internet connection free for all pharmacies and drug stores so that they are able to use the system with reduced cost?
3. Has DACA set out the software requirements specification for a web-based drug information system and the method of acquiring it?

Area 5: On the role of DICs in supporting the implementation of web-based drug information system in Ethiopia

1. What is the role of DICs in the prospective implementation of web-based drug information system in Ethiopia?
2. How many DICs are made operational?
3. What are the causes for the non-operational DICs (if any)?
4. Do the operational DICs have computers and Internet connection?
5. Do you have specific software for collecting, organizing, and disseminating drug information to health professionals?
6. Are the operational DICs receiving drug information inquiries?
7. How do you see the potential of DICs in providing technical support to drug retail outlets if a web-based drug information system is implemented in Ethiopia?[at least from the structural/organizational point of view]
8. What problems do you anticipate in the prospective implementation of web-based drug information system?
9. What opportunities do you anticipate from the prospective implementation of web-based drug information system?
10. Are there any comments that you would like to add regarding these points?

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[6] ETC is the sole Internet service provider in Ethiopia and is government-owned institution.

We have finished the interview. Thank you for your patience and spending your much time to conduct this interview!

ANNEX – 4: Interview guide questions to Health Facility Level Drug Information Centers (DICs)

Addis Ababa University

Faculty of Informatics and Faculty of Medicine (Joint)

Health Informatics Program

Name of Drug Information Center_____

Date_____

Respondents: The respondents of this in-depth interview are the Managers or Administrators of this Drug Information Center.

Introduction: My name is Elias Alemayehu. I am a postgraduate student of Health Informatics at Addis Ababa University. I am currently doing research for my thesis entitled

"Exploring the potential of Web-based Drug Information System Implementation among Pharmacies and Drug Stores in Addis Ababa"

I am here today to have an in-depth interview with the Manager or Administrator of this Drug Information Center about implementing a web-based drug information system, in line with your views concerning the level of DIC establishment and operation. All comments, both negative and positive, are welcome. You would say many points about the current drug information system and the prospects of a web-based drug information system.

With your permission, I will use a tape recorder to ensure accuracy of the data collection. I would like to confirm that all your comments are confidential and will be used for research purpose only. This interview will be conducted only if you agree to take part in this study.

Are you willing to participate in the study?

If you are willing to participate in this study, I will continue the interview.

Thank you for your willingness!

Part I: Interview Guide Questions

1. When did this Drug Information Center established? [You can say an estimated time]
2. Do you have the required number of personnel for the Drug Information Center?[In connection with the number of inquiries the DIC receives]
3. Do you have computers for the Drug Information Center? How many?
4. Is Internet connection available in this drug information center?
5. Does this drug information center receive drug-related questions from professionals and the public?
6. How many questions are forwarded from professionals and the public daily? (an average value)
7. What are the problems hindering this drug information center from being operational? Please mention the problems.
8. What do you think is the solution to these problems? Please list out the solutions.
9. Do you use specific software to process drug-related information acquisition, processing or dissemination such as a website?
10. Do you think the existing system of providing drug information enough to satisfy professionals' information needs?
11. Which parts of the existing system of providing drug information do you think are important? Please list out the important parts.
12. Which parts of the existing system of providing drug information do you think should be improved? Please list out the parts to be improved.
13. How do you think the improvements in Qn. 12 above should be made?
14. Do you think that a website-based drug information system is necessary to support the objectives of your drug information center?
15. What advantages do you expect from implementing a website-based drug information system in Addis Ababa?
16. What risks/treats do you expect from implementing a website-based drug information system in Addis Ababa?
17. Do you think there is an alternative way to improve the existing drug information system?
18. Do you have any further comments?

********** // **********

This is the end of this questionnaire.

Thank you very much for your patience and co-operation to complete this questionnaire!

ANNEX – 5: Information Sheet and Consent Form (Amharic Version)

ጤና ይስጥልኝ!

የመጠይቅ ቁጥር_____

ስሜ _____ ይባላል። የመጣሁትም አቶ ኤልያስ አለማየሁ ለተባለ የአዲስ አበባ ዩኒቨርሲቲ የሄልዝ ኢንፎርማቲክስ (Health Informatics) የድህረ ምረቃ ተማሪ የመመረቂያ ጥናት (Research Thesis) መረጃ ከእርስዎ ለመሰብሰብ ነው። የመመረቂያው ዕሁፍ ርእስም የሚከተለው ነው፡-

"Exploring the potential of Web-based Drug Information System Implementation among Pharmacies and Drug Stores in Addis Ababa"

በኢንተርኔት ላይ የተመሰረተ የመድሀኒት መረጃ ስርዓት በኢትዮጵያ ማለት በኮምፒተር የታገዘ የመረጃ ማደራጃ እና መለዋወጫ ስርዓት ሲሆን የሚያሳትፈውም የኢትዮጵያ መድሀኒት አስተዳደርና ቁጥጥር ባለስልጣን (DACA)፣ በአዲስ አበባ የሚገኙ የመድሀኒት መረጃ ማዕከላት (Drug Information Centers or DICs) እና መድሀኒት ቤቶችና መድሀኒት መደብሮችን ይሆናል።

የጥናቱ ዓላማም በኢንተርኔት ቴክኖሎጂ ላይ የተመሰረተ የመድሀኒት መረጃ ስርዓት በኢትዮጵያ ለመዘርጋት የሚያስችሉ ሁኔታዎች መሟላታቸውን መፈተሽ ነው። ይህንንም ለማሳካት በየመድሀኒት ቤቶችና መደብሮች ያለውን ነባራዊ ሁኔታ ማጥናት ተገቢ ሆኖ ተገኝቷል። በዚህም መሰረት ይህ መድሀኒት ቤት ወይም መድሀኒት መደብር ለዚህ ጥናት ተመርጧል። የእርስዎም ንቁ ተሳትፎ እና ትክክለኛ መረጃ በመስጠት መተባበር ለጥናቱ ዓላማውን ከግብ መድረስ ከፍተኛ አስተዋፅኦ አለው።

በዚህ መጠይቅ ላይ የሚሰበሰበው መረጃ ለጥናቱ ዓላማ ብቻ እንደሚውል ላረጋግጥልዎት እወዳለሁ። ምንም አይነት እርስዎን መለያ የሚሆን መረጃ የማይሰበሰብ መሆኑን አረጋግጣለሁ። መመለስ ያልፈለጉትን ማንኛውንም ጥያቄ አለመመለስ እንደሚችሉ አስገነዝባለሁ። እንዲሁም በማናቸውም ጊዜ ይህን መጠይቅ መመላሳን መተው ይችላሉ። ሆኖም በዚህ መጠይቅ ላይ የሚሰጡት መረጃ ለዚህ ጥናት መሳካት ከፍተኛ አስተዋፅኦ እንዳለው በድጋሚ አረጋግጣለሁ። ይህን መጠይቅ ለመመላሳት የሚፈጀው አማካይ ጊዜ ከ15-25 ደቂቃዎች ብቻ ነው።

በዚህ ጥናት ላይ መሳተፍ ይፈልጋሉ? (የ"√"ን ምልክት በመስጠት ያመልክቱ)

እሳተፋለሁ_____

አልሰተፍም_____

ANNEX – 6: Questionnaire for Pharmacies and Drug Stores (Amharic Version)

አዲስ አበባ ዩኒቨርሲቲ

የህክምና ፋኩልቲና የኢንፎርማቲክስ ፋኩልቲ (በጋራ)

የሄልዝ ኢንፎርማቲክስ ፕሮግራም

ክፍለ ከተማ _____ ቀበሌ _____

ቀን_____

ክፍል አንድ፡ አጠቃላይ መረጃዎች

መመሪያ፡- እባክዎ ከተጠቀሱት ምርጫዎች ውስጥ <u>በመክበብ</u> የመልሱ።

ተ.ቁ.	ጥያቄ	ምርጫዎች	ኮድ
101	እድሜዎን በሙሉ ዓመታት ይግለፁ	_____ (ምሳሌ፡ 27)	
102	ፆታዎን ይምረጡ	3. ወንድ 4. ሴት	1 2
103	የሙያዎትን ምድብ ይግለፁ	4. ፋርማሲስት 5. ድረጊስት 6. የፋርማሲ ቴክኒሺያን	1 2 3
104	በዚህ ድርጅት ውስጥ ያሎትን ኃላፊነት ይግለፁ	4. የድርጅቱ ባለቤት 5. ዋና ፋርማሲስት/ድራጊስት 6. የፋርማሲ ባለሙያ	1 2 3
105	በዚህ ድርጅት ውስጥ ለምን ያህል ጊዜ አገልግለዋል? (በሙሉ ዓመታት ይግለፁ)	_____	
106	በአጠቃላይ ያሎትን የስራ ልምድ በሙሉ ዓመታት ይግለፁ(በሙሉ ዓመታት ይግለፁ)	_____	

ክፍል ሁለት፡ የመድሀኒት ቤቱ ወይም መደብሩ የኢንፎርሜሽን ቴክኖሎጂ መሰረተ ልማት

መመሪያ፡- እባክዎ ከተጠቀሱት ምርጫዎች ውስጥ <u>በመክበብ</u> ይመልሱ፡፡

ተ.ቁ.	ጥያቄ	ምርጫዎች	ኮድ
201	የድርጅትዎን ዓይነት ይግለፁ	1. መድሀኒት ቤት 2. መድሀኒት መደብር	1 2
202	የድርጅትዎን የይዞታ ዓይነት ይምረጡ	1. የህዝብ/የመንግስት 2. የግል 3. የNGO	1 2 3
203	በድርጅትዎ ውስጥ ኮምፒውተር አለ?	1. አለ 2. የለም (ከሌለ ወደ 208)	1 2
204	በድርጅትዎ ውስጥ ያለውን ኮምፒተር ይጠቀመበታል?	1. አዎን 2. አልጠቀምበትም (ካልተጠቀመ ወደ 208)	1 2
205	በድርጅትዎ ውስጥ ያለውን ኮምፒተር ምን ያህል ጊዜ ይጠቀመበታል?	1. በየቀኑ 2. በሳምንት አንድ ጊዜ 3. በወር አንድ ጊዜ 4. አልፎ አልፎ 5. አልጠቀምም	1 2 3 4 5
206	በድርጅትዎ ውስጥ የመድሀኒት መረጃን የሚያደራጅ የኮምፒውተር ፕሮግራም (computer software) አለዎት?	1. አዎን 2. የለም 3. አላወኩም	1 2 3
207	በድርጅትዎ ውስጥ የኢንተርኔት አገልግሎት አለ?	1. አዎን 2. የለም (ከሌለ ወደ 210) 3. አላወኩም	1 2 3

208	ለድርጅትዎ አገልግሎት ይሆን ዘንድ ኮምፒውተር የመግዛት አቅም አለ?	1. አዎን 2. የለም (ከሌለ ወደ 210) 3. አላወኩም	1 2 3
209	ለድርጅትዎ መገልገያ ይሆን ዘንድ ኮምፒውተር ለመግዛት ታቅዷል?	1. አዎን 2. አልታቀደም 3. አላወኩም	1 2 3
210	ለድርጅትዎ መገልገያ ይሆን ዘንድ ለኢንተርኔት አገልግሎት የመመዝገብ አቅም አለ?	1. አዎን 2. የለም (ከሌለ ወደ 301) 3. አላወኩም	1 2 3
211	ለድርጅትዎ መገልገያ ይሆን ዘንድ ለኢንተርኔት አገልግሎት ለመመዝገብ ታቅዷል?	1. አዎን 2. አልታቀደም 3. አላወኩም	1 2 3

ክፍል ሶስት፡ የሙያተኞች የእውቀት ደረጃ

መመሪያ፡- እባክዎ ከተጠቀሱት ምርጫዎች ውስጥ <u>በመክበብ</u> የመልሱ።

ተ.ቁ.	ጥያቄ	ምርጫዎች	ኮድ
301	መደበኛ የሆነ የኮምፒውተር ስልጠና ወስደዋል?	1. አዎን 2. አልወሰድኩም	1 2
302	ኮምፒተር የሚጠቀሙ ከሆነ፣ ለምን ጉዳይ ኮምፒተርን ይጠቀማሉ?	1. በኢሜይል ከሌሎች ሰዎች ጋር ለመገናኘት 2. ዶኩሜንቶችን ለመሳፍም ሆነ የተሳፉትን ለማየት 3. መድሀኒትን በተመለከተ ለሚሰራ ስራ 4. ለሌላ ስራ_____	1 2 3

303	ስለኮምፒተራይዝድ የመረጃ ስርዓቶች ሰምተው ያውቃሉ?	1. አዎን 2. አላውቅም	1 2
304	የኢንተርኔት አገልግሎት ተጠቃሚ ኖት?	1. አዎን 2. አይደለሁም (ካልሆኑ ወደ 401)	1 2
305	የኢንተርኔት አገልግሎት ተጠቃሚ ከሆኑ፣ ኢንተርኔትን መድሀኒት ነክ መረጃዎችን ለማግኘት ይጠቀመበታል?	1. አዎን 2. አልጠቀምበትም	1 2
306	ኢንተርኔት ላይ የተመሰረቱ የመድሀኒት መረጃ ስርዓቶችን ያውቃሉ?	1. አዎን 2. አላውቅም	1 2
307	ኢንተርኔትን በምን ያህል ጊዜ መድሀኒት ነክ ለሆኑ ጉዳዮች ይጠቀመበታል?	1. በየቀኑ 2. በየሳምንቱ 3. በየወሩ 4. አልፎ አልፎ 5. ከቶ አልጠቀምም	1 2 3 4 5
308	ከኢንተርኔት የሚገኘውን የመድሀኒት ነክ መረጃ እንዴት ይገመግመዋል?	1. በጣም ጠቃሚ 2. ጠቃሚ 3. በቂ ያልሆነ 4. የማያስፈልግ 5. የተሳሳተ	1 2 3 4 5
309	በየጊዜው የሚያስፈልግዎትን መደሀኒት ክምችት (Stock) ለማስላት ኮምፒተርን ይጠቀማሉ?	1. አዎን 2. አልጠቀምም	1 2

ክፍል አራት፡ ሙያተኞች ኢንተርኔት ላይ ስለተመሰረተ የመድሀኒት መረጃ ስርዓት ያላቸው አመለካከት

መመሪያ፡- እባክዎ ከተጠቀሱት ምርጫዎች ውስጥ የሚስማሙበትን ደረጃ በማክበብ ይመልሱ።

ተ.ቁ.	ጥያቄ	ምርጫዎች	ኮድ
401	ስለተለያዩ መድሀኒቶችና አይነቶቻቸው ዝርዝር መረጃ ማወቅ ለእለታዊ የስራ ተግባራት ጠቃሚ ነው።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
402	ኮምፒውተር ላይ የተመሰረተ የመረጃ አያያዝ የመድሀኒት ክምችትን በአግባቡ ለመቆጣጠርና የክምችት ማለቅን (stock-out) ለማስቀረት ጠቃሚ ነው።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
403	ኮምፒውተር ላይ የተመሰረተ ስርዓት የመድሀኒት አሉታዊ ተፅኖዎችን (Adverse Drug Reaction or ADRs) ሪፖርት ለማድረግ ይጠቅማሉ።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
404	ኮምፒውተር ላይ የተመሰረተ ስርዓት ከሌሎች መድሀኒት ቤቶችና መደብሮች ጋር የክምችት ማለቅን (stock-out) መረጃ ለመለዋወጥ ይጠቅማል።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5

405	ኮምፒውተር ላይ የተመሰረተ ስርዓትን በመዘርጋት ተጠቃሚዎች የጠየቁትን መድሀኒት በየትኛው መድሀኒት ቤት ወይም መደብር ማግኘት እንደሚችሉ መግለፅ ጠቃሚ ነው።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
406	ኢንተርኔት ላይ የተመሰረተ የመድሀኒት መረጃ ስርዓት በመዘርጋት ከመድሀኒት አስተዳደርና ቁጥጥር ባለስልጣን (DACA) ጋር መረጃ መለዋወጥ ጠቃሚ ነው።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
407	ኢንተርኔት ላይ የተመሰረተ የመድሀኒት መረጃ ስርዓት ቢዘረጋ ድርጅትዎ ለመጠቀም ዝግጁ ነው።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
408	ድርጅትዎ ኢንተርኔት ላይ የተመሰረተ የመድሀኒት መረጃ ስርዓትን ከመጠቀም የሚከለክሉት ነጥቦች ምን ሊሆኑ ይችላሉ?(ከአንድ በላይ መምረጥ ይችላሉ)	1. የኮምፒውተር ስልጠና አለመውሰድ 2. የኮምፒውተር አለመኖር 3. የኢንተርኔት አለመኖር 4. አለመፈለግ 5. ሌላ_____	1 2 3 4 5
409	የኮምፒውተርና ኢንተርኔት አጠቃቀም ላይ ስልጠና ቢሰጥ ኢንተርኔት ላይ የተመሰረተ የመድሀኒት መረጃ ስርዓትን ለመተግበር ጠቃሚ ነው።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5

410	ለድርጅትዎ የኮምፒውተርና ኢንተርኔት አገልግሎትን ተጠቃሚ መሆን ይቻላል።	1. በጣም እስማማለሁ 2. እስማማለሁ 3. መልስ የለኝም 4. አልስማማም 5. በጣም አልስማማም	1 2 3 4 5
411	በእርስዎ አስተያየት ኢንተርኔት ላይ የተመሰረተ የመረጃ ስርዓትን ቢዘረጋ ምን ምን ጥቅሞች አሉት?	1. የተቀላጠፈ የመረጃ አያያዝ 2. በየጊዜው የሚወጡ መረጃዎችን ቶሎ ቶሎ ማግኘት 3. ለተጠቃሚዎች የተቀላጠፈ መረጃ መስጠት 4. የክምችት ማለቅን (stock-out) መከላከል 5. ያልተፈለገ የመድሀኒት ተፅኖዎችን (Adverse Drug Reaction) በተሻለ መልኩ ሪፖርት ማድረግ 6. ሌላ_____	1 2 3 4 5 6
412	በእርስዎ አስተያየት ኢንተርኔት ላይ የተመሰረተ የመረጃ ስርዓትን ቢዘረጋ ምን ምን ችግሮች አሉት?	1. የመረጃ አያያዝን በትክክል አለመረዳት 2. የክምችት ማለቅን ቶሎ አለማሳወቅ 3. የኢንተርኔት ውጭ 4. የኮምፒውተር አለመኖር 5. ሌላ_____	1 2 3 4 5

ይህ የመጠይቁ መጨረሻ ነው። ጊዜዎትን ወስደው ስለተባበሩኝ እጅግ በጣም አመሰግናለሁ።

Declaration

I, the undersigned, declare that this thesis is my original work in partial fulfillment of the requirement for the Degree of Masters of Science in Health Informatics and has not been presented for a degree in this or any other university. All source of materials used for this thesis and all people and institutions who gave support for this work have been duly acknowledged.

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This thesis has been submitted for examination with our approval as the university advisors.

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