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https://doi.org/10.58694/20.500.12479/259

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DEVELOPMENT OF A WEB AND MOBILE APPLICATION FOR DRUG ABUSE INFORMATION AWARENESS

Joyce Philipo Mnunguli

A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Master's Degree in Information and Communication Science and Engineering of the Nelson Mandela African Institution of Science and Technology

Arusha, Tanzania

February, 2019

ABSTRACT

The harmful use of illicit drugs, “Drug Abuse”, is the most frequent problem in the world. The awareness creation of drug abuse information to the community reduces the usage of illegal drugs. The collection and management of addicts’ data, statistics about addicts, storage and accessibility of drug abuse information are conducted on paper-based approaches. This results in several problems such as loss of data, time consumption in data collection and delay in reporting. This study aimed to improve accessibility of drug abuse information through development of mobile application for addicts’ data collection and web application for accessibility of drug abuse information awareness and retrieval of treatment center reports. Data were collected through questionnaires, interviews and observations. The study shows that there is limited information on drug abuse issues to the community.

The developed mobile and web applications were evaluated and tested through field study to assess usability and effective of data entry. The applications improve accessibility of drug abuse information, addicts’ data collection and reporting, statistics on drug usage and number of addicts on treatment, storage of addicts’ information and improving awareness program conducted by the drug control commission. Thus, provides drug abuse information awareness to the community, policy makers and researchers. The viability of both developed mobile and web application is to minimize resources such as human effort, cost, and time consumption during data collection, as well as appropriate storage of addicts’ data. A case study of Dar es Salaam and Arusha regions in Tanzania.

DECLARATION

I, Joyce Philipo Mnunguli do hereby declare to the senate of the Nelson Mandela African Institution of Science and Technology that this dissertation is my own original work and that it has neither been submitted nor being currently submitted for degree award in any other institution.

Joyce Philipo Mnunguli _____ 28th February 2019

Name and signature of the candidate **Date**

The above declaration is confirmed

Dr. Kisangiri Michael _____ 28th February 2019

Name and signature of the supervisor **Date**

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CERTIFICATION

The undersigned certify that has read and found the dissertation acceptable by the Nelson Mandela African Institution of Science and Technology.

Dr. Kisangiri Michael 28th February 2019

Name and signature of the supervisor **Date**

ACKNOWLEDGEMENT

First and foremost, I would like to thank God Almighty for giving me the opportunity to join master's program at Nelson Mandela African Institution of Science and Technology, also I thank him for giving me courage, strength, and health throughout my study which resulted to this achievement.

I would like to acknowledge the support from the African Development Bank (AFDB) for financing my study and research work.

Special thanks to my supervisor Dr. Kisangiri Michael for encouragement, support and assistance throughout my research.

Sincere thanks go to my family members, for their prayers, support and encouragement during my study. Special thanks to my father Mr. Philipo Mnunguli and Uncle Thomas Mnunguli for their support during my study.

Also, I would like to thank everyone who has contributed to my study at NM-AIST including my colleagues, lecturers and friends. They played a significant role, they were social, cooperative and caring during my study and stay at NMA-IST.

DEDICATION

To you my beloved late mother Mrs. Jenipher Philipo Mnunguli I dedicate my dissertation

TABLE OF CONTENTS

ABSTRACT i

DECLARATION ii

COPYRIGHT iii

CERTIFICATION iv

ACKNOWLEDGEMENT v

DEDICATION vi

TABLE OF CONTENTS vii

LIST OF FIGURES x

LIST OF TABLES xii

LIST APPENDICES xiii

ABBREVIATIONS xiv

CHAPTER ONE 1

INTRODUCTION 1

1.1 Background Information 1

1.2 Research problem 4

1.3 Objectives 4

1.3.1 General Objective 4

1.3.2 Specific Objectives 5

1.4 Research questions 5

1.5 Significance of the research 5

1.6 Limitations and assumptions of the study 6

CHAPTER TWO 7

LITERATURE REVIEW 7

2.1 Introduction 7

2.2 Mobile technology in Tanzania 7

2.3 Web technology 7
2.4 Related works 8
CHAPTER THREE 11
MATERIAL AND METHODS 11
3.1 Introduction 11
3.2 Research case study area 11
3.3 Sample size and sampling technique 12
3.4 Data collection methods 12
3.5 Data analysis methods 13
3.6 Architectural design 13
3.6.1 Conceptual design 14
3.6.2 Use case diagram 15
3.6.3 Data flow diagram 17
3.6.4 Database schema 20
3.7 Development and implementation of the proposed solution 20
3.7.1 Development Approach 20
3.7.2 Tools and technologies used 21
3.7.3 Other requirements 23
3.7.4 Development of mobile application 23
3.7.5 Assumptions and dependencies on the mobile application usage 23
3.7.6 Development of web application 23
3.7.7 Assumptions and dependencies on the web application usage 24
CHAPTER FOUR 25
RESULTS AND DISCUSSION 25
4.1 Introduction 25
4.2 Requirements for the developed mobile and web applications 25

4.3 Research case study area results and discussion 26
4.3.1 General awareness on the drug abuse information 26
4.3.2 Awareness on the treatment centers location 27
4.3.3 Availability of illegal drugs 28
4.3.4 Sources of information on drug abuse 28
4.4 Overview of the existing system 29
4.5 Results and discussion for the developed applications 31
4.5.1 Developed mobile application 31
4.5.2 Developed web application 33
4.6 Validation 42
4.6.1 Unit testing 42
4.6.2 Integration testing 42
4.6.3 System Testing 42
4.6.4 User acceptance testing 43
CHAPTER FIVE 46
CONCLUSION AND RECOMMENDATION 46
5.1 Conclusion 46
5.2 Recommendation 47
REFERENCE 48
APPENDICES 52
RESEARCH OUTPUTS 78

LIST OF FIGURES

Figure 1. General conceptual framework 15

Figure 2. Use case diagram 16

Figure 3: Context diagram 18

Figure 4: Data flow diagram level 1. 19

Figure 5. Drug Abuse Information System (DAIS) database schema 20

Figure 6. Rapid Application Approach 21

Figure 7. Awareness in Dar es Salaam and Arusha. 27

Figure 8. Awareness on treatment location in Dar es Salaam and Arusha 27

Figure 9. Accessibility of illegal drugs 28

Figure 10. Source of drug abuse information 29

Figure 11. The home page and about page of Waraibu data App. 31

Figure 12. The registration page in the Waraibu data mobile App 32

Figure 13. Login and admission page 33

Figure 14. The login interface 34

Figure 15. The home page for drug abuse awareness 35

Figure 16. Statistics on the usage of drugs and number of addicts on treatment 35

Figure 17. Treatment center location in Arusha and Dar es Salaam. 36

Figure 18. Login page for administrator 37

Figure 19. Management of rehab center 38

Figure 20. Approval process 38

Figure 21. Notification to treatment center 39

Figure 22. Addicts' details 39

Figure 23. Report retrieval 40

Figure 24. Downloaded registered data in Excel format 40

Figure 25. The subscribe page 41

Figure 26. Push message page 41

LIST OF TABLES

Table 1. Use case requirement description 17

Table 2. Presents the results of the user acceptance testing..... 44

Table 3. The analysis of the received comments 45

LIST APPENDICES

Appendix 1: Validation Questionnaire 52

Appendix 2: Questionnaire 56

Appendix 3: Interview Questions for NGO's and Treatment center. 59

Appendix 4: Drug Control Commission Interviews Questions 61

Appendix 5: Code for login layout 62

Appendix 6: Code for login page on JAVA side 65

Appendix 7: Code for API interaction between web and mobile application 69

Appendix 8: R codes for bar chat 77

ABBREVIATIONS

ACHESS	Alcohol Comprehensive Health Enhancement System Support
AIDS	Acquired Immune Deficiency Syndrome
AMIS	Addiction Management Information System
CSS	Cascading Style Sheet
DASIS	Drug and Alcohol Services Information System
DAIS	Drug Abuse Information System
DENS	Drug Evaluation Network Study
DCC	Drug Control Commission
HIV	Human Immunodeficiency Virus
HTML	Hypertext Transfer Markup Language
ICT	Information Communication Technology
IDE	Integrated Development Environment
ISATS	Inventory of Substance Abuse Treatment Services
JDK	Java Development Kit
JRE	Java Runtime Environment
MEFADA	Methadone Family against Drug Abuse
MVC	Model View Control
NBS	National Bureau of Statistics
NGO	Non-Governmental Organization
NSSATS	National Survey of Substance Abuse Treatment Service
PHP	Hypertext preprocessor
RAD	Rapid Application Design

SAMHSA	Substance Abuse and Mental Health Services Administration
SDLC	System Development Life Cycle
TANPUD	Tanzania Network for People who Use Drugs
TCRA	Tanzania Communications Regulation Authority
TES	Therapeutic Education System
TEDS	Treatment Episode Data Set
UN	United Nation
US	United States
UNODC	United Nations Office of Drug and Crime
UML	Unified Modeling Language
WOCHIVI	Women and Child Vision
XML	Extensible Markup Language
YOVARIBE	Youth Volunteers against Risky Behaviors

CHAPTER ONE

INTRODUCTION

This chapter provides the general introduction of the research study, it comprises the following sections; background information, research problem statement, general and specific objectives, research questions, the significance of the study and the limitation of the study.

1.1 Background Information

Drug abuse refers to the use or misuse of illegal drugs which results in negative effects to the human body (Reynolds *et al.*, 2006). It is commonly known as the consumption of drugs without a doctor's prescription. Other studies describe drug abuse as the desire to use or increase the amount of substance (Needle *et al.*, 2006). The commonly abused drugs include cannabis, cocaine, heroin, khat, cigarette, and alcohol.

Globally, it is estimated that one in twenty adults population aged between 15 and 64 years were misusing drugs. Nonetheless, 207 400 deaths were reported as due to drug misuse in 2014 (UNODC, 2016). Although all age groups are affected, the youth are the most vulnerable group since they are usually exposed to a number of social pressures, physical changes, and stronger desires to fit in. It is also estimated that over 29 million people who use illegal drugs suffer from drug use disorders (UNODC, 2016).

Drug abuse has been a global phenomenon affecting African countries including Tanzania. Youth were identified as the most vulnerable group, especially those who are not able to resist peer pressure. The most commonly abused illegal drugs in Africa are cannabis, heroin, khat, cocaine, opium and cigarettes. A report from UNODC shows that over 28 million people in Africa use illegal drugs, and this is due to the easy availability of illegal drugs and drug trafficking activities (UNODC, 2016). However, in Tanzania, the Drug Control Commission (DCC) report of 2012 says that in Tanzania, the number of addicts' ranges between 150 000 and 500 000 people, where 96% were youth (DCC, 2012). The abuse of illegal drugs is rapidly escalating from the usage of cannabis to more dangerous illegal drugs such as heroin, opium and cocaine (Odejide, 2006a). Recently, the increase of trafficking of heroin and cocaine has made easy availability and accessibility of illegal drugs in most of the African countries despite

the existence of rules and regulations which prohibit the entrance of illegal drugs (Odejide, 2006b).

In Tanzania, illegal drugs have been imported from different countries such as India, Iran, Brazil, Afghanistan, Peru, and Bolivia hence increasing the availability and accessibility within the community (DCC, 2013). On the other hand, transmission of illegal drugs across the country borders like Zambia, Rwanda, Malawi and Burundi contributes to the easy availability of the illegal drugs (DCC, 2013). Besides, cannabis is mostly cultivated in several regions of Tanzania such as; Arusha, Tanga, Mara, and Kilimanjaro, and some farmers have been claiming to use cannabis as traditional vegetables and eye medicine (DCC, 2013).

Adolescence, social or physical pressures in young adulthood, availability and easy accessibility of illegal drugs, depression, low self-esteem, few awareness platforms, and limited knowledge on effects and prevention of drug abuse are among the factors which highly contributes to the engagement and consumption of illegal drugs, alcohol and cigarette (Singer, 2008). Also it was mentioned that poverty, refugees, social conflicts and political instability problems contribute to the rapid spread of drug abuse among youths (Odejide, 2006a).

Drug abuse results in number of health, social and economic problems. Health impacts include;- heart diseases, mental retardation, lung diseases, and Human Immunodeficiency Virus (HIV) (Njeri *et al.*, 2014). The risk of HIV infection increases because of sharing needles and syringes during injections since the injection is the popular method used. Statistics show that about 14 million people in the world are inject drugs (UNODC, 2016). Despite the above effects caused by drug abuse, youths and adults still fall into the trap of using illegal drugs, in the fact of low awareness within the society on the effects of drug abuse.

The United Nation (UN) provided international standards and guidance to the policymakers worldwide to develop drug abuse awareness and education programs, policies and systems that will be invested in the future for the children, young adults, families and communities (UNODC, 2015). One among the programs is the system that will provide easy accessibility of drug abuse information (effects and prevention of drug abuse, statistics on the usage of illegal drugs and number of addicts on treatment) and awareness to the general public in such a way that people can get knowledge and avoid misusing drugs and alcohol (Marsch *et al.*, 2014).

The government of Tanzania established Drug Control Commission (DCC) purposely for coordinating government policies on drug abuse, trafficking, and providing education on drug abuse to the community (PMO, 2005). It is also responsible for managing Non-Governmental Organizations (NGOs), rehab centers and methadone clinics which are responsible for providing treatment to addicts and awareness. On the other hand, Mental Health Department which is under Ministry of Health and Social Welfare was given responsibilities to deal with substance use disorders which include providing treatment for the people who are affected (Magabe, 2013). Other effort that the government considered includes establishment of treatment centers and destroying the cultivation as it highly contributes to the local business of illegal drugs and increases the usage.

The treatment of addicts is considered as one among the initiatives used to deal with drug abuse impacts. Treatment of addicts are provided in hospitals and the rehabilitation centers. The NGOs and the people at treatment centers search the addicts within the community then bring them to the treatment center. It has been seen that most of the addicts are engaged on several crimes including raping, killing, robbing and selling drugs within the community. Therefore, providing treatment to the addicts reduces social problems in the society. The studies have shown that education program is not enough for drug dependence (addicts), it should be combined with the treatment for quick recovery (UNODC, 2003).

Treatment center and clinics which provides treatment to the addicts, records addicts' data in paper. The government uses the data from treatment center for national. Thus, bring awareness to the community on the statistics on the number of addicts on treatment and the number of cured patients which encourage other groups and families to bring the drug dependence to the treatment centers for treatment and consultation. Further, documentation of addicts' data enable treatment centers to keep track and monitor patient (addicts) treatment. The awareness of addicts' data is also potential to the NGOs, policymakers and the researchers (Pulford *et al.,* 2007).

The activities of drug abuse in Tanzania which are conducted and managed by the DCC are performed through the use of paper-based approach. The awareness programs and addicts' data collection from the treatment centers are conducted through the use of paper which is expensive and recorded in a flat files. Limited resources such as ICT tools in drug abuse sector contribute

to the lack of instantly drug abuse information awareness (effects and prevention, geographical location of treatment centers) to the community. Manual and a lot of paperwork in managing drug abuse activities lead to the loss/damage of data, inaccuracy of addicts' data and lack of statistics on the usage of drug abuse and the number of addicts on treatment.

Therefore, this study proposes the development of ICT tools (web and mobile application) to help in data collection, reporting, providing awareness and storage of drug abuse information. A mobile application for data collection from treatment centers and web application for management of drug abuse information from different treatment centers as well as providing drug abuse information awareness to the community, scholars and policymakers.

1.2 Research problem

The limited awareness on the issues related to the effects and prevention of drug abuse has contributed to youths being involved in drug abuse activities. The information and statistics about addicts, usage and accessibility of drugs, effects and preventions means such as education are vital to the government and private institutions in reducing the risk and rescuing the drug abuse effects. Currently, this information is being managed in a paper-based form, whereby institutions such as rehab centers submit patient's details and monthly reports to the Drug Control Commission (DCC) in hardcopies which are then stored in flat files. Consequently, this affect the whole process of collecting data, storage, reporting, and awareness, contributing to several problem; such as time consumption, loss of files, delay in national-level reporting, and sometimes difficulties in reaching a large number of people during awareness programs. Therefore, in this study ICT tools were proposed as a means to enhance the management of drug abuse data and processing of statistical information as well as community awareness creation.

1.3 Objectives

1.3.1 General Objective

To develop a web and mobile applications for deliverance of awareness information on drug abuse issues in the community, including; rehab centers, researchers, policymakers and NGOs.

1.3.2 Specific Objectives

(i) To identify the requirements needed for the development of the applications from different rehab centers.

(ii) To design and develop a web and mobile applications for delivering awareness information on drug abuse issues to the community and rehab centers.

(iii) To validate the developed web and mobile-based application.

1.4 Research questions

(i) What are the strengths and weaknesses of the existing awareness programs and addict data collection?

(ii) What are the requirements for the web and mobile applications for the drug abuse information awareness?

(iii) How should the architectural solution for drug abuse information awareness management be designed?

(iv) How usable are the proposed web and mobile applications?

1.5 Significance of the research

(i) The study has contributed by bringing in the arena of information system and mobile application to provide drug abuse information awareness.

(ii) The developed applications will enable timely collection of patients (addicts) information from treatment centers though mobile application and retrieved through web application thus assist to minimize time for data collection and reporting.

(iii) This study will be of interest to scholars, policy makers, NGOs, rehab centers and the community.

(iv) The study will lead to innovative means for provisions of educative information and statistics on the usage of illegal drugs and the number of addicts on treatment.

(v) The developed applications will enhance awareness on the drug abuse information (effects and prevention of drug abuse) and show geographical location of the treatment centers for consultation to the community in general through push message technology.

1.6 Limitations and assumptions of the study

This study assumes that all treatment centers have mobile phones with a capability of installing mobile applications for addicts' data collection. This can be a challenge in terms of usage but the government through drug abuse commission provides timely training on new innovation that involved drug abuse issues. In addition, the study assumes that all users of both mobile and web application have internet access to access contents of both applications.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents reviews on related works regarding drug abuse issues and the software developed to assist in collection and management of addicts' information from treatment centers. It provides different studies which have been done on drug abuse information awareness.

2.2 Mobile technology in Tanzania

Mobile technology is the form of technology that is mostly used in cellular communication and other related aspects (Patrick *et al.,* 2008). There has been a steady growth of mobile technology in Tanzania and the number of users increases every day. It was reported that the number of mobile phone subscribers increased from 71% in 2014 to 80% in 2016 (TCRA, 2017). Easy accessibility of internet with low cost bundles bring the community in the usage of mobile technology in different services. The number of internet user's has also increased from 20% in 2014 to 40% in 2016 (TCRA, 2017).

Mobile technology enables service delivery in public health services and the promotion of personal health (Patrick *et al.,* 2008). It provides a means of gathering and disseminating information to the general public. Moreover, mobile technology is potential in disease prevention, treatment and monitoring of the progress of the patients (Qiang *et al*., 2011). Through mobile technology, communities can get consultation on a particular disease in their geographical location. Knowledge and information can also be distributed to the community through the use of mobile technology (Karch, 2006). In the context of this study, mobile technology will be used by rehab centers for registration and collection of addicts' information that will synchronize and be accessed through a web application.

2.3 Web technology

Web technology refers to the way which computer communicate to each other using markup language and multimedia package (Chawla *et al.,* 2017). It provides a way were users can view the contents and interact with each other through the provided platform (Manzoor *et al*., 2014). Web applications have been used to provide online treatment for those people who were unable

to reach to the treatment centers due to geographical isolation. Some difficulties in accessing traditional treatment services have led to the development of web applications to assist in providing treatment, and reporting on several health matters. (Chawla *et al.,* 2017). In healthcare, web applications have several impacts in different activities. They increase the availability of information and big data, enhance sharing of information among health facilities, and facilitate storage of information and reporting (Ortiz *et al.,* 2003). In the context of this study, web technology refers to the website which is a means and source of drug abuse awareness information including; effects and prevention of drug abuse, addict information, statistics on the usage of drugs and retrieval of reports from treatment centers.

2.4 Related works

The use of Information and Communication Technology (ICT) is increasing in solving real-life problem. Drug abuse is one scenario, whereby several efforts have been invested regarding awareness on drug abuse issues and management of its information.

Gustafson *et al.* (2014) described the development of Alcohol Comprehensive Health Enhancement System Support (ACHESS) application, which provides interaction between addicts and practitioners. It is an embedded application in smartphone devices. It has both static contents and interactive features (Gustafson *et al*., 2014), ACHESS provides a platform where patients interact and share their stories and have a discussions. The application was intended for drug addicts. One of the weaknesses of this application is that it has biasness as it used by the addicts only and does not benefit the community, government agencies, and policymakers.

Marsch *et al.* (2014) developed a computer-based education system called the Therapeutic Education System (TES) that provides education on drug abuse issues such as effects and prevention of drug abuse. It provides different courses on drug abuse issues and self-training module, where an individual can listen to audio clips and do some homework provided by the system. Users need to purchase the mobile application and register to a specific course then start training. However, the application does not provide an interactive mechanism that can help the user to provide feedback and ask questions. It was only intended for addicts and not otherwise with a specific goal of self-training.

Furthermore, in United States (US) there is the Drug and Alcohol Services Information System (DASIS), which acts as a source of drug and alcohol services information. It comprises of three

datasets which are the Inventory of Substance Abuse Treatment Services (I-SATS), the National Survey of Substance Abuse Treatment Services (N-SSATS), and the Treatment Episode Data Set (TEDS) (SAMHSA, 2008). I- SATS is responsible for listing all organized substance abuse and mental health treatment facilities, TEDS collects demographic treatment information of the patients and N-SSATS is responsible for doing a census on all facilities listed in I- SATS (SAMHSA, 2014). DASIS with its three data sets provides information on the mental health data and drug abuse disorders. The system focuses on providing survey information on drug abuse, treatment services programs, and drug history information on people who are on treatment. However, it does not provide awareness information on the effects and prevention of drug abuse, and it does not provide interactivity among users or show treatment location so as people can be aware of where consultation and treatment services are provided.

Similarly, in United States there is the Drug Evaluation Network System (DENS) which is an electronic information system that tracks trends in substance abuse treatment. It comprises of descriptive information of drug addicts and their discharge status. It was developed to provide timely information on the population of substance dependent individuals in national treatment. It provides descriptive information on drug addicts on treatment. Such information includes; demographic related information, types and amounts of substances used prior to treatment entry, medical health and the criminal activity involved in. It is a web-based application which collects information which is then sent to a central database (Carise *et al.*, 2003). This system lacks an awareness raising part for the community as information is kept in a database for national use. Thus community accessibility of information in the database is lacking.

Furthermore, in Canada, there is an Addiction Management Information System (AMIS), which is the national case management database for addicts' information. This was developed purposely to improve data collection, analysis and reporting process. It presents the work done by treatment centers in Canada. Treatment centers use the system to feed all activities done at the centers including admission and discharge details of the patients (Thunderbird, 2018). This system was intended to benefit treatment centers in order to have enough and accurate data on the addicts and other activities conducted at the treatment center. However, it the misses part of community awareness of drug abuse information.

The provided related works on drug abuse information management systems focus on the storage of addict information rather than providing awareness on drug abuse issues such as treatment centers locations, effects and prevention, statistics on addicts and illegal drugs usage. Therefore, the study proposed development of the web and mobile based applications for drug abuse information creation awareness, whereby mobile application will be used for data collection from treatment centers and a web application will provide interface for users to access information about the trends of the usage of drug abuse, statistical reports on number of people receiving treatments, location of treatment centers as well as awareness information.

CHAPTER THREE

MATERIAL AND METHODS

3.1 Introduction

This chapter focuses on presenting the materials and methods used in this study, including development of the proposed solution. The chapter details on research case study, sampling techniques, data collection and analysis methods, requirements analysis and architectural design. Moreover, the chapter expounds on the development of web and mobile application for drug abuse information creation awareness.

3.2 Research case study area

A case study area was selected as one of the important parts of the first objective of the study in understanding and answering the research questions such as "What are the requirements for the development of mobile application for drug abuse information awareness?" and" What are the strengths and weaknesses of the existing awareness programs and addict data collection processes?". The outcome of the case study contributed to the requirements needed for the development of a prototype solution for drug abuse information awareness based on web and mobile applications. The study was conducted at Dar es Salaam and Arusha regions in Tanzania. The reason for selection of the regions was the large number of addicts' treatment centers as well as cannabis cultivation activities conducted in Arusha.

Dar es Salaam is the largest economic city in Tanzania, located in the coastal Indian Ocean. The area of Dar es Salaam is 1 393 km^2 (538 sq mi). According to Tanzania Bureau of Statistics, Dar es Salaam population is approximately 4.3 million (NBS, 2017). It is formed by five districts; Kinondoni, Ilala, Kigamboni, Ubungo and Temeke. In addition, it comprises social, economic and industrial activities. Furthermore, Dar es Salaam is the only region which comprises with a large number of treatment centers which is eleven compared to other regions in Tanzania.

Arusha is a city in northern eastern Tanzania with an approximate population of 1.6 million (NBS, 2017). The area of Arusha region is 34 526 km^2 and it is located near the greatest national parks and game reserve in Africa, including; Kilimanjaro National Park, Serengeti National Park, Ngorongoro Conservation Area, Lake Manyara National Park and Arusha National Park.

It has 7 districts: Karatu, Longido, Monduli, Arusha City, Ngorongoro, Meru and Arusha rural district. This region was selected due to the presence of cannabis cultivation which increases availability and usage of cannabis within the community.

3.3 Sample size and sampling technique

The study involved a total of 252 residents in both regions where, 150 respondents were from the five districts (Kinondoni, Ilala, Kigamboni, Ubungo and Temeke) within Dar es Salaam and 102 respondents were from the three districts (Monduli, Meru and Longido) in Arusha. Other stakeholder's institutions involved in the study include;- Drug Control Commission (DCC), eight rehab centers located in Kigamboni, Pugu, Temeke and Mbezi Kimara in Dar es Salaam and Njiro in Arusha, psychiatrist from methadone clinics (Muhimbili Hospital and Temeke Hospital) and five NGOs. The NGOs include;- the Tanzania Network for People who use Drugs (TANPUD), Peer group, Methadone Family against Drug Abuse (MEFADA), Youth Volunteers against Risky Behaviors (YOVARIBE) and Women and Child Vision (WOCHIVI).

However, two respondents from DCC, two respondents from each rehab centers, two psychiatrists and one representative from each NGOs were involved in the study. Participants with the same characteristics were selected to participate in the study. The participation was voluntary and respondents were informed about the facts and the benefits of the study before their participation. Also they were found through communication with the particular district offices. Other stakeholders were found by visiting relevant institutions. Simple random sampling technique was used to get the representative sample of the community. This technique was used to give all respondents equal chance to participate in the study.

3.4 Data collection methods

During the study, data were collected in the period of two months, January to February in 2018. This study used questionnaires, interviews and observations as tools for data collection as described below.

Questionnaire: Self-administered questionnaires were provided to the people within the community. Closed ended (multiple choice) questions were used to get the data, for instance response on yes (awareness) and No (not aware). Thus the threshold to pass is yes and to fail

is No. The closed ended approach was used because they consume less time to respond and are easy to compare. The questionnaires were distributed to youth of age between 18-40 years, male 132 and female 120. The main objective was to understand the knowledge the community has on drug abuse issues. The knowledge of drug abuse issues include awareness on the treatment and consultation center location, health impacts, effects and prevention of drug abuse.

Interviews: Structured interview questions were used. Interviews were conducted with two respondents from the government (DCC) and private institutions dealing with preventions, controlling and treatment of drug addicts in Tanzania. The institutions included; eight rehab centers, five NGOs and two methadone clinic (Muhimbili and Temeke hospitals). The main objective was to understand how the current activities in dealing with controlling and prevention of drug abuse were being done, especially awareness programs to the community, addicts' data collection, storage and reporting within the rehabs, methadone clinics (hospitals) and DCC.

Observations: This was done throughout the study area, to observe how drug abuse information awareness programs were conducted and how addicts' data were collected and stored.

3.5 Data analysis methods

Both qualitative and quantitative data were obtained during the study through the interviews, questionnaires and observations. Inductive approach of qualitative analysis was used in qualitative data and descriptive statistics (frequency) was used in quantitative data basically to compare the data. Thereafter, data were analyzed by using R software, which provides management capabilities and administrative tools for high performance and data analytics. In addition Google sheet was also used.

3.6 Architectural design

The previous section explored more on the research study area, data collection methods, sampling technique and data analysis tools. This part explores more on the design of the proposed solution presented by the use case diagram, data flow diagram and database schema.

3.6.1 Conceptual design

The conceptual design presents the structure/components of the system. Based on the study findings, several problems on drug abuse information awareness, addicts data collection, storage and reporting were identified, some of these problems are loss and damage of data, consumption of time during addict data collection, delay in national reporting, and sometimes difficulties in reaching a large number of people during awareness programs. Therefore, in solving the mentioned problems the study developed an integrated web and mobile based applications for drug abuse information creation awareness.

(i) Mobile application

The mobile application is used for daily data collection and reporting of patients details from the treatment center then submits to the central database which is managed by the DCC. This tool provides the easiest way of collecting information and providing statistics on the most used illegal drugs and the number of patients on the treatment. In addition, patient's details synchronize to the database and accessed through a web application.

(ii) Web application

A web application provides an interface allowing information access to all users including; the DCC, treatment centers (rehab centers and methadone clinics), NGO's, researchers, community and policy-makers. Moreover, the solution allows user participation through the push message technique where short stories or testimonies and awareness messages on the drug addictions is disseminated. In addition, the designed solution provides the easiest way in locating nearby treatment centers. The application supports storage, reporting and management of drug abuse information. The designed solutions architecture as shown in Fig. 1 potentially contributes to drug abuse data management and awareness creation to the general public of Tanzania.

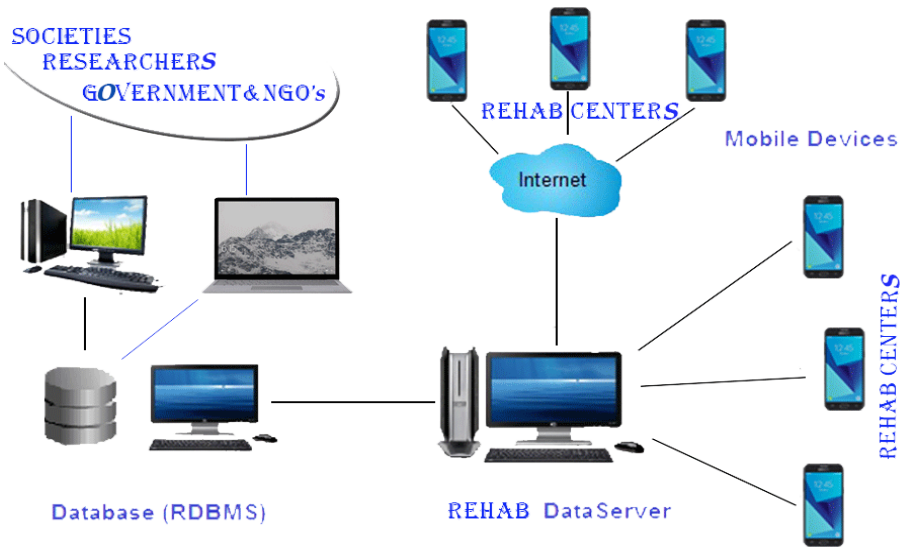

Figure 1: General conceptual framework

3.6.2 Use case diagram

In this study, Unified Modelling Language (UML) was used in designing different diagrams of the proposed solution. Unified Modeling Language is the standard language for constructing and visualizing the design of the system (Bell, 2003). Use case diagram is one of many UML diagrams that capture functional requirements of the system. It shows the interaction between actions that the system should perform and external actors (Guia, 2002). It is presented in a way that any user can understand easily. In the context of this study, use case presents three actors that will interact with the proposed solution. Each of them has different roles in the proposed application.

The system comprises with actors with their underlying roles. Roles are the tasks that should be done in the system. Actors are the users of the system, they represent the interest of a various groups of stakeholders of the drug abuse sector. The following are the main actors of the system.

(i) Administrator (from DCC)
(ii) Treatment centers (rehab centers and methadone clinic)
(iii) Local users (Researchers, NGO's and society)

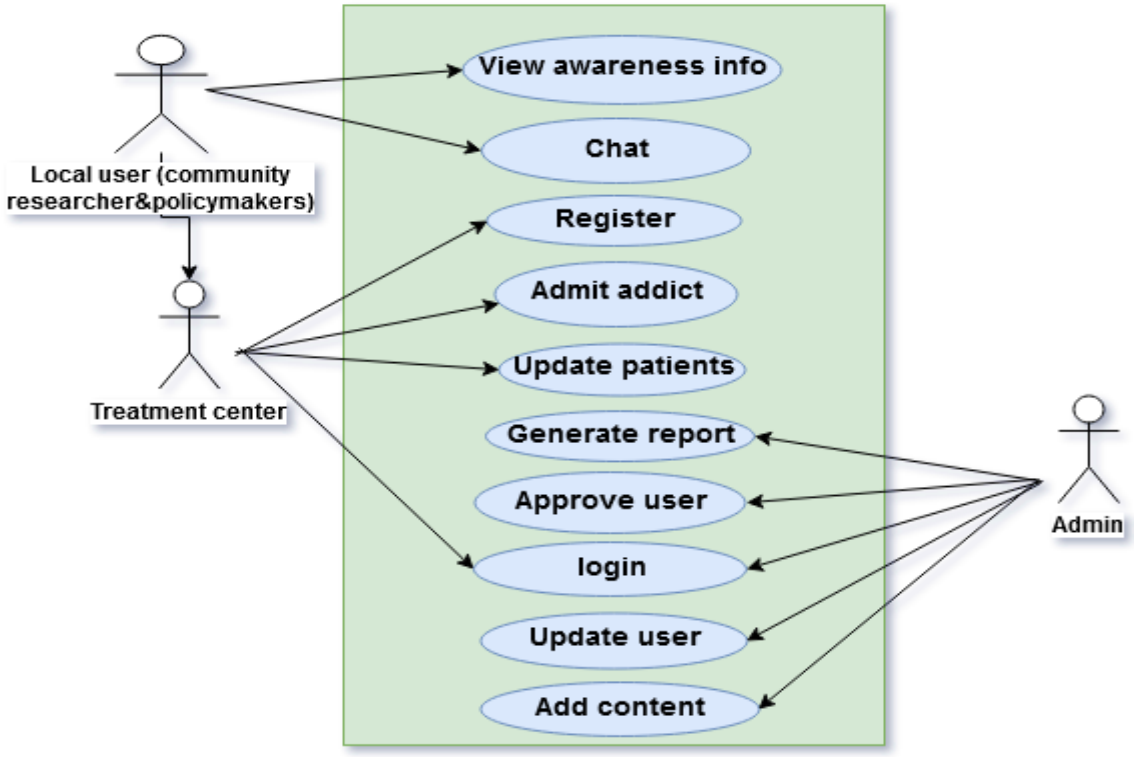

Figure 2: Use case diagram

Table 1: Use case requirement description

No.	Use case	Requirements description
1.	Login	• Administrator should be able to login to the system • Treatment center personnel should be able to login to the system
2.	Add contents	Administrator should be able to add contents (drug abuse issues) to system
3.	Approve users	Administrator should be able to approve users (treatment centers) so as they can be able to admit and update patients details
4.	Push message	Administrator should be able to push several messages to the community for drug abuse information awareness.
5.	View report	Administrator should be able to view report in the system
6.	View awareness information	Local users (researchers, policy-makers and the community) shall be able to view drug abuse awareness information (effects and prevention of drug abuse, treatment location, statistics on the number of addicts on the treatment and trends on the usage of illegal drugs)
7.	Chat	Local users shall be able to interact with the system through chatting forum in the system
8.	Register	Treatment centers (rehab center and methadone clinic) shall be able to register to the system so that they can be able to provide patients details to the system.
9.	Admission	Treatment center shall be able to admit patients through the use of mobile application
10.	Update patients details	Treatment center shall be able to update patients (addicts) information

3.6.3 Data flow diagram

The data flow diagram is a graphical representation that shows the flow of information among processes in the system. It shows the input and output of data as processed in the system. It includes; process, external entity, data store and data flow. There are different levels of data flow diagram including; level 0 (context diagram), level 1 and level 2. Level 0 provides a broad

view of the whole system, level 1 breaks down the process of the system, lastly level 2 breaks processes from level1 into more sub-processes (Ibrahim *et al*., 2010). In the context of this study context diagram and level one presents the flow of information in the proposed solution.

(i) Context diagram

The context diagram is also called level 0; it presents the overview of the whole proposed solution. Also, it involves the interaction between the system and its external entities (Ibrahim *et al*., 2010). This approach provides a general understanding to the system analyst, developer and stakeholders. Figure 2 shows the context diagram of the proposed solution.

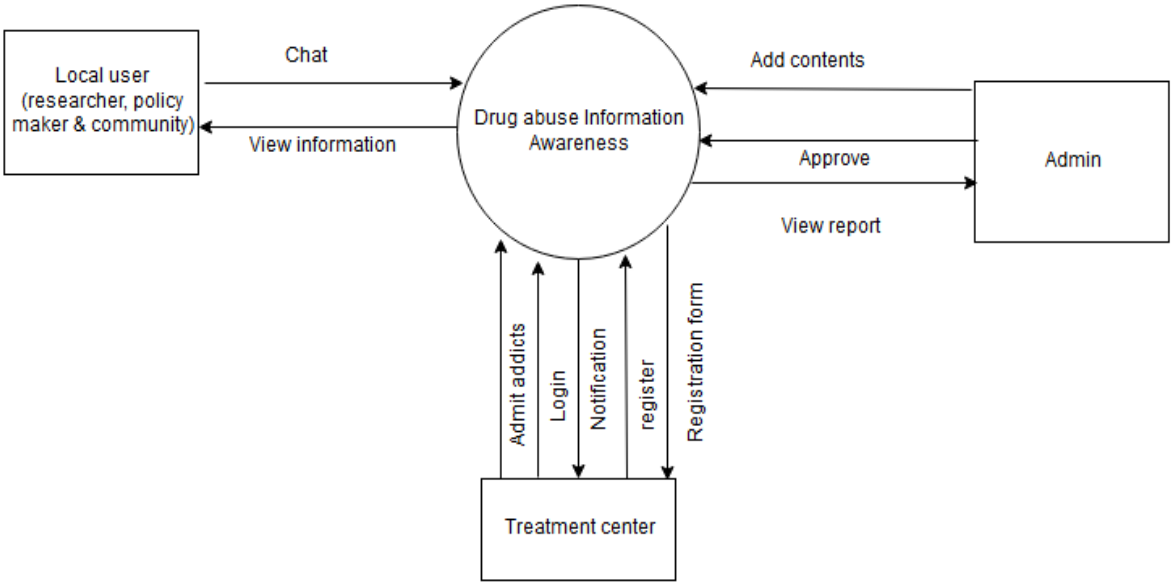

Figure 3: Context diagram

(ii) Data flow diagram level 1

Data flow diagram level 1 presents decomposition of the system process into sub-processes (Ibrahim *et al.*, 2010). When the process decomposition occurs the diagram requires data stores and data flow (arrows) to link them. The diagram allows stakeholders to understand the processes of the system and the flow of information. Figure 3 presents data flow diagram level 1.

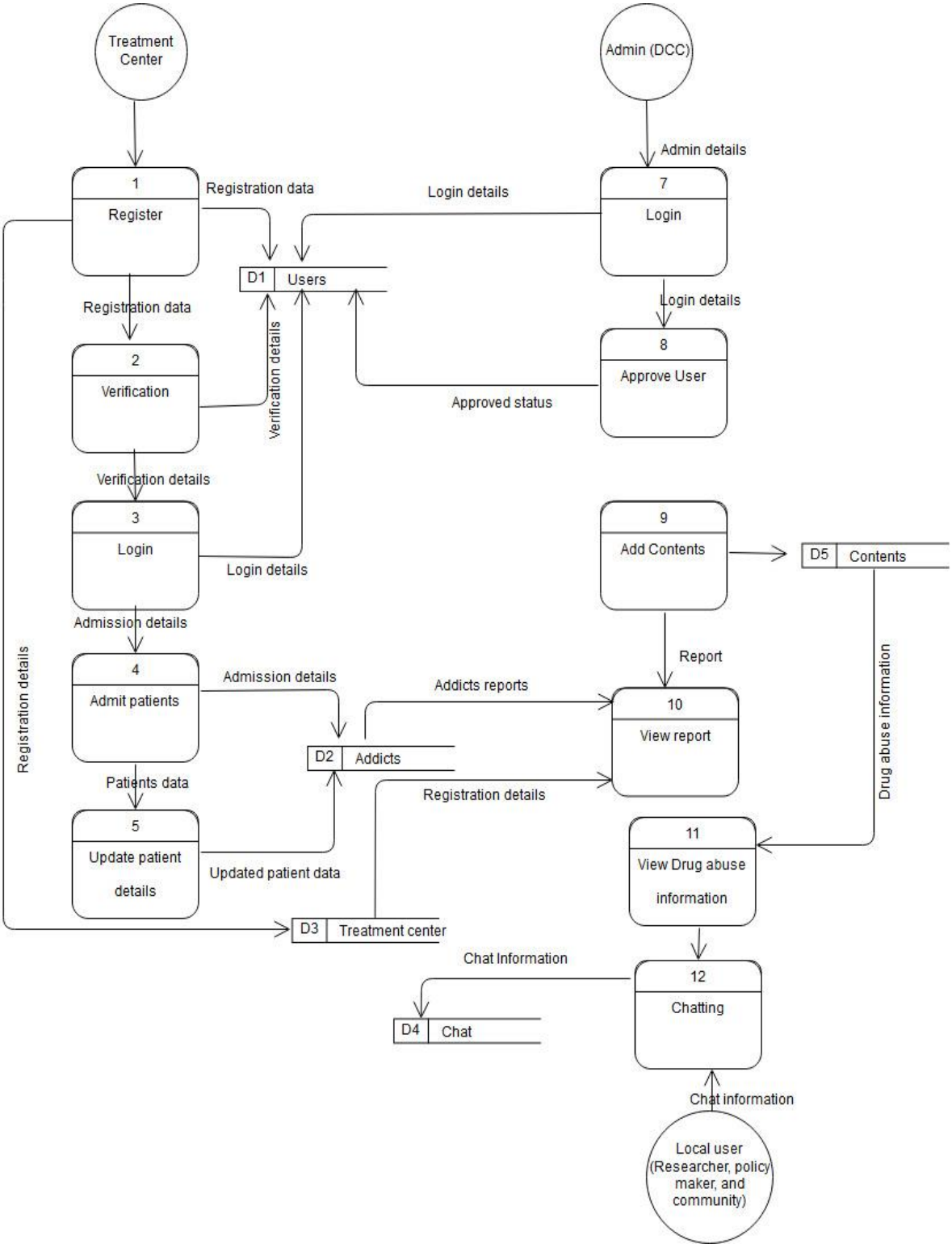

Figure 4: Data flow diagram level 1.

3.6.4 Database schema

This is the logical representation of a database created by the database management system. It provides a graphical view and structure of the database architecture. Database schema presents the logical diagram that comprises tables, attributes and the relationship between the tables (Klett, 2011). The database schema of the developed solution with its tables is presented in Fig. 4.

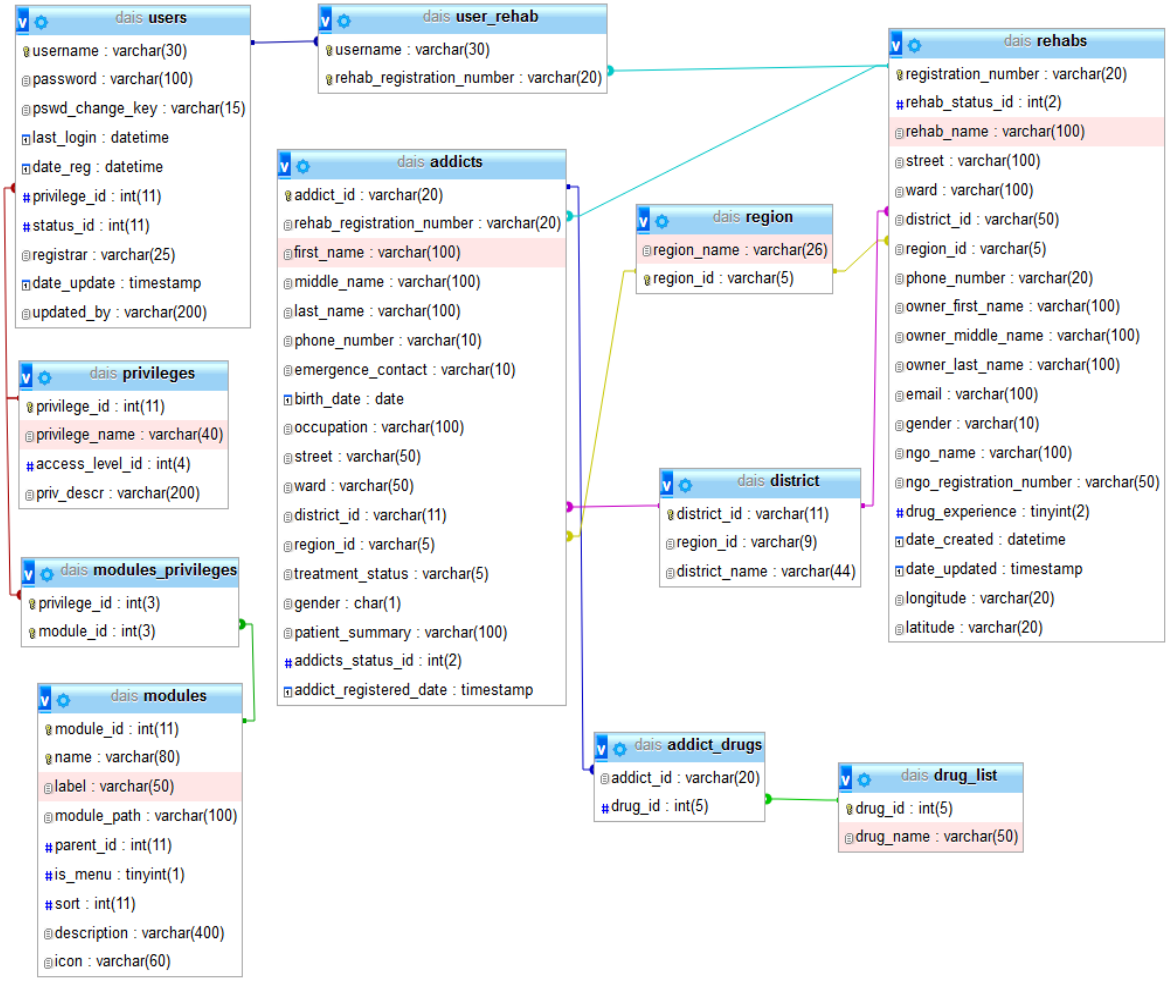

Figure 5: Drug Abuse Information System (DAIS) database schema

3.7 Development and implementation of the proposed solution

3.7.1 Development Approach

Development process describes a set of activities needed to transform user's requirements into the software platform. To accomplish the whole process of development of the proposed

solution, system development life cycle (SDLC) was considered as the guideline in the development of the system. The development approach used is the Rapid Application Development (RAD). Rapid Application Design approach was chosen due to time limitation of development cycle as it has the ability to quicken development of the system thus minimize development time. This approach focuses on minimizing development time while maximizing progress (Beynon-Davies *et al*., 1999). The major advantage of this approach is its ability to allow improvement of the application as the requirements changes. All phases were used in this study. As shown in the Fig. 6, RAD approach comprises of four phases including; requirements planning, design, development and cutover.

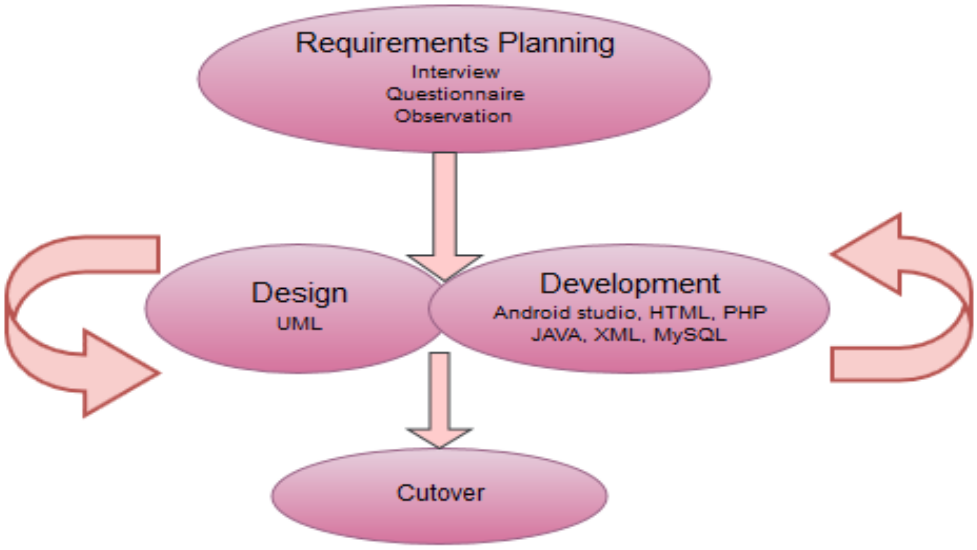

Figure 6: Rapid application approach.

3.7.2 Tools and technologies used

Tools and technologies that were used in the development of both mobile and web application include:

(i) Code Igniter PHP framework

This is a free open source PHP framework for web application development. It is implemented in model-view-control (MVC) development pattern. It is a framework with a powerful tool that is capable of creating features of the web application. The study uses code igniter because of

its flexibility and easy management, thus increasing maintainability to the end user. The model part of the framework focuses on database management and manipulation. The model comprises of data structure, classes and data logic. On the other hand, the view part bases on the information and web page generation that involves footer, header and upload of general information that will be accessed by the users. Further, control is the class linked with URL for loading purpose. It connects the model, view and other essential resources specifically for processing the HTTP requests and generating web pages.

(ii) CSS and HTML

Cascading style sheet (CSS) is the language that describes the Hypertext Markup Language (HTML) document. It also describes how components of HTML should be presented/displayed in a page. On the other hand, HTML is the standard markup language used for web application interface creation. It also enables easy structuring of web pages. The study uses CSS and HTML to format web application interfaces.

(iii) XML and JAVA

Extensible Markup Language (XML) is designed in a format that is readable to both human and machines. It is also designed for storage and sharing of data as well as parsing data from the database to the mobile application. It defines layout, color, string, arrays, font and shape. The study used XML to design the user interface layout of the mobile application. On the other hand, JAVA was used for building functionalities of the mobile application

(iv) Android studio

Android Studio is an open source tool with built-in libraries that support the easy development of mobile applications. It provides an Integrated Development Environment (IDE) for easy development. Android studio comprises with the Java Runtime Environment (JRE) and Java Development Kit (JDK) components. The study uses android version 4.4 for mobile development due to its performance stability compared to other tools like Eclipse.

(v) XAMPP and MySQL

This is an open source which is mostly used as a web server, it stands for cross-platform, APACHE, MariaDB, PHP and Perl. On the other hand, MySQL is an open source used for

database design and management. The study used MySQL due to its high performance and scalability to meet users demand.

3.7.3 Other requirements

(i) Internet connection
(ii) NetBeans
(iii) Web browser; Mozilla and chrome
(iv) Operating system; Windows
(v) Word press and JavaScript language

3.7.4 Development of mobile application

The developed mobile application involved the use of Android studio, JAVA and XML. Extensible Markup Language was used to design user interface of the application while JAVA focuses on building functionalities of the application. In this study, mobile was an application developed specifically for addicts' data collection from a treatment center. Treatment centers perform registration then get approved by the administrator, thereafter login to the mobile application and feed addict information.

3.7.5 Assumptions and dependencies on the mobile application usage

(i) All mobile application users have the ability to use mobile application.
(ii) All mobile application users will afford to own smartphone.
(iii) There is a good internet connection to enable the mobile application to connect with database.
(iv) There is a good internet connection to allow the administrator to approve users of the mobile application without delay.
(v) All treatment centers who are the main user of the mobile application own mobile application with android operating system.

3.7.6 Development of web application

The development of web application involved the use of the following programming languages; PHP, HTML, JavaScript and CSS. Hypertext Transfer Markup Language was used to design web page interfaces, JavaScript and CSS were used for graphical output of web

application. On the other hand, MySQL as the database management software was used in designing the database while on the server side PHP language was used.

3.7.7 Assumptions and dependencies on the web application usage

(i) There is good internet connection to access web application

(ii) All web application have knowledge on how to use computers

(iii) Good internet connection for administrator to add contents and retrieve reports from registered treatment center.

(iv) Internet connection to enable administrator to push short message to the community

(v) Internet connection to synchronize all admitted addicts data through the use of mobile application then accessed through the web application

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter expounds on the requirements needed for the development of the web and mobile application for drug abuse information awareness both functional and non-functional requirements are explored. It also provides a description of the design of the proposed solution. It also presents the results and discussions of the data collected in the study and development of the web and mobile applications.

4.2 Requirements for the developed mobile and web applications

Requirement analysis is the process of determining the expectation of user's new or altered product (Maguire *et al.,* 2002). In this study, requirement analysis involved both functional and non-functional requirements. The interviews and observation done at rehab centers and drug control commission discovered that treatment center records addicts data on paper then submit to the DCC office monthly, then the DCC store the data in flat files, this is because of the lack of ICT resources. It was also observed that 90% of the treatment center personnel use smartphones and the treatment center does not have computers for data storage.

The government requirement for a treatment center to start operation is registration, and this is the potential requirement in the development of the mobile application. Thereafter, 80% respondents suggested that the registration and admission of addicts shall be done through mobile application because treatment center personnel own smartphones and not computers. On the other hand, the requirements that were mentioned by the DCC respondents include: - retrieval of addicts' data, database for data storage and statistics on the usage of illegal drugs and number of addicts to be retrieved through web application. Each of these functions have significant to the development of both web and mobile applications for drug abuse information creation awareness.

(i) Functional requirements

Functional requirements capture the operations and activities that system must perform (Malan *et al.,* 2001). In the context of this study functional requirements include;

(a) Registration of rehab center must be done through mobile application

(b) Rehab centers must be authenticated to use mobile application

(c) Push message to the community shall be done through web application

(d) The reports must be generated through the web application

(e) Users must be able to view drug abuse information

(f) Statistics graphs must respond when the treatment center admits patients

(g) Web application must generate report.

(h) Admission of patients shall be done through a mobile application.

(ii) Non-functional requirements

These are the requirements that specify how the system works (Chung, 2000). Also, non-functional requirements involve tasks which are not directly attached to a user. These include;

(a) Appropriate response time (4sec) for both mobile and web application

(b) Effective data entry

(c) Secure authentication for users of applications

(d) Reliability and portability of the proposed solution

(e) The proposed solution should allow maintainability

4.3 Research case study area results and discussion

4.3.1 General awareness on the drug abuse information

The study sought to find out the certainty of general awareness of drug abuse information. It was found that about 74% of respondents in Dar es Salaam were not aware of drug abuse information and only 26% had awareness on drug abuse information, similarly, 73% of respondents in Arusha were are not aware of drug abuse information, while only 27% had awareness on drug abuse information (causes, effects and preventions of drug abuse). This is as presented in Fig. 7.

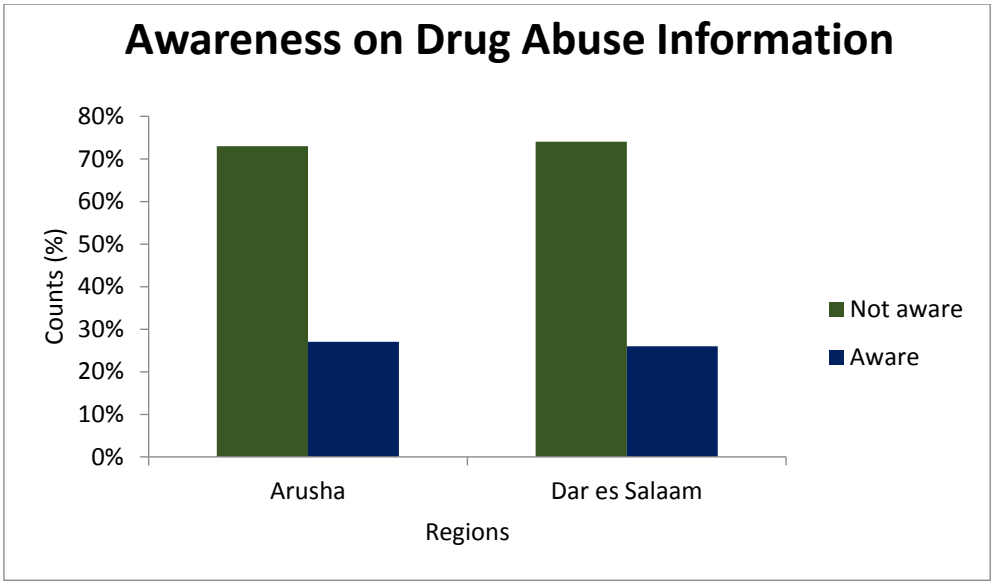

Figure 7: Awareness in Dar es Salaam and Arusha.

4.3.2 Awareness on the treatment centers location

To know the locations for consultation and treatment service is vital in increasing the awareness of drug abuse and treatment of addicts within a society. During the study it was revealed that in Dar es Salaam about 78% of the respondents were not aware of the treatment centers locations, and only 22% knew where to get treatment and consultation on drug abuse issues, whereas in Arusha 79% of respondents did not know where to get consultation services or treatment for addicts while only 21% knew where to the services provided.

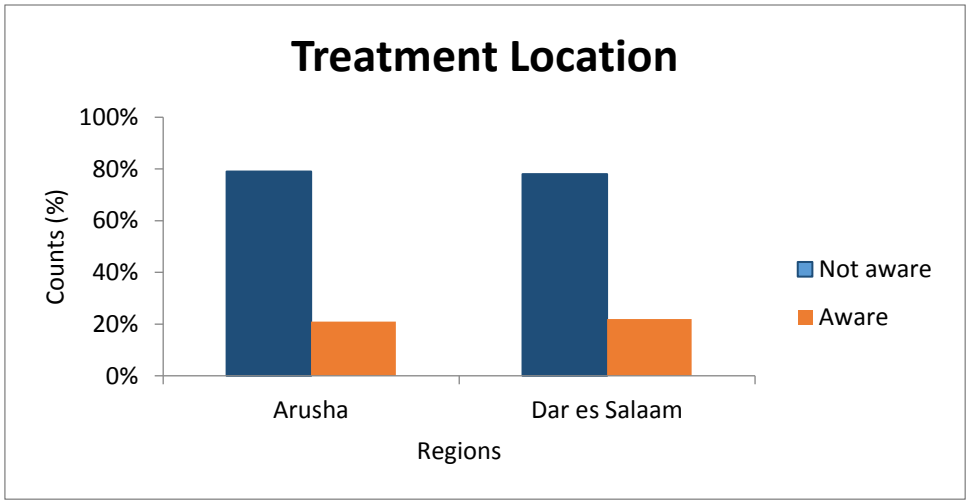

Figure 8: Awareness on treatment location in Dar es Salaam and Arusha

4.3.3 Availability of illegal drugs

Availability of illegal drugs is also a factor that contributes to the increase in the usage of illegal drugs in the community. The research revealed that the availability of illegal drugs influences more people to engage themselves in drug abuse activities such as trafficking and other small business which are done locally within the community thus brings more people to use drugs. Generally, 48% of respondents agreed that there is easy accessibility of illegal drugs, 28% felt there was fairly easy accessibility and availability, 15% felt there was fairly difficult accessibility availability and 9% responded it was difficult. The results shows that there is the easy accessibility of illegal drugs among the community, and this influences youth to engage in drug abuse activities.

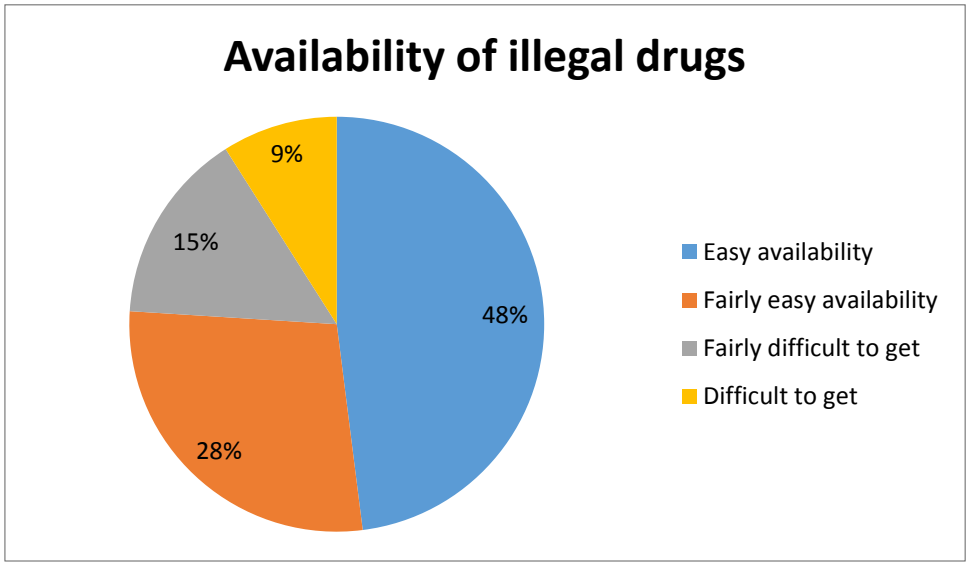

Figure 9: Accessibility of illegal drugs

4.3.4 Sources of information on drug abuse

The study found that there are several ways which were considered as sources of drug abuse information in the community. The community uses media, friends and schools programs to get information. Media (radio, television and newspaper) was the most popular source of information with 45% of usage as compared to the school's programs which had 24% and friends which had 32%. Nevertheless, the study found that despite the availability of sources of information in the community, drug abuse information was rarely provided through the

media, which was most frequently used as the source of information by most of the respondents.

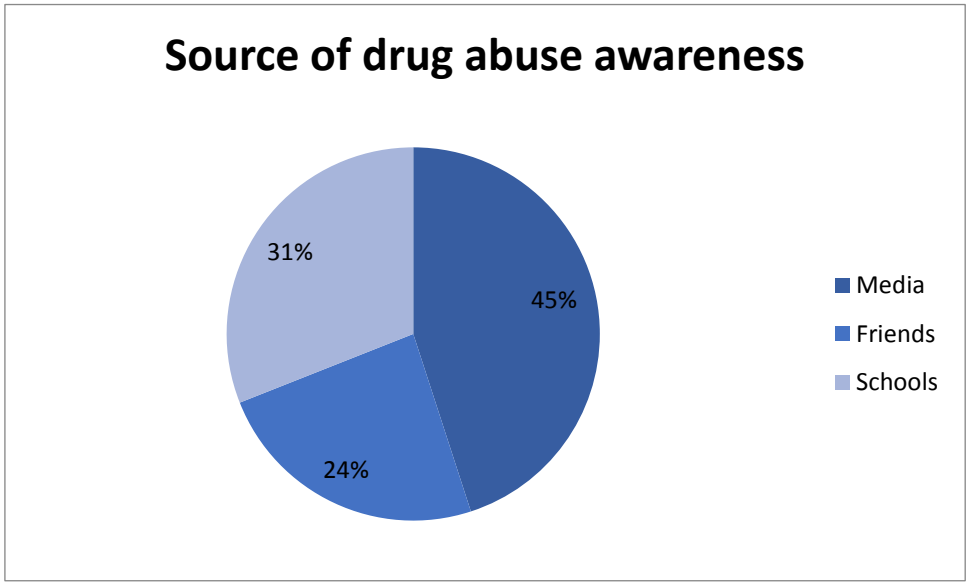

Figure 10: Source of drug abuse information

4.4 Overview of the existing system

Interviews and observations were also conducted by the study and helped in examining how drug abuse activities were conducted within DCC, NGO's, rehab centers and a methadone clinics. Currently, NGOs provide awareness manually by going into different places such as schools, and neighborhood while distributing awareness materials in form of brochures, they also conduct training programs and advertisement which were conducted via radio and television.

However, the study found that awareness programs in schools and places where addicts are found were conducted only once per week due to the lack of resources. Apart from that, they were also obligated to take addicts to the methadone clinics and rehab centers for treatment and consultation services. Also, it was observed that larger group of people were gradually falling into drug addiction due to the lack of awareness and prevention programs. Most of NGOs focus their efforts in taking addicts to the therapy while leaving a large group of people behind without awareness. These were due to the little involvement of ICT tools in their operations, which could have helped them to reach a larger audience.

The community felts that information on the effects (health and social effects) and prevention of drug abuse are very potential to the society. The information can be used in education program starting from the family, school and within the community. Other information include the treatment center location to let the community aware of where to get consultation and treatment for addiction. Information on the symptoms and testimonials of addicts were mentioned as the supporting information that can be used by families to educate their relatives and convince the addicts in the family or community to get consultation and treatment. Avoiding friends who are engaged in drug abuse and attend to rehab centers have been mentioned as the best option of preventing relapse after treatment. Thus the web application displays a map to show the location to where to get consultation and provides information on drug abuse for awareness.

Also, the study revealed that data collection from several rehab centers were conducted in paper-based manner, whereby treatment centers record details of patients (addicts) on papers and submit to the DCC office monthly. It was therefore hard to get accurate information of patients found in treatment centers. The study found that 52% of addicts' data submitted by rehab centers were inaccurate, while 48% were accurate. As was the fact, sometimes led DCC personnel to work around the centers to collect the required information for national reporting.

However, the DCC itself kept the collected information on flat files which resulted in damage or loss of information and delay in generating general drug abuse report. For instance, the number of damaged files in 2017 was estimated to be 14 (40%) out of 36 paper files (monthly reports) collected from 8 treatment center, this was due to misallocation of files. On the other hand, it was discovered that 80% of the addicts treated at the rehab centers were engaged in drug abuse without knowing the side effects of using illegal drugs. All respondents from different rehabs acknowledge that drug abuse is still a big challenge in the country and there was a lack of awareness on the drug abuse issues. Furthermore, the study observed that 96% of rehab activities were conducted in paper-based as they did not have any ICT tool such as a database for data storage and manipulations of data, hence data were lost due to unavoidable circumstances.

Therefore, the study has proved the need for ICT tools to support data collection, storage and provide awareness drug abuse information. This enables scholars, professionals, policymakers and other stakeholders to get more information on drug abuse issues which includes trends in the usage of illegal drugs and statistics on the number of patients who are on treatment.

4.5 Results and discussion for the developed applications

4.5.1 Developed mobile application

The developed mobile application called "**Waraibu data**" facilitated the collection of addicts' data from several rehab centers in Dar es Salaam and Arusha. It had functionalities which enabled treatment centers to register and admit the addicts. Information from the mobile application was synchronized and stored into the main database before being retrieved through the web application. The **Waraibu data** mobile App consisted of three menu items; - About, registration and login. The administrator of this mobile application is the DCC personnel and other user is treatment center. Figure 11 presents the home page and about page of **Waraibu data App.**

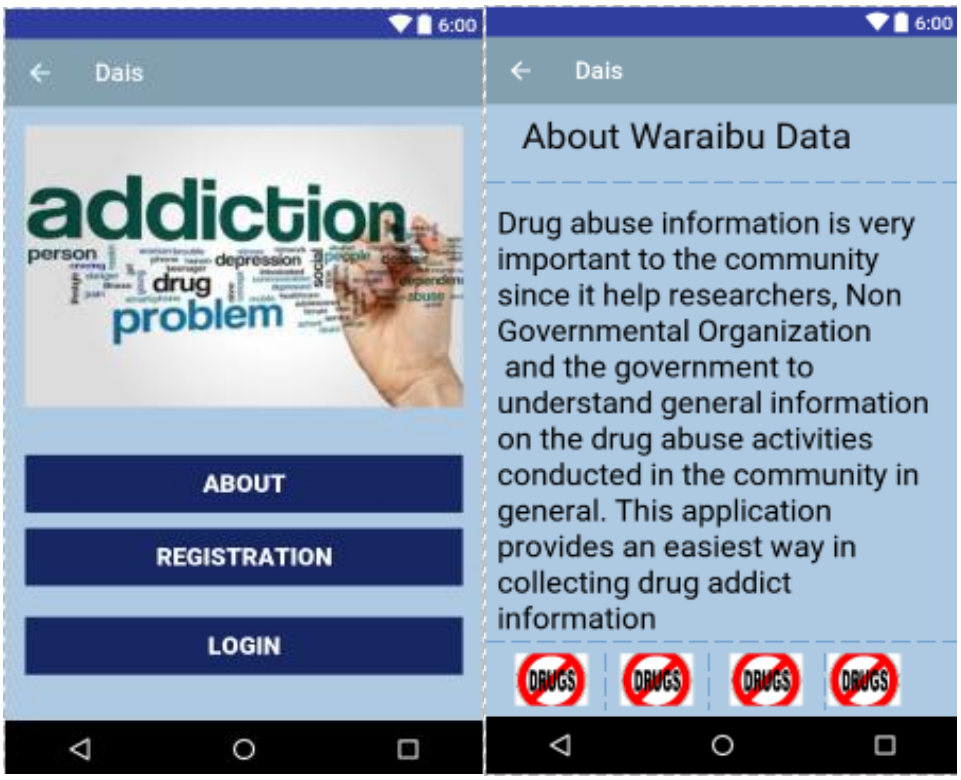

Figure 11: The home page and about page of Waraibu data App.

(i) Registration

The registration page allows the rehab owners to feed their particulars into the central database. The particulars include:- first name, middle name, last name, email address, gender, NGO name, NGO registration number, experience on the usage of drugs, rehab name, street, ward, district, region and phone number. Such information is important for the government through the DCC as a reference during monitoring, controlling and statistical analysis of the centers.

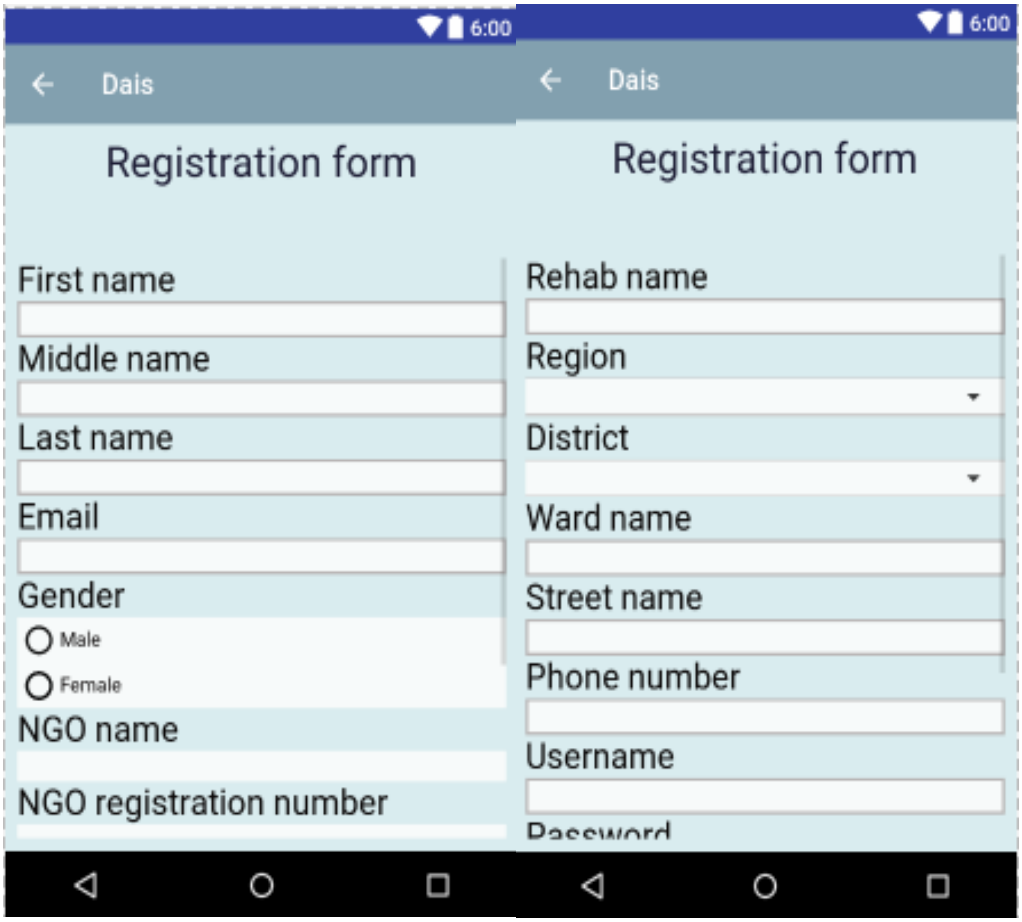

Figure 12: The registration page in the Waraibu data mobile App

(ii) Login and admission page

After registration, an administrator (DCC) will approve the user (rehab center), and then notification will be sent to the user for confirmation of registration. Thereafter, user will login then select admission form to admit patients. Figure 13 contains screenshots that present the interface for login and admission. The admission form gives the user the fields to feed addicts

particulars, which include first name, middle name, last name, phone number, emergence contact, districts, region, type of used drugs. Type of drugs used helps to update the graphs for statistics on the usage of illegal drugs.

Figure 13: Login and admission page

4.5.2 Developed web application

The developed web application called Drug Abuse Information System (DAIS) had several functionalities to enhance storage, reporting, and interface for awareness on the drug abuse information, which include effects and prevention of drug abuse, location of treatment centers, and statistics on the usage of illegal drugs and number of addicts on the treatment. The DAIS starts from the login page, which allows administrator/manager to manage, add or update contents.

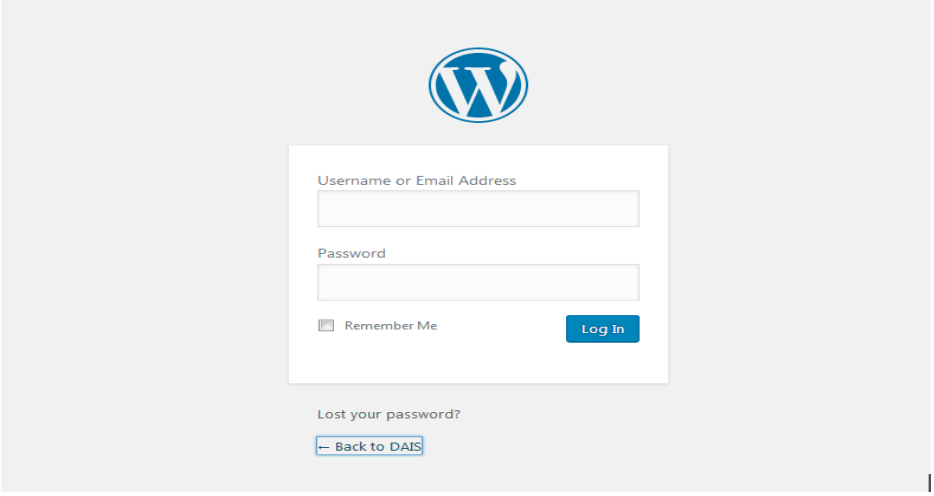

Figure 14: The login interface

(i) Community awareness information

Drug Abuse Information System provides awareness information about the drug abuse for the different number of the community (researchers, society and policy-makers). Figure 15 shows the pages that provide awareness. The menu included information such as; drug abuse general information (facts on drug abuse, reasons for drug abuse, and symptoms for drug addiction), effects, prevention and treatment. Also, the system has made the availability of the information like testimonies to encourage youth not to engage in drug abuse and statistics (usage of illegal drugs and number of addicts on treatment) presented in graphs. Additionally, DAIS consisted of the geographical map for locating treatment centers including hospitals and rehab centers. The forum menu in DAIS allowed the community to interact with the web application. The main page of DAIS presented in Fig. 15.

Figure 15: The home page for drug abuse awareness

(ii) Data and statistics page

Figure 16 presents the number and statistics for the addicts on treatment and the usage of drugs found on the system. Data were synchronized from the mobile application (Waraibu data) to the web application (DAIS), and then presented in graphs. The system enabled automatic update of the data, for instance when treatment centers admit a new patient (addict) the graphs update automatically. Thus gives researchers, policy-makers and decision maker's opportunity to get timely information and use them accordingly.

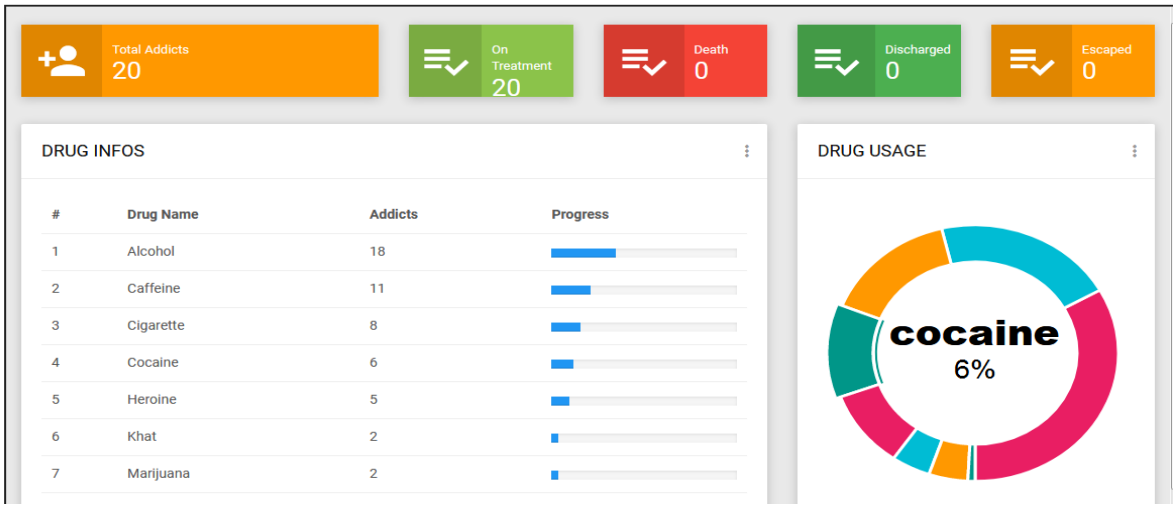

Figure 16: Statistics on the usage of drugs and number of addicts on treatment

(iii) Location of treatment centers

With DAIS, as shown on Fig. 17, the geographical location map was provided, locating available treatment centers found in Dar es Salaam and Arusha. This feature eases the accessibility of the treatment centers location to users and makes them more aware of the places where they can find proper consultation and treatment services. The Fig. 17 shows treatment centers location both in Arusha and Dar es Salaam.

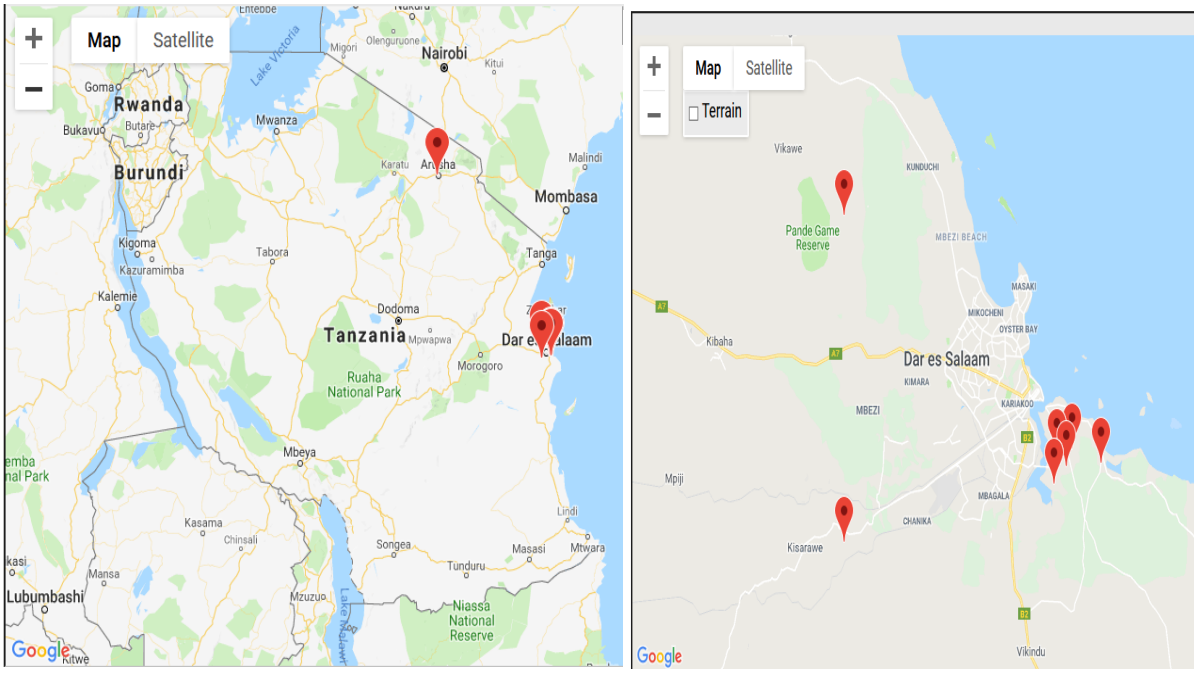

Figure 17: Treatment center location in Arusha and Dar es Salaam.

(iv) A web application for storage, reporting and management of treatment centers

From the main page of developed DAIS, the administrator/manager will be able to access the login page purposely for report retrieval, approve treatment centers to admit patients to the system and other monitoring activities. The administrator provided credentials for authenticity into the main system.

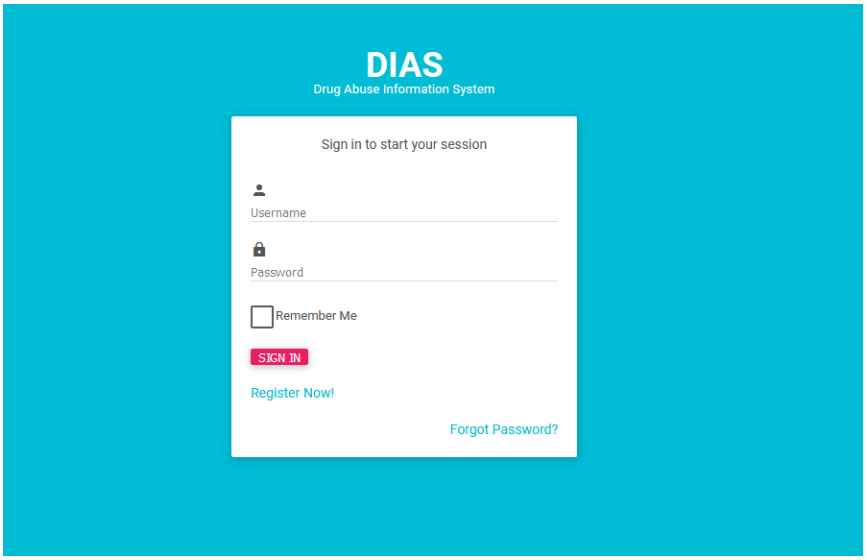

Figure 18: Login page for administrator

After login, the administrator can browse and access all menus of the system, including; *Dashboard, Manage rehab, Manage addicts, Push message and Manage users*. Manage rehab and manage addicts are the important menu items within the system. Manage user menu enables the administrator to manage all users while dashboard consist of general information of the web application including; registered rehab, confirmed rehab centers, rejected rehabs and graphs for statistics.

(v) Manage rehab

The management of rehab centers consists of rehab centers registration, which requires particulars such as Owner details (first name, middle name, and last name), gender, email, NGO name, registration number, and experience in drugs, rehab name, street, ward, district and region. When the rehab center personnel does registration through Waraibu data, the information are being sent to the central database and retrieved through the DAIS.

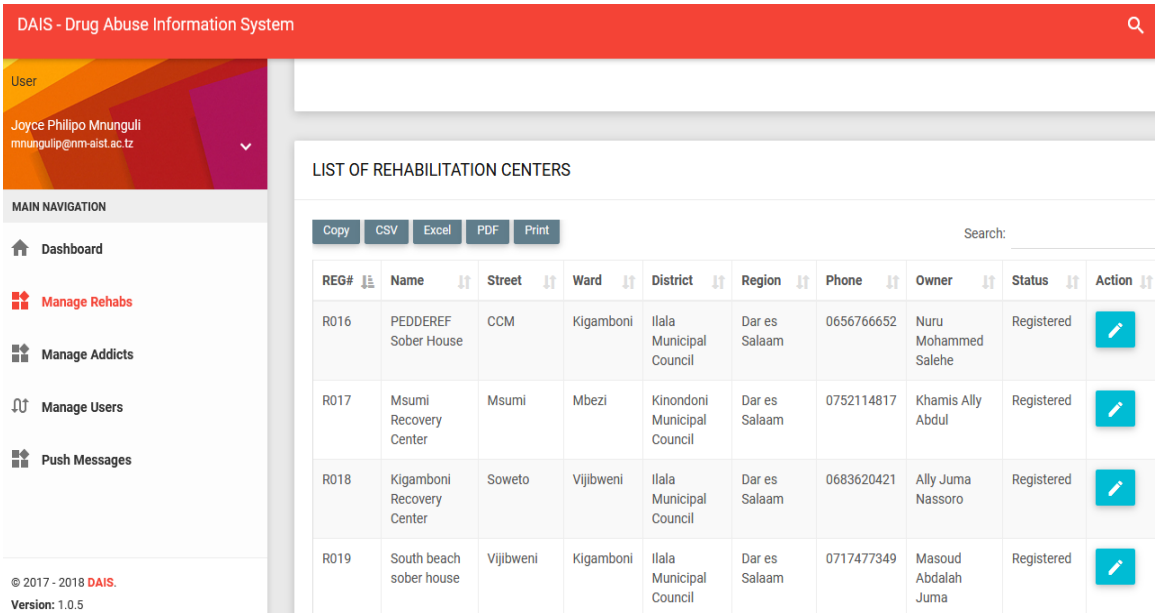

Figure 19: Management of rehab center

Thereafter, administrator approves treatment center users then the system sends notification to the user (rehab center personnel) by email so as to allow them to proceed with admission of patients (addicts). Figures 20 and 21 express the approval and notification.

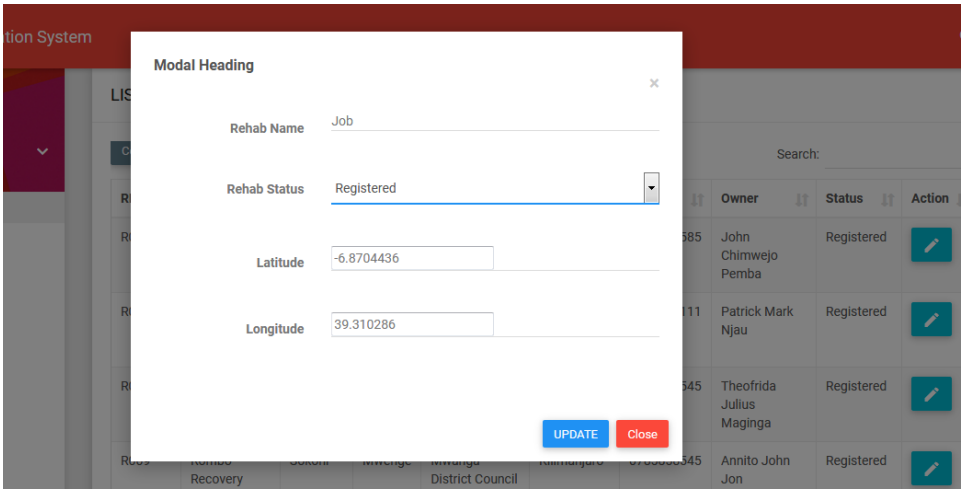

Figure 20: Approval process

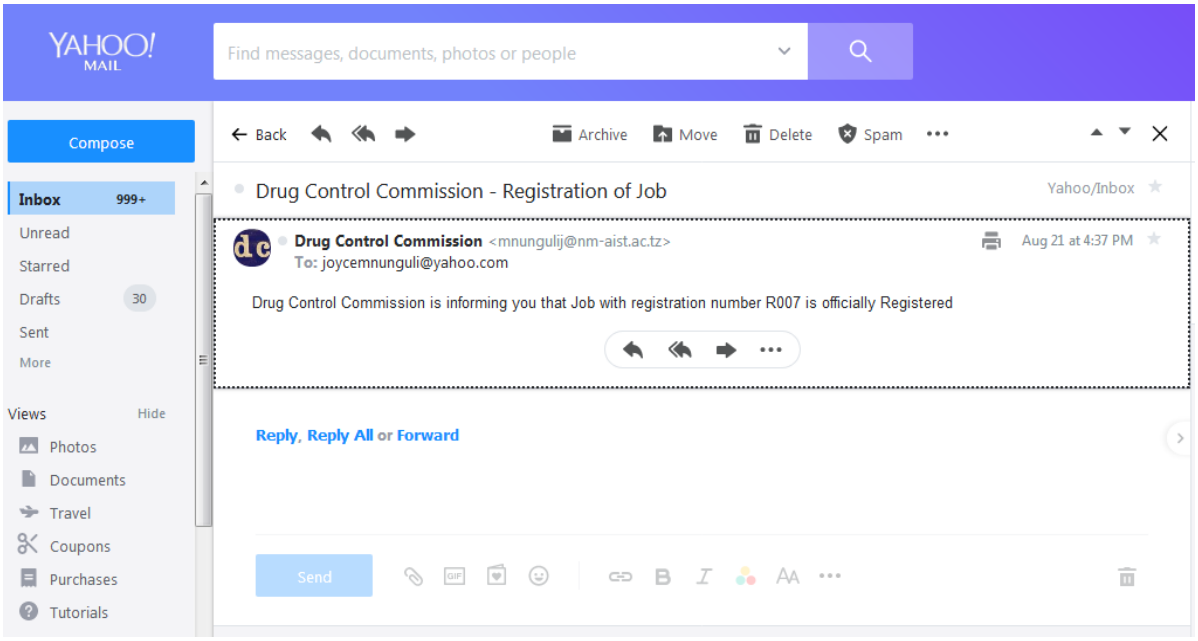

Figure 21: Notification to treatment center

(vi) Manage addicts

With manage addicts menu the information of addicts from all treatment centers is being retrieved. These are the information provided by treatment center through the mobile application.

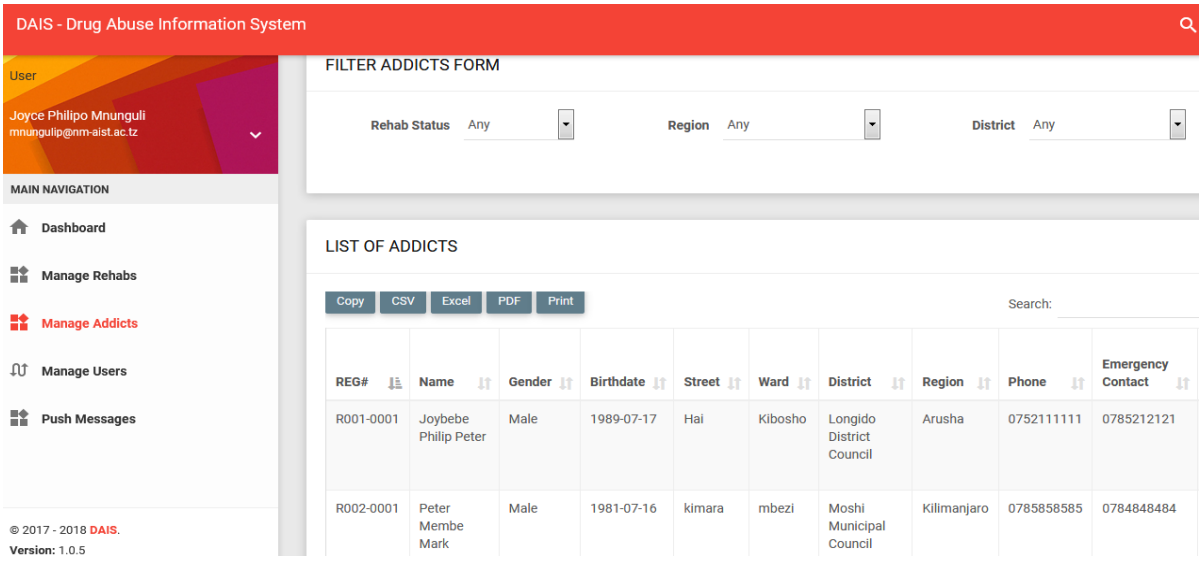

Figure 22: Addicts' details

Moreover, the developed DAIS is capable of filtering reports according to the region, district and rehabs. The report can be retrieved in excel, CSV and PDF format. In addition, the DAIS allows copying and printing of the rehab and addicts information. Figure 23 shows how addicts' information can be filtered, while Fig. 24 is an example of the downloaded report file in Excel format.

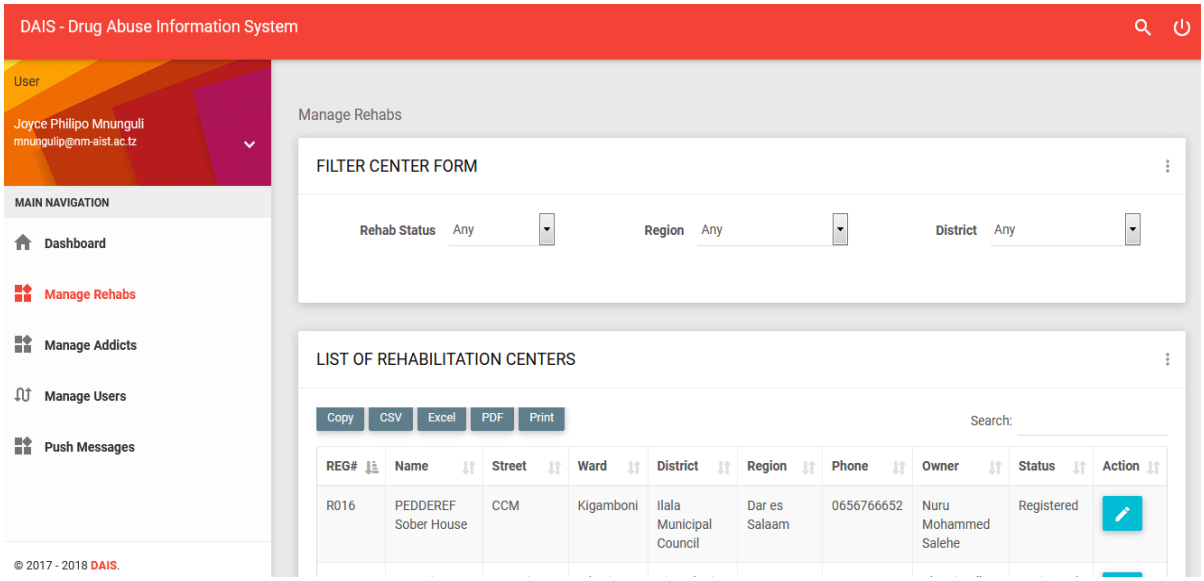

Figure 23: Report retrieval

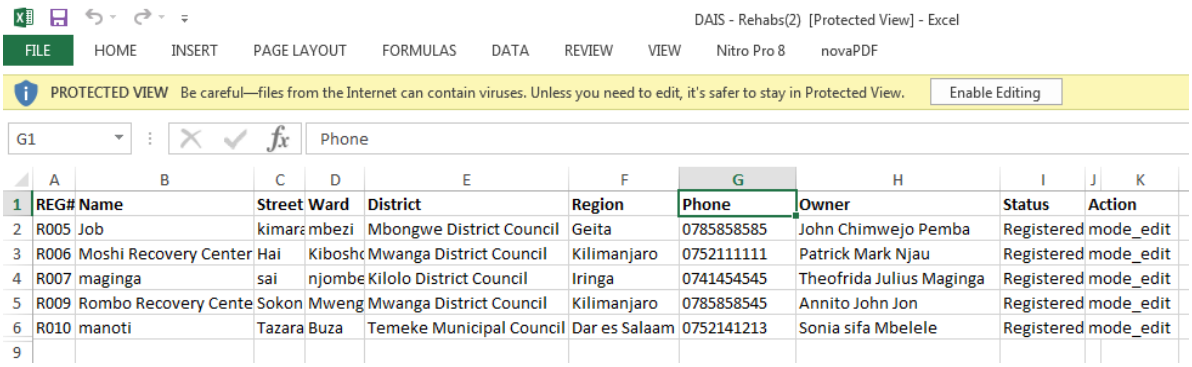

Figure 24: Downloaded registered data in Excel format

(vii) Push message

The DAIS used push message technique to push awareness information to the community on the effects, prevention of drug abuse as well as testimonials of the addicts. The visitors of the DAIS provided with the opportunity to provide their contacts to get more information on drug

issues. Thereafter, the DCC personnel collect the number then sent the messages to the provided contacts, thus increasing awareness to the community at their geographical location. Figure 25 shows where to subscribe and the Fig. 26 shows the push message page.

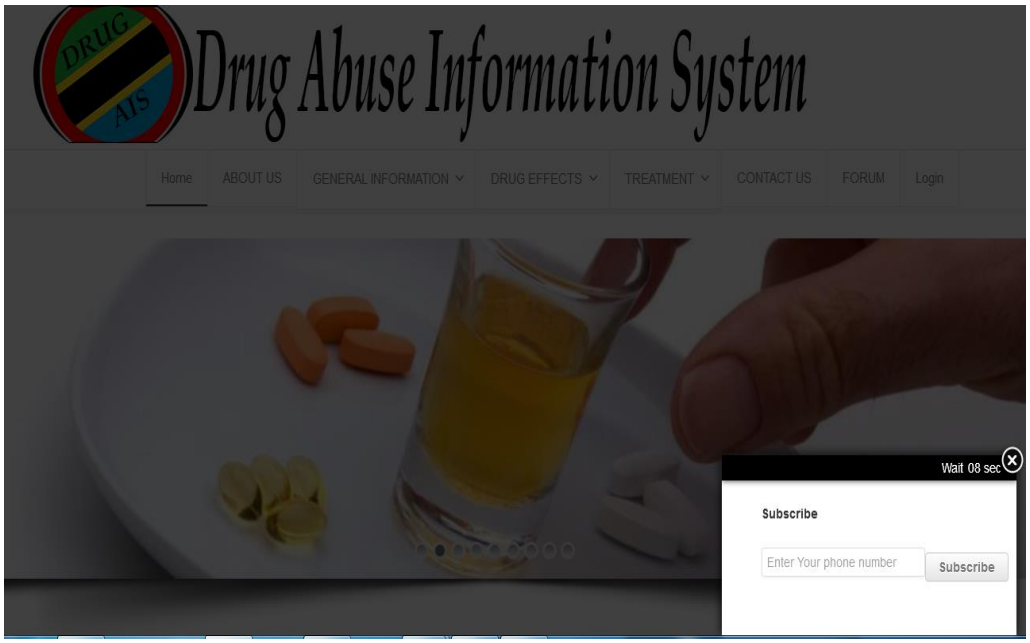

Figure 25: The subscribe page

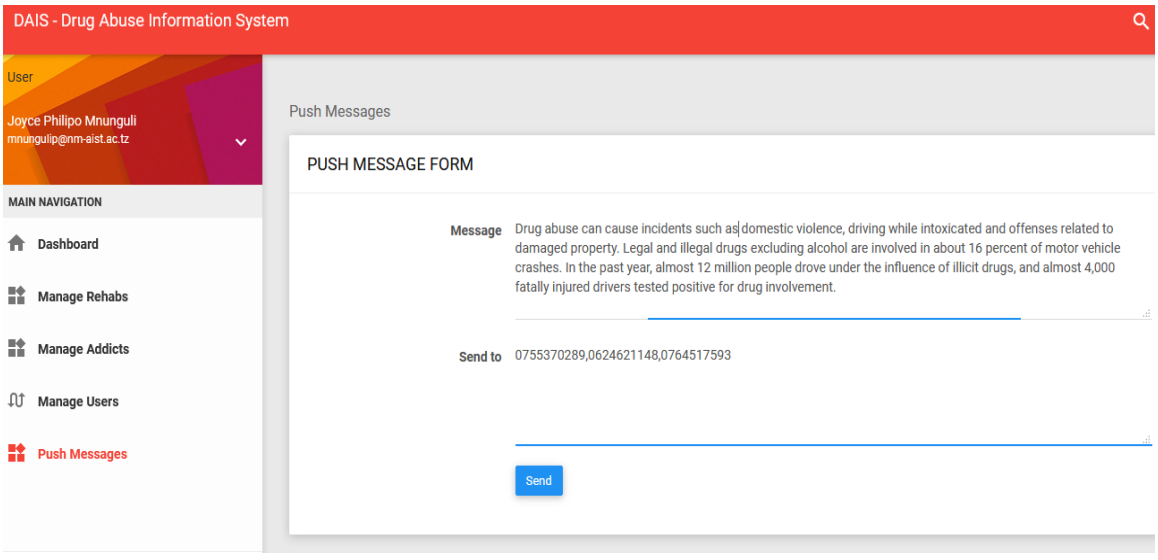

Figure 26: Push message page

4.6 Validation

Validation of the software refers to the affirmation of the user requirements of the system (Lumley *et al*., 2002). It proves if the system meets the requirements of the users. During the process of validation, testing of the software was adopted to check if the desired results were met, thus increasing the quality of the software. The DASIS and Waraibu data App were validated by passing through the different stages of testing such as unit testing, integration testing, system testing and user acceptance testing.

4.6.1 Unit testing

This is the first stage of software testing. It refers to the process of testing functionalities of the system by testing each module of the developed application (Olan, 2003). The purpose of the unit testing is to validate if system components perform as required (Bruegge, 2007). It is normally done by a developer within a controlled environment. Unit testing provides a better reliability of the functionalities of the system for a better accessibility and usability. Some of the important modules of DAIS that were tested include;- content display, data retrieval from the mobile application to the web application, user authentication, short message service (SMS), email notification, and interactivity (mobile and web application) to mention a few. For instance, the interactive module has features which allow the user (DCC personnel) to access treatment data sent through a mobile application, its code presented in Appendix 7.

4.6.2 Integration testing

This is the process of testing software whereby individual's units/components are combined and tested as a group. The purpose of the integration testing is to expose defects occurring between integrated components (Bruegge, 2007). The integrated part of DAIS which was tested was the connection between the mobile application and web application. The integration testing was performed to determine if all integrated components are working properly.

4.6.3 System Testing

This is the level of software testing whereby the complete software is tested to check if it works properly (Oladimeji, 2007). This testing was also done to verify that both mobile and web applications meet requirement specification and design. The "Waraibu data App" and DAIS

were tested to check if all of the functionalities are working properly and meet user requirements.

4.6.4 User acceptance testing

The developed DAIS prototype was hosted online to the web server to test all of the functionalities and user experience on the usage of web and mobile application. The web and mobile applications were presented to DCC, who are the main users of the web application and treatment centers who uses mobile application. The flow of the information to the web application starts from the mobile application. Thus treatment centers were able to perform registration through mobile application and thereafter, received the email notification from the web application to allow them to proceed with the login and submission of patient information through the mobile application. The DCC was able to login to the web application to approve treatment center and retrieve reports and addicts information. The information provided by the treatment centers were retrieved through the web application and updated the statistics graphs.

Furthermore, questionnaires were created with the main objective of finding out user perception and views on the developed Waraibu data App and DAIS for drug abuse information awareness. All users were given the opportunity to give their views about the developed applications. The questionnaire is presented in appendix 1.

Table 2. Presents the results of the user acceptance testing

	Strong agree (%)	Agree (%)	Disagree (%)	Not sure (%)
I think the web application is easy to use	58	40	0	2
I think I will be able to use this web application	67	31	1	1
The web application will facilitate management of drug abuse information	45	59	0	1
I think web application will be useful to the DCC	77	23	0	0
The web application will assist to get statistics on the usage of drug abuse and number of addicts on treatment	61	37	1	1
The web application will be useful for storage and retrieval of reports	71	28	0	1
The web interface is well presented for drug abuse awareness	69	31	0	0
This web application will benefit decision making and policy makers.	43	55	0	2
The mobile application will assist to get addicts and treatment data from treatment center	50	49	0	1

As shown in Table 2 the DCC personnel was extremely satisfied with the web application and mobile application. They strongly agreed with the developed solution and agreed to use both applications in their daily activities. They admitted that they don't have such applications and the developed applications will improve their performance in conducting their responsibilities.

On the other hand, the mobile application was presented to the treatment centers and treatment center were given opportunity to use the application then give their views on the developed application. Questionnaires were distributed to the users and their response was recorded and analyzed.

Table 3. The analysis of the received comments

	Strong agree (%)	Agree (%)	Disagree (%)	Not sure (%)
The mobile application is easy to use	60	39	0	1
I think I will be able to use this mobile application	57	42	0	1
The mobile application is comfortable to use	52	48	0	0
I think this mobile application will save time of report submission to the DCC	70	28	1	1
I think this mobile application will help to reduce the use of paper in recording and admitting addicts	49	51	0	0
I think mobile application will save money of buying stationaries (counter books, papers)	78	21	1	0

The analyzed data collected from the treatment centers presented in Table 3 shows the satisfaction and acceptance of the mobile application to the users. They strongly agreed on the usefulness of the application.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Drug abuse is one among critical problems that affect most of the young adult. Due to the miss use of illegal drugs the government have to take more responsibilities on emphasizing and introducing more treatment centers and engage different NGO,s to participate in providing awareness on the effects and prevention of drug abuse. The availability of illegal drugs in the community and lack of awareness information is proportional to the misuse of the illegal drug. There are several problems associated with the use of illegal drugs including; health effects, social effects and economic effects. The common health effects include; - lung disease, mental, HIV/AIDS, hepatitis, cancer and heart diseases.

Drug abuse information is significant to policy-makers, researchers, NGOs and the community at large. However, the process of gathering drug abuse information is still a challenge in drug abuse sector in such a way it lacks accurate information regarding addicts in the treatment. On the other hand, lack of storage of addicts' data contributes to an inappropriate statistic on the usage of illegal drugs and the number of addicts existing in the treatment center. Further, the use of paper-based in drug abuse sector has contributed to several problems including loss of data, delay in national reporting and consumption of time during addict data collection and reporting.

This study reported the whole process of development of drug abuse information awareness. Specifically, the study reviewed existing drug abuse activities conducted at the drug control commission, treatment centers, NGOs and get to know how information awareness conducted in the community. However, the review was done at a case study of Dar es Salaam and Arusha. Thus, the study developed a mobile application for addicts' data collection and web application for storage of addicts' information and management, reporting, and enhancing awareness programs.

The developed mobile application "Waraibu Data" was able to assist on addicts' data collection whereby treatment centers were able to register and get access to feed addict data which

synchronized to the web application "DAIS". All information provided through mobile application was accessed through the use of web application.

Furthermore, the developed web application provided an interface for drug information awareness which includes; statistics on the usage of illegal drugs, effects and prevention of the drug abuse, statistics on the number of addicts in treatment. Data collected from mobile application synchronize and be accessed through a web application which results to automatic generation of graphs to show the statistics. On the other hand, the web application was able to store addicts' data, retrieve reports from treatment centers and display a map that shows treatment centers location. The viability of both developed mobile and web application is to minimize resources such as human effort, cost, and time consumption during data collection, appropriate storage of the addicts' data. Thus, improve drug abuse activities and provide awareness to the community, policymakers and researchers on the drug abuse issues.

5.2 Recommendation

To this end, the study recommends the following; Government should increase efforts on providing awareness on the drug abuse information so that the community can get knowledge and escape from misusing drugs. Through, the use of ICT tools the drug abuse sector will be able to provide awareness to the community. Moreover, the study offers some area of extension for the adaptation of the work to the community. The study can be extended by improving the developed web application database to allow direct interaction between users and practitioners. Nevertheless, the study can be extended by improving the mobile application to allow consultation services to be conducted regardless of their geographical location.

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APPENDICES

Appendix 1: Validation Questionnaire

I am Joyce Philipo Mnunguli, master's student at The Nelson Mandela Institution of Science and Technology (NM-AIST), currently doing a research titled " A web and mobile based application for drug abuse information awareness: A case of Dar es Salaam and Arusha in Tanzania". I have developed a web and mobile application for drug abuse information awareness. A mobile application for addicts' data collection and web application for storage, reporting and awareness on drug abuse information.

The aim of this questionnaire is to assess on the developed prototype/first sample of both applications by giving your views on how you feel/think about the platform hence getting feedback for more improvements.

Please choose the best answer.

1. Your name/designation …….
2. Are you good in computer skills?
    a. Strong agree
    b. Agree
    c. Disagree
3. The web application is easy to use?
    a. Strong agree
    b. Agree
    c. Disagree
4. This web application is comfortable to use?
    a. Strong agree
    b. Agree
    c. Disagree
5. This platform is well presented for drug abuse awareness
    a. Strong agree
    b. Agree
    c. Disagree
6. Will you be able to use this web application?

a. Strong agree
b. Agree
c. Disagree

7. The web application will be useful for storage and retrieval of reports
    a. Strong agree
    b. Agree
    c. Disagree
8. The web application will assist to get statistics on the usage of drug abuse
    a. Strong agree
    b. Agree
    c. Disagree
9. I think more features should be added to this platform
    a. Strong agree
    b. Agree
    c. Disagree
10. This web application will benefit decision making and policy makers.
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
11. I think the community will benefit from this application
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
12. I think this platform will provide drug abuse information awareness to the community
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
13. What are more features that should be added to the platform?

14. Do you have any other comments?

Rehab center Validation questionnaire

1. Rehab center name ……..
2. Do you have a smartphone?
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
3. The application is comfortable to use
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
4. Do you think you can use this mobile application
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
5. This mobile application is easy to use
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
6. I think this mobile application save time for report submission
    a. Strong agree
    b. Agree
    c. Disagree
    d. Not sure
7. I think this mobile application will money
    a. Strong agree
    b. Agree

c. Disagree
d. Not sure

8. I recommend this mobile application to be used to all treatment center in Tanzania
    a. Strong agree
    b. Agree
    c. Disagree

Appendix 2: Questionnaire

I am Joyce Philipo Mnunguli, master's student at The Nelson Mandela Institution of Science and Technology (NM-AIST), currently doing a research titled " A web and mobile based application for drug abuse information awareness: A case of Dar es Salaam and Arusha in Tanzania". The aim of the questionnaire is to understand the knowledge community has on the drug abuse issues.

1. **General information on the drug abuse issues (Community)**

Please tick (√) where appropriate

1. Gender

   a. Male ☐ b. Female ☐

2. Do you have knowledge or awareness on drug abuse issues?

   a. Yes ☐ b. No ☐ c. I don't know ☐

   If yes tick the awareness/ knowledge you have

   i. Rehab center location or where treatment for the addict provided ☐
   ii. Effects of drug abuse ☐
   iii. Prevention of drug abuse ☐

3. What are the initial causes of drug addiction in your community? Tick one or more

   a. Peer pressure ☐
   b. Availability of illegal drugs and inhalants substance ☐
   c. Environment ☐
   d. Unemployment ☐
   e. Stress/depression ☐
   f. I don't know ☐

4. Which type of illegal drugs are you aware with? Tick one or more

   a. Cocaine ☐
   b. Heroin ☐

c. Caffeine ☐
d. Marijuana ☐
e. I don't know ☐

5. What are the most illegal drugs abused in your community/environment? Tick one or more

a. Cocaine ☐
b. Heroin ☐
c. Caffeine ☐
d. Marijuana ☐
e. I don't know ☐

6. How difficult is it to get access to illegal drugs like cocaine marijuana, Heroin, etc.?

a. Very easy ☐
b. Fairly easy ☐
c. Fairly difficult ☐
d. Very difficult ☐
e. Don't know ☐

2. **Health Impact**

7. Are you aware of the common methods used in consumption of illegal drugs?

a. Yes ☐ b. No ☐

If yes which of the following do you know? Tick one or more

a. Smoking ☐
b. Inhalation ☐
c. Ingestion ☐
d. Injection ☐

8. Are you aware of the health impact or consequences of using illegal drugs?

a. Yes ☐ b. No ☐ c. I don't know ☐

If yes which of the following health effect do you know? Tick one or more

a. HIV/AIDS ☐

b. Brain damage ☐
c. Lung diseases ☐
d. Mental retardation ☐
e. Heart diseases ☐

10. Which of the following drugs are used for injection?

a. Cannabis ☐
b. Heroin ☐
c. Cocaine ☐
d. Caffeine ☐
e. I don't know ☐

3. Awareness section

11. Do you know any place within your community which offers consultation services on the uses/effects and prevention on illegal/drug abuse?

a. Yes ☐ b. No ☐ c. I don't know ☐

If yes mention…….

12. Do you know any place in your community which offer treatment for addict?

a. Yes ☐ b. No ☐ c. I don't know ☐

If yes mention two places……..

13. Have you ever involved or attended in any drug abuse awareness program?

a. Yes ☐ b. No ☐ c. I don't know ☐

15. Where do you get information about illegal drugs use, effect, treatment and prevention?

i. News paper ☐
ii. Media ☐
iii. Friends ☐
iv. School/university/workplace ☐
v. Neighborhood/community ☐
vi. I don't know ☐

Appendix 3: Interview Questions for NGO's and Treatment center.

A. NGOs interviews questions

The interview questions aim to understand the weakness and strength of the awareness programs and addicts data collection.

1. How does awareness programs conducted?
2. How often do you provide awareness to the community regarding drug abuse issues?
3. How long does it take to mobilize people in order to provide awareness?
4. What are materials/information, method/tools used for drug abuse awareness program?
    a. Materials/information……
    b. Methods/tools……
5. What are the challenges faced during conducting awareness?
6. How are you overcoming the provided challenges?
7. What are the response impact of the awareness training conducted?
    a. Very good ☐
    b. Good ☐
    c. Poor ☐
    d. I don't know ☐
8. Is there any electronic tool that link between rehab centers, NGO's and the community?
9. Do you think having a mobile application in hand will help to providing awareness to the general public and help reduce the number of people who are engaged in drug abuse issues?

B. **Treatment center interview questions** (awareness information)

1. Name of rehabs center …… Location ……....
2. Number of in-patient/addict ……..Number of out-patient/addict……..
3. How do you get patients (Addict)?
4. At what stage of addictions do you normally receives patients?
    a. Serious addiction

b. Middle level addiction
c. Earlier stage of addiction

5. Which stage(s) in qn2 above frequently received.....? (Give the number if possible monthly/yearly).....
6. What are the common methods used in treating each stage (s) in qn2:
    a. Serious addiction……
    b. Middle level addiction……
    c. Earlier addiction…….
7. What kind of illegal drugs found to affects most of patients received in your center? Mention the number of addict
    a. Cocaine……..
    b. Heroin……
    c. Caffeine…….
    d. Marijuana……..
8. What are the challenges in treating addict?
9. Can you give few stories/testimonies of treated addict?
10. How do you keep and secure record patients details?
11. Do you have any electronic tool for keeping record and providing consultation?
12. What are the information used to influence addicts or families to bring their patients/addict to the rehab center?
13. Do you think having a mobile application in hand will help to providing awareness to the general public and help reduce the number of people who are engaged in drug abuse issues? If yes Why?

Appendix 4: Drug Control Commission Interviews Questions

The interview questions at DCC aimed at understanding the current situation on the addicts' data collections, management of treatment center, addicts data and management of awareness programs conducted by the NGO's

1. Name/ Designation……
2. Gender
    a. Male
    b. Female
3. How do you collect addicts' data?
4. How do you store addicts data
    a. Flat files
    b. Paper
    c. ICT tool (DB)
5. The submitted data from treatment center are accurate
    a. Strong agree
    b. Agree
    c. Disagree
6. How do you secure addicts data?
7. Do you think ICT tool can help to store data and provide awareness
    a. Strong agree
    b. Agree
    c. Disagree
8. How do you get monthly reports from treatment center?
9. A mobile application can help to collect addicts data from treatment center
    a. Strong agree
    b. Agree
    c. Disagree

Appendix 5: Code for login layout

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/activity_login"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:paddingBottom="46dp"
    android:paddingLeft="36dp"
    android:paddingRight="36dp"
    android:paddingTop="46dp"
    android:background="#eafafc"
    tools:context="com.example.joy_pc.datacollect.LoginActivity">
    <include layout="@layout/activity_loading"/>
    <LinearLayout
        android:id="@+id/main_view"
        android:orientation="vertical"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        android:visibility="visible">
    <LinearLayout
        android:orientation="vertical"
        android:layout_width="match_parent"
        android:paddingLeft="15dp"
        android:paddingRight="15dp"
        android:layout_height="match_parent"
        android:background="@drawable/round_conners"
        android:layout_alignParentTop="true">
        <ImageView
            android:layout_marginTop="-20dp"
```

```
    android:layout_width="98dp"
    android:layout_height="132dp"
    android:layout_gravity="center"
    app:srcCompat="@drawable/user_icon"
    android:layout_alignParentBottom="true"
    android:layout_alignParentLeft="true"
    android:layout_alignParentStart="true"
    android:id="@+id/imageView2" />
<TextView
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Sign In"
    android:textSize="35dp"
    android:layout_gravity="center"
    android:textColor="@color/colorPrimary"
    android:id="@+id/textView"/>
<EditText
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:inputType="textPersonName"
    android:drawableLeft="@drawable/ic_person_black_24dp"
    android:ems="10"
    android:background="#eafafc"
    android:layout_alignParentTop="true"
    android:layout_alignParentLeft="true"
    android:layout_alignParentStart="true"
    android:layout_marginLeft="0dp"
    android:layout_marginStart="0dp"
    android:layout_marginTop="57dp"
    android:id="@+id/btn_username"
    android:hint="USERNAME"
```

```
    style="@style/Widget.AppCompat.EditText" />
<EditText
    android:background="#eafafc"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:inputType="textPassword"
    android:id="@+id/btn_password"
    android:hint="PASSWORD"
    android:drawableLeft="@android:drawable/ic_lock_lock"
    style="@style/Widget.AppCompat.EditText"
    android:layout_below="@+id/username"
    android:layout_alignLeft="@+id/username"
    android:layout_alignStart="@+id/username"
    android:layout_marginTop="25dp" />
<Button
    android:text="Login"
    android:layout_marginTop="25dp"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:id="@+id/btn_login"
    android:layout_gravity="center"
    android:layout_alignBaseline="@+id/btn_about"
    android:layout_alignBottom="@+id/btn_about"
    android:layout_alignParentRight="true"
    android:layout_alignParentEnd="true"
    android:textColor="#ffffff"
    android:background="#416d71"
    android:textStyle="bold"
    android:textSize="20dp"
    />    </LinearLayout>    </LinearLayout></RelativeLayout>
```

Appendix 6: Code for login page on JAVA side

```
package com.example.joy_pc.datacollect;
import android.app.Activity;
import android.content.Context;
import android.content.Intent;
import android.content.SharedPreferences;
import android.graphics.Color;
import android.os.AsyncTask;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.support.v7.widget.Toolbar;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.Toast;
import org.apache.http.NameValuePair;
import org.apache.http.message.BasicNameValuePair;
import org.json.JSONException;
import org.json.JSONObject;
import java.util.ArrayList;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.Toast;
import android.os.AsyncTask;
import android.widget.ArrayAdapter;
import android.widget.ListView;
import android.widget.Toast;
```

```
import org.apache.http.params.HttpParams;
import org.apache.http.message.BasicNameValuePair;
import org.json.JSONArray;
import org.json.JSONException;
import org.json.JSONObject;
import java.io.BufferedReader;
import java.io.InputStreamReader;
import java.net.HttpURLConnection;
import java.net.URL;
import java.util.ArrayList;
import android.widget.ProgressBar;
import android.widget.TextView;
public class LoginActivity extends AppCompatActivity {
    private EditText editTextusername, editTextpassword;
    ListView listView
    General_functions general_functions = new General_functions();
    String URL = general_functions.root_url()+"login";
    JSONParser jsonParser = new JSONParser();
    private ProgressBar progressBar;
    TextView txt;
    Button btnLogin;
    SharedPreferences sharedpreferences;
    public static final String MyPREFERENCES = "MyPrefs" ;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_login);
        getSupportActionBar().setDisplayHomeAsUpEnabled(true);
        editTextusername = (EditText) findViewById(R.id.btn_username);
        editTextpassword = (EditText) findViewById(R.id.btn_password);
        btnLogin = (Button) findViewById(R.id.btn_login);
```

```
btnLogin.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View view) {
        String username = editTextusername.getText().toString();
        String password = editTextpassword.getText().toString();
        AttemptLogin attemptLogin = new AttemptLogin();
        attemptLogin.execute(username, password, "");
    }       });   }  private class AttemptLogin extends AsyncTask<String, Integer,
JSONObject> {
    @Override
    protected void onPreExecute() splash(true); super.onPreExecute();
   }   @Override
    protected JSONObject doInBackground(String... args) {
        String email = args[2];
        String password = args[1];
        String name = args[0];
        ArrayList<NameValuePair> params = new ArrayList<NameValuePair>();
        params.add(new BasicNameValuePair("username", name));
        params.add(new BasicNameValuePair("password", password));
        if (email.length() > 0)
            params.add(new BasicNameValuePair("email", email));
        JSONObject json = jsonParser.makeHttpRequest(URL, "POST", params);
        return json;
    }       protected void onPostExecute(JSONObject result) {
        try {       if (result != null) {
              String success_flag = result.getString("success");  if (success_flag.equals("1")) {
                  sharedpreferences = getSharedPreferences("session",
Context.MODE_PRIVATE);
                  SharedPreferences.Editor editor = sharedpreferences.edit();
                  String rehab_status_id= result.getString("rehab_status_id");
                  editor.putString("username", result.getString("username"));
```

```
                editor.putString("rehab_status_id", result.getString("rehab_status_id"));
                editor.putString("privilege_id", result.getString("privilege_id"));
                editor.putString("rehab_registration_number",
result.getString("rehab_registration_number"));
                editor.commit();    Toast.LENGTH_LONG).show();
                Intent mintent = new Intent(LoginActivity.this, DashboardActivity.class);
                startActivity(mintent); } else { splash(false);
                Toast.makeText(getApplicationContext(), result.getString("message"),
Toast.LENGTH_LONG).show();}    } else {
              Toast.makeText(getApplicationContext(), "Unable to retrieve any data from
server", Toast.LENGTH_LONG).show();
            }    } catch (JSONException e) {  e.printStackTrace();
        }      } @Override
      protected void onProgressUpdate(Integer... values) {
        super.onProgressUpdate(values);    }
      protected void splash(Boolean show){
        if(show){  progressBar = (ProgressBar) findViewById(R.id.progressBar);
          progressBar.setVisibility(View.VISIBLE);
          if (findViewById(R.id.main_view).getVisibility() == View.VISIBLE) {
              findViewById(R.id.splach_screen).setVisibility(View.VISIBLE);
            findViewById(R.id.main_view).setVisibility(View.GONE);
          }  }else {progressBar = (ProgressBar) findViewById(R.id.progressBar);
          progressBar.setVisibility(View.INVISIBLE);
          if (findViewById(R.id.splach_screen).getVisibility() == View.VISIBLE) {
                findViewById(R.id.splach_screen).setVisibility(View.GONE);
                        findViewById(R.id.main_view).setVisibility(View.VISIBLE);
          }     }    }    }}
```

Appendix 7: Code for API interaction between web and mobile application

Controller class

```
<?php
defined('BASEPATH') OR exit('No direct script access allowed');
class Mobile extends CI_Controller {
   function __construct() {
      parent::__construct();
      $this->load->model("users/mobile_model");
   }    public function index() {
      $this->load->library('javascript');
      $this->load->library('table');
      ?>       <!DOCTYPE html>
      <html>      <head>
            <meta charset="UTF-8">
            <title>Title of the document</title>
         </head>
         <body>
            <?php
            $validation = TRUE;
            $post_data = array();
            $post_data['rehab_registration_number'] = 'R018';
            $post_data['registration_number'] = $this->global_functions-
>generate_reg_number(0);
            $post_data['addict_id'] = $this->global_functions-
>generate_addicts_number(array('rehab_registration_number' =>
$post_data['rehab_registration_number']));
            $post_data['first_name'] = "Joyce" . rand();
            $post_data['middle_name'] = "hnnn";
            $post_data['last_name'] = 'HHHH';
            $post_data['phone_number'] = '0755370289';
            $post_data['emergence_contact'] = '066666666666';
            $post_data['birth_date'] = '2006-06-19';
            $post_data['occupation'] = 'Mwalimu';
            $post_data['street'] = 'STete';
            $post_data['ward'] = 'Kigurunyembe';
            $post_data['district_id'] = '2';
            $post_data['region_id'] = 'TZ.DO';
            $post_data['treatment_status'] = 'YES';
            $post_data['gender'] = 'F';
            $post_data['patient_summary'] = 'Test summary';
            $post_data['drug_used'] = '[]4[]7[]6[]1';
            $post_data_rehab = array();
            $post_data_rehab['registration_number'] = $this->global_functions-
>generate_reg_number(0);
            $post_data_rehab['rehab_name'] = 'Kimimani' . rand(100, 1000);
```

```
            $post_data_rehab['street'] = 'Kiliman';
            $post_data_rehab['ward'] = 'Njoro';
            $post_data_rehab['district'] = '2';
            $post_data_rehab['region'] = 'TZ.DO';
            $post_data_rehab['phone_number'] = '0868686';
            $post_data_rehab['username'] = 'DEMO' . rand(0, 100);
            $post_data_rehab['password'] = 'demo';
            $post_data_rehab['owner_first_name'] = 'Joy';
            $post_data_rehab['owner_middle_name'] = "Mnu";
            $post_data_rehab['owner_last_name'] = 'Mnu';
            $post_data_rehab['email'] = 'Mnk';
            $post_data_rehab['gender'] = "F";
            $post_data_rehab['drug_experience'] = 'YES';
            $post_data_rehab['ngo_name'] = 'Kik' . rand(100, 1000);
            $post_data_rehab['ngo_registration_number'] = "THOO" . rand(100, 1000);
            $data = array(
               array('Name', 'Color', 'Size'),
               array('Fred', 'Blue', 'Small'),
               array('Mary', 'Red', 'Large'),
               array('John', 'Green', 'Medium')
            );
            $this->table->set_caption('Colors');
            echo $this->table->generate($data);
            $title = "What's wrong with CSS?";
            echo url_title($title);
            $atts = array(
               'width' => 800,
               'height' => 600,
               'scrollbars' => 'yes',
               'status' => 'yes',
               'resizable' => 'yes',
               'screenx' => 0,
               'screeny' => 0,
               'window_name' => '_blank');
            echo anchor_popup(current_url() . '/drug_list', 'Drdug list', $atts) . '<br>';
            $attributes = array('title' => 'Mail me');
            echo mailto('me@my-site.com', 'Contact Me', $attributes) . '<br>';
            echo anchor(current_url() . '/get_regions_list', 'Region list') . '<br>';
            echo anchor(current_url() . '/get_districts_list', 'District list') . '<br>';
            echo anchor(current_url() . '/register_rehab', 'Register') . '<br>';
            echo anchor(current_url() . '/generate_reg_number/0', 'Generate Rehab Registration
Number') . '<br>';
            echo anchor(current_url() . '/register_addicts/?' . http_build_query($post_data),
'Register Addicts') . '<br>';
            echo anchor(current_url() . '/register_rehab/?' .
http_build_query($post_data_rehab), 'Register Rehab') . '<br>';
            $this->load->library('pagination');
```

```
            $config['base_url'] = 'http://example.com/index.php/test/page/';
            $config['total_rows'] = 200;
            $config['per_page'] = 20;
            $this->pagination->initialize($config);
            echo $this->pagination->create_links();?>
        </body>
    </html>
    <?php
  }   public function get_drug_list() {
    $drug_list_query = $this->mobile_model->get_drug_list($filter_data = array());
    $json = array();
    if ($drug_list_query->num_rows() > 0) {
        foreach ($drug_list as $row) {
            $json[] = array('drug_id' => $row['drug_id'], 'drug_name' => $row['drug_name']);
        }       } else {
    }       echo json_encode($json);
  }   public function get_regions_list() {
    $region_list_query = $this->global_functions->get_regions($filter_data = array());
    $json = array();
    $json[] = array('region_id' => -1, 'region_name' => '--select---');
    if ($region_list_query->num_rows() > 0) {
        $region_list = $region_list_query->result_array();
        $i = 0;
        foreach ($region_list as $row) {
            $json[] = array('region_id' => $row['region_id'], 'region_name' =>
$row['region_name']);
        }       } else {     }
    echo json_encode($json);
  }   public function get_districts_list() {
    $filter_data = array();
    if ($this->input->post_get('region_id')) {
        $filter_data['region_id'] = $this->input->post_get('region_id');
    }       $region_list_query = $this->global_functions->get_districts($filter_data);
    $json = array();
    $json[] = array('district_id' => -1, 'district_name' => '--select---');
    if ($region_list_query->num_rows() > 0) {
        $region_list = $region_list_query->result_array();
        $i = 0;
        foreach ($region_list as $row) {
            $json[] = array('district_id' => $row['district_id'], 'district_name' =>
$row['district_name']);
        }   } else {  }
    echo json_encode($json);
  }   public function register_rehab() {
    $validation = TRUE;
    $error_message = "";
    $post_data = array();
```

```
$post_data['registration_number'] = $this->global_functions->generate_reg_number(0);
if (isset($_REQUEST['rehab_name'])) {
   $post_data['rehab_name'] = $_REQUEST['rehab_name'];
} else {
   $error_message .= "\n Please fill Rehab Name";
   $validation = FALSE;
}  if (isset($_REQUEST['street'])) {
   $post_data['street'] = $_REQUEST['street'];
} else {
   $error_message .= "\nPlease fill Street";
   $validation = FALSE;
} if (isset($_REQUEST['ward'])) {
   $post_data['ward'] = $_REQUEST['ward'];
} else {
   $error_message .= "\nPlease fill Ward";
   $validation = FALSE;
}  if (isset($_REQUEST['district'])) {
   $post_data['district_id'] = $_REQUEST['district'];
} else {
   $error_message .= "\n Please fill District";
   $validation = FALSE;
} if (isset($_REQUEST['region'])) {
   $post_data['region_id'] = $_REQUEST['region'];
} else {
   $error_message .= "\n Please fill Region";
   $validation = FALSE;
} if (isset($_REQUEST['phone_number'])) {
   $post_data['phone_number'] = $_REQUEST['phone_number'];
} else {
   $error_message .= "\n Please fill Phone Number";
   $validation = FALSE;
} if (isset($_REQUEST['username'])) {
   $post_data['username'] = $_REQUEST['username'];
} else {
   $error_message .= "\n Please fill User Name";
   $validation = FALSE;
} if (isset($_REQUEST['password'])) {
   $post_data['password'] = $_REQUEST['password'];
} else {
   $error_message .= "\n Please fill Password";
   $validation = FALSE;
}
if (isset($_REQUEST['owner_first_name'])) {
   $post_data['owner_first_name'] = $_REQUEST['owner_first_name'];
} else {
   $error_message .= "\n Please fill Owner First Name";
   $validation = FALSE;
```

```
  } if (isset($_REQUEST['owner_middle_name'])) {
     $post_data['owner_middle_name'] = $_REQUEST['owner_middle_name'];
  } else {
     $error_message .= "\n Please fill Owner Last Name";
     $validation = FALSE;
  } if (isset($_REQUEST['owner_last_name'])) {
     $post_data['owner_last_name'] = $_REQUEST['owner_last_name'];
  } else {
     $error_message .= "\n Please fill Owner Last Name";
     $validation = FALSE;
  } if (isset($_REQUEST['email'])) {
     $post_data['email'] = $_REQUEST['email'];
  } else {
     $error_message .= "\n Please fill Email";
     $validation = FALSE;
  } if (isset($_REQUEST['gender'])) {
     $post_data['gender'] = $_REQUEST['gender'];
  } else {
     $error_message .= "\n Please fill Gender";
     $validation = FALSE;
  }
  if (isset($_REQUEST['ngo_name'])) {
     $post_data['ngo_name'] = $_REQUEST['ngo_name'];
  } else {
     $error_message .= "\n Please fill NGO Name";
     $validation = FALSE;
  }
  if (isset($_REQUEST['ngo_registration_number'])) {
     $post_data['ngo_registration_number'] = $_REQUEST['ngo_registration_number'];
  } else {
     $error_message .= "\n Please fill NGO Registration Number";
     $validation = FALSE;
if (isset($_REQUEST['drug_experience'])) {
     $post_data['drug_experience'] = $_REQUEST['drug_experience'];
  } else {
     $error_message .= "\n Please fill Your exerience in drug";
     $validation = FALSE;
  }       $this->load->model("users/mobile_model");

  $json = array();
  if ($validation == TRUE) {
     $t=$this->mobile_model->register_rehab($post_data) ;
     if ($t=="TRUE") {
        $json['success'] = 1;
        $json['message'] = "Information Successiful submitted";
     } else {
        $json['success'] = 0;
```

```
            $json['message'] = $t;
        }       } else {
        $json['success'] = 0;
        $json['message'] = "Please fill the following information  \n" . $error_message;
      }
      echo json_encode($json);
   }
   public function register_addicts() {
      $validation = TRUE;
      $error_message = "";
      $post_data = array();
      // $post_data['addicts_number'] = $this->global_functions-
>generate_addicts_number(array('rehab_registration_number'=>));
      if (isset($_REQUEST['rehab_registration_number'])) {
         $post_data['rehab_registration_number'] =
$_REQUEST['rehab_registration_number'];

         $post_data['addict_id'] = $this->global_functions-
>generate_addicts_number(array('rehab_registration_number' =>
$post_data['rehab_registration_number']));
      } else {
         $error_message .= "\n Please fill rehab_registration_number ";
         $validation = FALSE;
      }
      if (isset($_REQUEST['first_name'])) {
         $post_data['first_name'] = $_REQUEST['first_name'];
      } else {
         $error_message .= "\nPlease fill first name";
         $validation = FALSE;       }
      if (isset($_REQUEST['middle_name'])) {
         $post_data['middle_name'] = $_REQUEST['middle_name'];
      } else {
         $error_message .= "\nPlease fill middle name";
         $validation = FALSE;       }
      if (isset($_REQUEST['last_name'])) {
         $post_data['last_name'] = $_REQUEST['last_name'];
      } else {
         $error_message .= "\n Please fill last name";
         $validation = FALSE;       }
      if (isset($_REQUEST['phone_number'])) {
         $post_data['phone_number'] = $_REQUEST['phone_number'];
      } else {          $error_message .= "\n Please fill phone number";
         $validation = FALSE;       }
      if (isset($_REQUEST['emergence_contact'])) {
         $post_data['emergence_contact'] = $_REQUEST['emergence_contact'];
      } else {    $error_message .= "\n Please fill emergence contact";
         $validation = FALSE;       }
```

```
if (isset($_REQUEST['birth_date'])) {
   $post_data['birth_date'] = $_REQUEST['birth_date'];
} else { $error_message .= "\n Please fill birth date";
   $validation = FALSE;       }
if (isset($_REQUEST['occupation'])) {
   $post_data['occupation'] = $_REQUEST['occupation'];
} else {
   $error_message .= "\n Please fill occupation";
   $validation = FALSE;       }
if (isset($_REQUEST['street'])) {
   $post_data['street'] = $_REQUEST['street'];   } else {
   $error_message .= "\n Please fill street";
   $validation = FALSE;       }
if (isset($_REQUEST['ward'])) {
   $post_data['ward'] = $_REQUEST['ward'];       } else {
   $error_message .= "\n Please fill ward";
   $validation = FALSE;       }
if (isset($_REQUEST['district_id'])) {
   $post_data['district_id'] = $_REQUEST['district_id'];
} else {
   $error_message .= "\n Please fill district";
   $validation = FALSE;       }
if (isset($_REQUEST['region_id'])) {
   $post_data['region_id'] = $_REQUEST['region_id'];
} else {
   $error_message .= "\n Please fill region";
   $validation = FALSE;  }
if (isset($_REQUEST['treatment_status'])) {
   $post_data['treatment_status'] = $_REQUEST['treatment_status'];
} else {
   $error_message .= "\n Please fill treatment status";
   $validation = FALSE;       }
if (isset($_REQUEST['gender'])) {
   $post_data['gender'] = $_REQUEST['gender'];
} else {
   $error_message .= "\n Please fill gender";
   $validation = FALSE;       }
if (isset($_REQUEST['patient_summary'])) {
   $post_data['patient_summary'] = $_REQUEST['patient_summary'];
} else {
   $error_message .= "\n Please fill patient summary";
   $validation = FALSE;       }
if (isset($_REQUEST['drug_used'])) {
   $post_data['drug_used'] = explode('[]', $_REQUEST['drug_used']);
   //print_r($post_data['drug_used']);       } else {
   $error_message .= "\n Please fill addicts status ";
   $validation = FALSE;       }
```

```
        $this->load->model("users/mobile_model");
        $json = array();
        // $validation = TRUE;
        if ($validation == TRUE) {
            //$this->mobile_model->register_rehab($post_data) ;
            $t = $this->mobile_model->register_addicts($post_data);
            if ($t == "TRUE") {                $json['success'] = 1;
                $json['message'] = "Information Successiful submitted";
            } else {  $json['success'] = 0;
                $json['message'] = $t;  }   } else {
            $json['success'] = 0;
            $json['message'] = "Please fill the following information  \n" . $error_message;
        }        echo json_encode($json);
    }   function login() {
        $json = array();
        if (!isset($_REQUEST['username'])) {
            $json['success'] = 0;
            $json['message'] = "Username can not be blank";
        } elseif (!isset($_REQUEST['password'])) {
            $json['success'] = 0;
            $json['message'] = "Password can not be blank";        } else {
            $username = strtoupper(str_replace(" ", "", $this->input->post_get('username',
TRUE)));
            $password = sha1($this->input->post_get('password', TRUE));
            $users_list_query = $this->mobile_model->get_users($filter_data = array('username'
=> $username, 'password' => $password));
            if ($users_list_query->num_rows() > 0) {
                //$users_rehab_query = $this->mobile_model->get_user_rehab($filter_data =
array('username' => $username));
                $json['success'] = 1;
                $json['message'] = "Login Successiful";
                $users_list = $users_list_query->result_array();
                $json['username'] = $users_list[0]["username"];
                $json['rehab_status_id'] = $users_list[0]["rehab_status_id"];
                $json['privilege_id'] = $users_list[0]["privilege_id"];
                $json['rehab_registration_number'] = $users_list[0]["rehab_registration_number"];
                $json["users_list"] = array();
                foreach ($users_list as $row) {
                    $json["users_list"][] = $row;}
            } else {$json['success'] = 0; $json['message'] = "Wrong Username or Password ";
                //"0789553355 4=49x12 2=25x18 8=8x12=";
            }echo json_encode($json);}    }
```

Appendix 8: R codes for bar chat

```
R version 3.4.3 (2017-11-30) -- "Kite-Eating Tree"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Workspace loaded from ~/.RData]

> Data <- read.csv("C:/Users/JOY-PC/Desktop/Data.xlsx", sep="")

>   View(Data)

> atab1 <- table(Data$regions,awareness)

> barplot(atab1,main = 'Awareness on drug abuse information',xlab = 'Regio
ns',ylab = 'Counts(%)',legend=T,col = c("green","dark blue"),beside = TRUE
)

> atab2 <- table(Data$regions,awareness)

> barplot(atab2,main = 'Treatment Location',xlab = 'Regions',ylab = 'Count
s(%)',legend=T,col = c("blue","orange"),beside = TRUE)
```

RESEARCH OUTPUTS

Journal of Information Systems Engineering & Management, 2018, 3(4), 31
ISSN: 2468-4376

Evidence based Practices for Drug Abuse Information Management and Awareness Approaches

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Citation: Mnunguli, J. P. and Kisangiri, M. (2018). Evidence based Practices for Drug Abuse Information Management and Awareness Approaches. *Journal of Information Systems Engineering & Management*, 3(4), 31. https://doi.org/10.20897/jisem/3942

Published: November 10, 2018

ABSTRACT

The harmful use of illicit drugs "Drug abuse" is the most frequent problem in the world. Khat, heroin, cocaine, cigarette and cannabis have been the most common used drugs in African countries, for instance Tanzania. Youth have been identified as the most vulnerable group and highly affected. Drug abuse results into economic, social and health effects including; mental retardation, lung diseases, heart diseases and Human Immunodeficiency Virus (HIV), disorders in adolescence, young adults and the general public. Several awareness and initiatives program were done by the government and private sectors in bringing awareness on the effects of drug abuse through community and school based education, distribution of brochures as well as media. However, in Tanzania, management of addict's data, statistics about addicts, storage and accessibility of drug abuse information are conducted on paper based approaches resulting into several problems such as damage of data and loss of information, time consumption in data collection, delay in reporting, and difficulties in reaching the large number of people during awareness programs. This paper presents the evidence of practices, awareness and information management on drug abuse, case of Dar es Salaam and Arusha major cities in Tanzania, with web and mobile application designed solution for drug abuse data management and awareness creation.

Keywords: drug abuse, awareness, addict data collection, addict information management, drug addiction

INTRODUCTION

The United Nations Office of Drug and Crime (UNODC) recognizes drug abuse as a frequent problem in the world and works on assisting members of states in the struggle against illicit drugs (UNODC, 2014). The increase in the number of people who misuse drugs reduces the manpower of the country. Drug abuse refers to the consumption or misuse of illegal drugs (Johnson et al., 2007). Other studies describe drug abuse as the desire to use or increase the amount of substance (Needle et al., 2006). Causes of drug misuse include; peer pressure, depression, low self-esteem, easy accessibility and availability of illegal drugs. The use of illegal drugs results in several effects including health, social and economic impact (Singer, 2008). Health impact include; mental retardation, lung diseases, heart diseases and HIV.

In addition, the use of illegal drugs results in disorders in adolescence, young adults and the general public (Balsa et al., 2010). It is estimated that over 29 million people who use illegal drugs suffer from drug use disorders, while injection being the popular method used, the statistics show about 14 million of people are injecting drugs (UNODC, 2016). Thus, the risk of HIV infection increases because of sharing of needles and syringe during the

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injections. It is estimated that one in eight people who were injecting drugs in 2015 were HIV victims which equates to 1.55 million of people who inject drugs living with HIV worldwide (UNODC, 2017).

Similarly, in Africa, there is an increase of illegal drugs usage from the traditional use of cannabis to other dangerous illegal drugs (Affinnih, 2002). The study shows that over 28 million people in Africa are using illegal drugs, this is due to the easy availability of illegal drugs and drug trafficking activities (UNODC, 2016). Common illegal drugs used in Africa include; khat, heroin, cocaine and cannabis. However, cannabis is mostly used (UNODC, 2013). Youth have been identified as a vulnerable group of people who are engaging in drug abuse issues (UNODC, 2013). Nevertheless, there are few suggested ways to help prevention of drug abuse activities, including; provision of education to the youth and community, and the provision of consultation and treatment to addicts instead of detaining them (Miller et al., 2008).

Tanzania as one of the country found in Eastern African, the number of youth affected due to the use of illegal drugs is higher. Despite, the fact that, youth are the most highly considered as the manpower of the nation, but is the most vulnerable group in engaging with drug abuse (Masibo et al., 2013). Drugs like cannabis, heroin, cocaine, khat, alcohol, and cigarette are most frequently drugs used by 5-12% of youth at the young age (Yusuph et al., 2016). The drug control commission (DCC) report of 2012 says that in Tanzania the number of addict ranges between 150,000 and 500,000 where 96% were youth (DCC, 2012).

Apart from the government efforts in blocking the penetrations and distribution of illegal drugs within a country, still most of the drugs used are imported from Iran, India, Bolivia and Peru thus increasing the availability and accessibility of drugs within the community (DCC, 2013). On the other hand, cannabis is mostly cultivated in several regions of Tanzania such as; Arusha, Tanga, Mara and Kilimanjaro and some farmers have been claiming to use cannabis as traditional vegetables and eye medicine (DCC, 2013). However, the government has been destroying the cultivation since it highly contributes to the local business of illegal drugs and increases the usage.

Consequently, there are several strategies and initiatives done by government and private sectors in the creation of drug abuse awareness to the community through community based education programs conducted to a certain group of people, educational programs at different levels; primary, secondary and university with the goal of reducing the impact on misuse of drugs and excessive use of alcohol (Johnson et al., 2007). These kinds of education are insisted to be conducted continuously in order to increase awareness within the community.

The information and statistics about addicts, usage and accessibility of drugs, effects and preventions means such as education are vital to the government and private institutions in reducing the risk and rescuing the drug abuse effects. Currently, the information is being managed in a paper-based form whereby treatment centers submit patient's details and monthly reports to Drug Control Commission (DCC) in paper-based then stored in flat files. Hence, the whole process of collecting data, storage, reporting and awareness programs are conducted manually thus contributes to several problems, such as consumption of time, loss of files, delay in national reporting, and sometimes difficulties in reaching many people during awareness programs.

Therefore, this paper presents the evidence of practices, awareness and information management on drug abuse which is the results of data collection and analysis conducted in Dar es Salaam and Arusha, Tanzania. In addition, this paper provides a technological designed solution based on a web and mobile application purposely for providing awareness to the general public, data collection, storage and information reporting on drug abuse.

RELATED WORK

Presently, the use of Information and Communication Technology (ICT) has increased in solving real-life problem scenarios. Drug abuse is one of it, several efforts have been invested regarding awareness on drug abuse issues and how drug abuse information can be managed.

Gustafson et al. (2011) described the development of Alcohol Comprehensive Health Enhancement System Support (ACHESS) application, which provides interaction between addicts and practitioners. It is an embedded application in the smartphone devices. It has both static contents and interactive features. It provides a platform where patients interact, share their stories and have discussion (Gustafson et al., 2014). This application was intended for the people who are addicted. One among weaknesses of this application is that it has a bias as it used by the addicts only and not benefiting the community and government agencies.

Also, Marsch et al. (2014) developed a computerized based education system called the Therapeutic Education System (TES) that provides education on drug abuse issues. It has a self-training module whereby an individual has to listen audios and do some homework provided by the system, the other part on this application is for alcohol and drugs awareness which provides opportunities for people to learn about drug abuse issues, it also provides different courses on drug abuse issues (Marsch et al., 2014). Users need to register to a specific course then start training. It was intended to the addicts and not otherwise.

Furthermore, Substance Abuse and Mental Health Services Administration agency (SAMHSA) in the United States introduces Drug and Alcohol Services Information System (DASIS) which act as the source of drug and

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alcohol service information. It comprises of three datasets which include the inventory of Substance Abuse Treatment Services (I-SATS), the National Survey of Substance Abuse Treatment Services (N-SSATS) and the Treatment Episode Data Set (TEDS) (SAMHSA, 2008). I-BHS is responsible for listing all organized substance abuse and mental health treatment facilities, TEDS collect demographic treatment information of the patients and N-SSATS is responsible for doing the census on all facilities listed in I-BHS (SAMHSA, 2014). DASIS with its three data sets provides information on the mental health data and drug abuse. The system focus on providing survey information on drug abuse, treatment services programs and drug history information on people who are in treatment. It does not provide information awareness on the effects and prevention of drug abuse, no any interactivity among users and does not show treatment location to let people aware of where consultation and treatment services are provided.

Therefore, the study proposes development of the web and mobile based application for drug abuse information awareness, where mobile application will be used for data collection from rehab centers and a web application will provide interface for users to access information about the trends on the usage of illegal drugs, statistical reports on number of people receiving treatments, location of treatment centers as well as awareness program. In addition, a forum for users discussion on drug abuse issues.

METHODOLOGY

Description of Study Area

The cases for this study were Dar es Salaam and Arusha. Dar es Salaam is the largest and economic city in Tanzania. It is located in coastal Indian Ocean. The area of Dar es Salaam is 1,393 km² (538 sq mi). According to Tanzania Bureau of Statistics (NBS) Dar es Salaam population is approximately 4.3 Million (NBS, 2017), it is formed by five districts; Kinondoni, Ilala, Kigamboni, Ubungo and Temeke. In addition, it comprises with the social, economic and industrial activities. Arusha is the city in northern eastern Tanzania with approximate population of 1.6 million (NBS, 2017). The area of Arusha region is 34,526 km². It is located near the greatest national parks and game reserve in Africa, including; Kilimanjaro national park, Serengeti National Park, Ngorongoro Conservation Area, Lake Manyara National Park and Arusha National Park. Moreover, tourism activities are the major economic activities found in Arusha. Arusha is also, known as one among regions which cultivate cannabis (Yusuph et al., 2016). Despite the initiative on prevention of drug abuse in Tanzania but these two regions still have a high number of youth who are engaged in drug abuse activities (DCC, 2013).

Sample Size and Sampling Technique

The study involved a total of 252 residents in both regions whereas, 150 respondents were selected in five districts (Kinondoni, Ilala, Kigamboni, Ubungo and Temeke) within Dar es Salaam and 102 respondents in three districts (Monduli, Meru and Longido) in Arusha. Other stakeholder's institutions who were involved in the study include; Drug Control Commission (DCC), eight rehab centers located in Kigamboni, Pugu, Temeke, Mbezi, Kimara and Njiro, psychiatric from methadone clinic (Muhimbili Hospital and Temeke Hospital) and five NGO's. The NGO's include; Tanzania Network for People who use Drugs (TANPUD), peer group, Methadone Family against Drug Abuse (MEFADA), Youth Volunteers against Risk Behavior (YOVARIBE) and Women and Child vision (WOCHIVI). Simple random sampling technique was used to get the representative sample of the community. This technique was used to give all respondents equal chance to participate in the study, since the respondents had homogenous behaviors.

Data Collection Methods

During the study, data were collected in the period of two months, January to February in 2018. The study used questionnaires, interviews and observation as tools for data collection. Questionnaires were distributed to the youth of age between 18-40 years to gather general knowledge on drug abuse information and programs. Interviews and observations were conducted to the government and private institutions which were dealing with prevention of drug abuse, controlling and treatment of addicts in Tanzania. The institutions include; Drug Control Commission, eight rehab centers, five NGO's and two methadone clinic from Muhimbili and Temeke hospitals. The main objective was to understand how the current activities in dealing with controlling and prevention of drugs were being done especially awareness program to the community, how addict's data collected, stored and reported within the rehabs, methadone clinic (hospitals) and DCC.

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Data Analysis Methods

Both qualitative and quantitative data were obtained during the study through the interviews, questionnaires, and observations. Data were analyzed by using a descriptive method in R software and google sheet which provides management capabilities and administrative tool for high performance and data analytics.

RESULTS AND DISCUSSION

General Awareness of the Drug Abuse Information

The study sought to find out the certainty of general awareness on drug abuse information, it was found that about 74% of respondents in Dar es Salaam did not have enough knowledge on drug abuse information while 26% had a knowledge on drug abuse information, similarly in Arusha 73% of respondents did not have enough knowledge of drug abuse information while 27% had enough information on drug abuse issues.

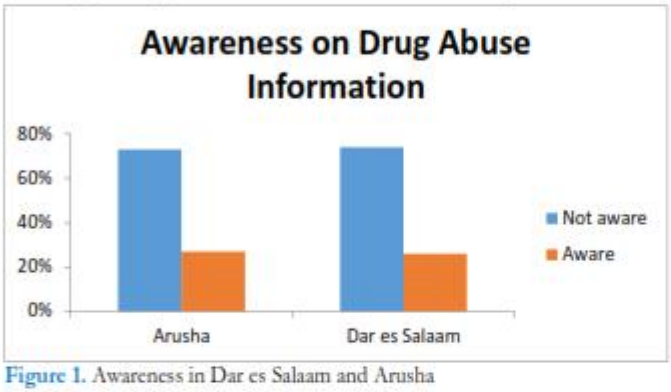

Figure 1. Awareness in Dar es Salaam and Arusha

Awareness on the Treatment Location

To know the location for consultation and treatment services is vital in increasing the awareness of addicts treatment center within a society. During the study it was found that in Dar es salaam 78% of the respondents were not aware of the treatment location, and only 22% knows where to get treatment and consultation on drug abuse issues, whereas in Arusha 79% of respondents did not know where to get consultation service or treatment for addicts while 21% knows where to get treatment services.

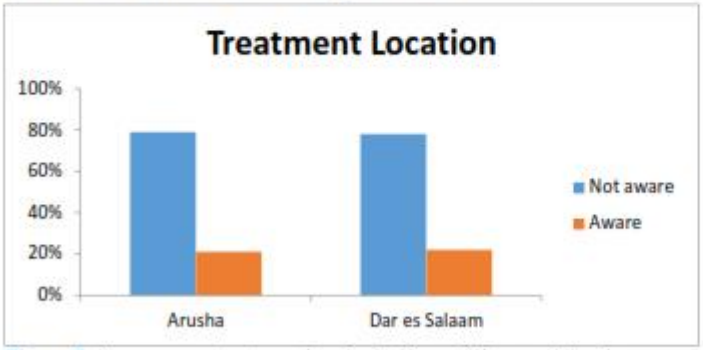

Figure 2. Awareness on treatment location in Dar es Salaam and Arusha

Availability of Drug Abuse

Availability of illegal drugs is also a factor that contributes to the increase of the usage of illegal drugs in the community. The research revealed that the availability of illegal drugs influence more people to engage themselves in drug abuse activities such as trafficking and other small business conducted locally within the community thus brings more people to use drugs. Generally, 48% of respondents agreed that there is easy accessibility of illegal drugs, 28% respond on fairly easy accessibility and availability, while 15% respond on fairly difficult and 9%

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respond on difficult. The higher percentage shows that there is the easy availability of illegal drugs among the community and this influence youth to engage in drug abuse activities.

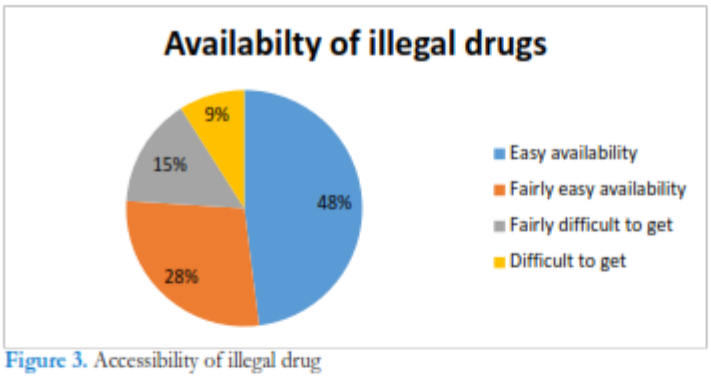

Figure 3. Accessibility of illegal drug

Sources of Information on Drug Abuse

The community uses media, friends and school program to get information. Media was the most popular source of information with 45% of usage compared to the school's program which were 24% and friends 32%. Nevertheless, the study found that despite the availability of sources of information in the community, drug abuse information was rarely provided through the media, which was the most frequently used as the source of information access.

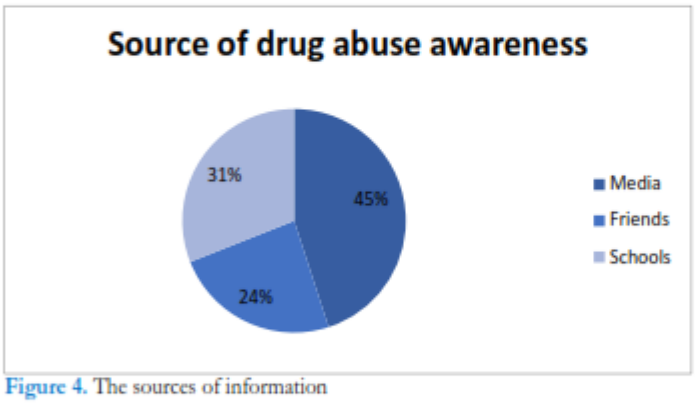

Figure 4. The sources of information

Overview of the Existing System

Interviews and observations were also conducted by the study and helped in examining how drug abuse activities were conducted within DCC, NGO's, rehab centers and methadone clinic. Currently, NGO's provide awareness manually by going into different places such as schools, neighborhood while distributing awareness materials in form of brochures, they also conduct training programs and advertisement which were conducted via radio and television.

However, the study found that awareness programs in schools and places where addicts found were conducted only once per week due to the lack of resources, apart from that they were also obligated to take addict to the methadone clinic and rehab centers for treatment and consultation services. Also, it was observed that larger group of people were gradually felling into drug addiction due to the lack of awareness and prevention programs, most of NGO's focus their effort in taking addicts to the therapy while leaving a large group of people behind without awareness. These were due to the little involvement of ICT tools in their operations.

The study revealed that data collection from several rehab centers were conducted in paper-based whereby treatment centers record details of patients (addicts) on papers and submit to the Drug Control Commission (DCC) office monthly and so it was hard to get accurate information of patients found in treatment centers. The study found that 52% of addict's data submitted by rehab centers were inaccurate, while 48% were the accurate data. As was the fact, sometimes led DCC personnel to work around the centers to collect the required information for

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national reporting. However, the DCC itself kept the collected information on flat files which resulted in damage or loss of information and delay in generating general drug abuse report. For instance, the number of damaged files in 2017 was estimated to be 14 (40%) out of 36 paper files (monthly reports) collected from 8 treatment center, this is due to misallocation of files. On the other hand, it was discovered that 80% of the addicts treated at the rehab center were engaged in drug abuse before without knowing the side effects of using illegal drugs. All respondents from different rehabs acknowledge that drug abuse is still a big challenge in the country and there was lack of awareness on the drug abuse issues. Furthermore, the study also observed that 96% of rehab activities were conducted in paper based as they had no any ICT tool such as a database for data storage and manipulations of data hence data were lost due to unavoidable circumstances.

Therefore, the study has proved the need for ICT tool to support data collection, storage and provide awareness on the effects and prevention of drug abuse. This will enable scholars, professionals, policy-makers and other stakeholders to get more information on drug abuse issues including trends of the usage of illegal drugs and statistics on the number of patients who are on treatment.

DESIGNED SOLUTION

Based on the study findings, several problems on drug abuse information awareness and addict's data collection were identified, for instance; loss and damage of data, consumption of time during addict data collection, delay in reporting, and sometimes difficulties in reaching large number of people during awareness programs. Therefore in solving the mentioned problems the study proposes an integrated web and mobile based application for drug abuse information awareness.

The mobile application side will be used as data entry tool for daily data collection and reporting of patient details from the rehab centers and methadone clinic and submits to the central database. This tool will provide an easiest way of collecting information and providing the statistics on the most illegal drugs used and the number of patients on treatment. On the other hand a web application with an interface allowing information access to all users including; the drug control commission, rehab centers, NGO's, and researchers. Moreover the solution will allow user participation through push message technique where short stories or testimonies and awareness messages on the drug addiction will be disseminated. Also through asking question and responses. In addition, the designed solution will provide the easiest way in locating nearby treatment or consultation center.

The proposed study designed solution architecture will be potentially contribute in drug abuse data management and awareness creation to the general public of Tanzania and world at large.

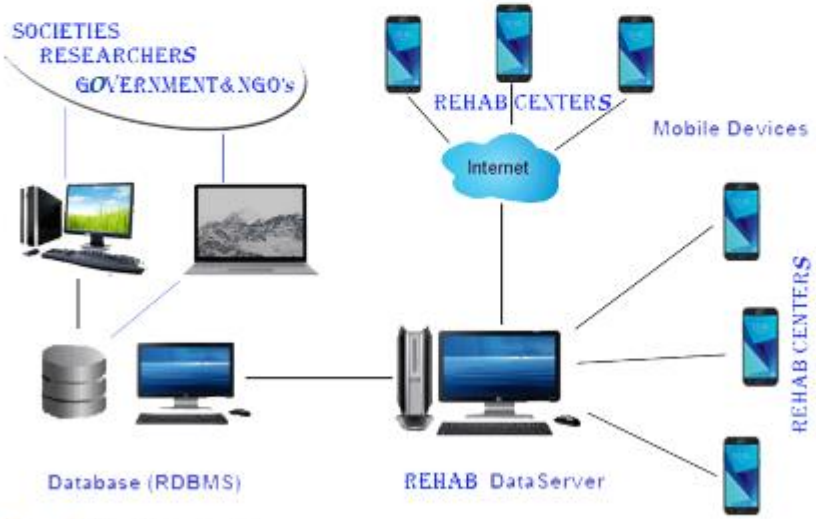

Figure 5. The designed solution

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CONCLUSION

The paper has presented the overview of the existing challenges on drug abuse sector and the analysis to show the extent of the problems on drug abuse such as awareness issues, treatment center location, data collection and storage problems in Tanzania. The study shows that there is inadequate drug abuse information within the community. Most of the people do not have enough knowledge on drug abuse issues (location of treatment center, effects and prevention of drug abuse), on the other hand collection and storage of patients data are being done in paper based which results into the loss of information and the delay on providing national reports. The presence of ICT tool plays a big role in reducing the challenges such as reducing the number of people who are using drugs, relapse prevention, reaching limited people who cannot participate in service, helping people remotely and providing drug abuse information to the public such as researchers, policy-makers and the government. Furthermore this paper presented a brief description on the design of web and mobile application as proposed ICT solution for optimizing the operations of drug abuse issues.

Future work will involve full design and development of the integrated solution of mobile application for data collection and a web application for drug abuse information awareness. Geographical mapping of treatment centers will be done in identifying centers which provides treatment and consultation on drug abuse issues. This will involve the use of several tools and software, which include android studio, JavaScript, XML, Hyper Text Markup Language (HTML), Hypertext Preprocessor (PHP), JAVA, MySQL and Dreamweaver.

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A MOBILE AND WEB APPLICATION FOR DRUG ABUSE INFORMATION AWARENESS

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ABSTRACT

Drug abuse information awareness and management is still a challenge in many developing countries including Tanzania where there is no ICT tool for managing drug abuse information. Addict's information are being kept in a paper then stored in flat files. In addition, the whole process of data collection and reporting are being done in paper-based which contributes to several problems including; delay in national reporting, time consumption, loss of data and difficulties in reaching a large number of people during awareness program. This paper presents a web and mobile based applications for drug abuse information management and awareness creation. This is to improve storage of data for drug abuse and addicted persons, easy accessibility of drug abuse information, also, obtaining statistical data on drug usage and addicts on treatment as well as ease data collection activities. The viability of the developed solution enhance management of drug abuse information and provide awareness to the community, scholars and policy-makers. A case study of Dar es Salaam and Arusha major cities in Tanzania with high population and a large number of youth who are engaged in drug abuse activities.

Keywords: Drug abuse, e-Health, mobile application, drug abuse information.

INTRODUCTION

Drug abuse refers to the use of drugs without doctor's prescription or consumption of a substance that harm human body (Reynolds *et al*., 2006). This study defines drug abuse as the excessive use of drugs which is either cultivated or imported in the country for the specific use but instead cause harm to human body.

Presently, in the world communities and societies, there is an increase of a number of people who are using drugs whereas peer pressure, stress or depression and availability of illegal drugs within the community has been identified as the main causes (Singer, 2008). For instance, in Tanzania, the impact of drug abuse is said to be extreme to both youth and adult. The common illegal drugs which are being consumed in Tanzania include; cannabis which has been identified as the most used illegal drugs compared to other illegal drugs also, heroin, cocaine, tobacco and khat (Yusuph *et al*., 2016). The use of illegal drugs not only affects society's social-economy activities but also become the source of many health problems such as mental retardation, heart disease, lung disease, hepatitis and HIV/AIDS (Njeri *et al*., 2014).

Information communication technologies (ICT) offers a way through into sectors in managing different operations including the health sector (Patrick *et al*., 2008). ICT in the health sector plays a major role in improving hospital business processes such as providing assistance to practitioners when attending patients, data collection and storage (Gustafson *et al*., 2011). Therefore, mobile and web technology plays a big role in the success of health activities through information gathering and disseminating to the public, for instances, consultation services and knowledge (Qiang *et al*., 2011). Thus, easy accessibility of information required by the community, policy makers and scholars.

Looking at the developed countries ICT tools have highly put into practice for controlling drug abuse effects. For example, tools such as ACHESS used for addict treatment (Gustafson *et al*., 2014), also, DASIS used to collect and store addict information's as well as Therapeutic Education System (TES) which used to provide education to the community regarding effects and prevention of drug abuse (Marsch *et al*., 2014). TES comprises of both audios and videos whereby people can learn by listening and watching videos. These ICT tools have been significant in providing awareness and storing addict information.

Currently, in Tanzania drug abuse operational activities are managed manually, inadequate and insufficient ICT tools resulting in the number of practitioners from one center to another to collect available addicts in a paper. Treatment center stores addict information on paper (counter book) thus produce and submit paper-based reports to drug control commission (DCC). In addition, awareness programs are also done manually within the community thus leaving a large group of people without knowledge on drug abuse issues. Subsequently, contributes to the delay in providing national reports, consumption of time in data collection,

difficulties in reaching a large number of people during awareness programs, and loss of information

Therefore, this paper presents development of web and mobile application for drug abuse information awareness. A mobile application that enables addict data collection, as the treatment center will use it to feed addict information and provide reports through a mobile application. Information from the mobile application will be synchronized to the web application. On the other hand web application will provide interface for drug abuse awareness, statistics and report retrieval from different treatment centers. The viability of the developed applications is to reduce the number of people engaged in drugs without knowledge, assist in addict data collection, treatment center reporting, storing addict information and improving awareness programs to reach a large number of people.

MATERIAL AND METHODS

Requirements analysis

Both functional and non-functional requirements of the developed system were identified. Functional requirements includes; push awareness message to the community, treatment center registration, user approval, user authentication, report generation from different treatment center and automatic statistic generation (statistics on the usage of illegal drugs and number of addicts on treatment). While the non-functional requirements were maintainability, security, reliability, performance and effectiveness.

Designed solution

The design of the developed applications has presented with the use case diagram. A use case diagram presents the functional requirements of the developed applications. It has three actors; administrator, normal user and treatment center. Administrator is responsible for managing the overall application including; approve user, add contents, generate report and update user details. Treatment center are required to register then admit addicts and update addicts detail through mobile application. Other actors are the normal users include; researchers, government policy makers, NGO's and the community who access awareness information (effects and prevention of drug abuse, treatment center location, list of treatment center, statistics on the used illegal drugs and the number of addicts on the treatment.

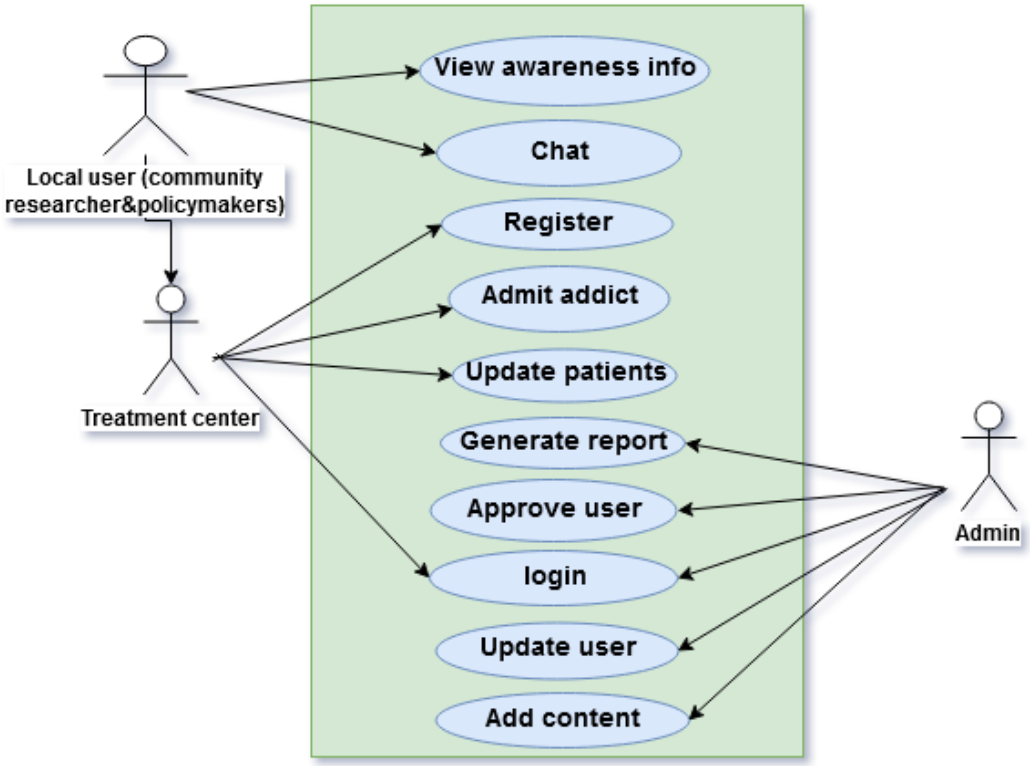

Figure1. Use case diagram

Developed mobile and web application

Mobile application: Development of the mobile application involved the use of Android studio, JAVA and XML. Android studio as an open source tool which contains built in libraries that easy development process. XML was used to design user interface of application while JAVA used for building functionalities of the application. Mobile application (*Waraibu Data App*) developed specifically for addict data collection from treatment centers. Treatment center perform registration then get approved by administrator, thereafter login to the mobile application and feed addict information.

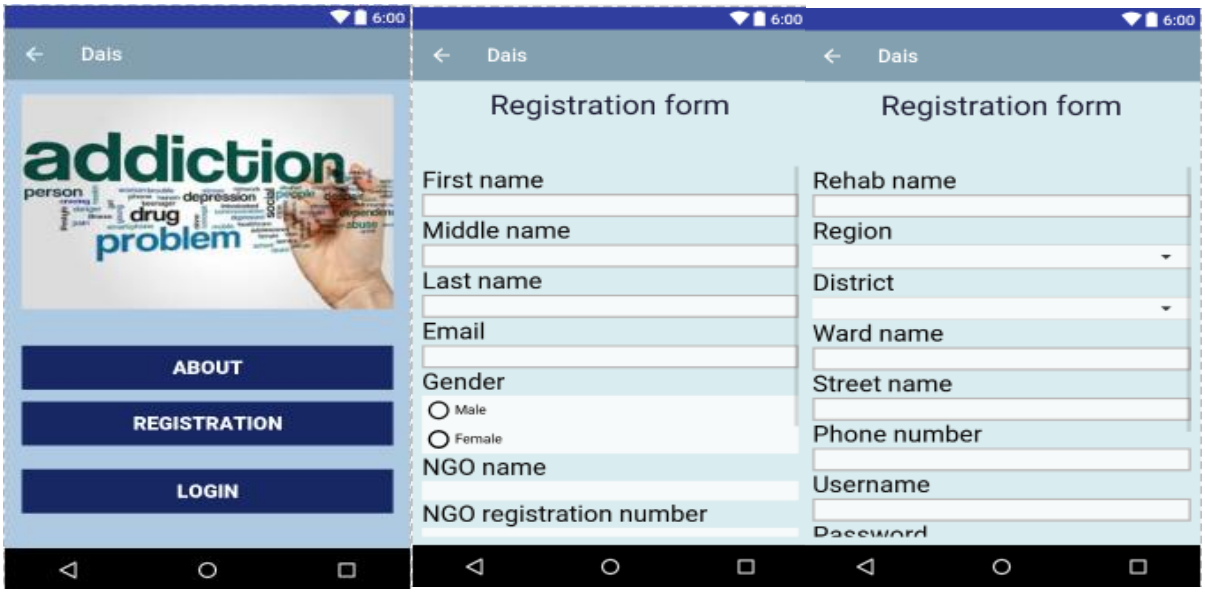

Figure2. Home and registration pages

Login and admission page

After registration, administrator approves the user, then notification sent to the user for confirmation of registration. Thereafter, user login then select admission form to admit patients. The below screenshots presents the interface for login dashboard and admission. The admission form gives the user fields to feed addicts particulars including; first name, middle name, last name, phone number, emergence contact, districts, region, type of used drugs. The provided addict's data help to update the graphs for statistics on the usage of drugs and number of addicts on treatment.

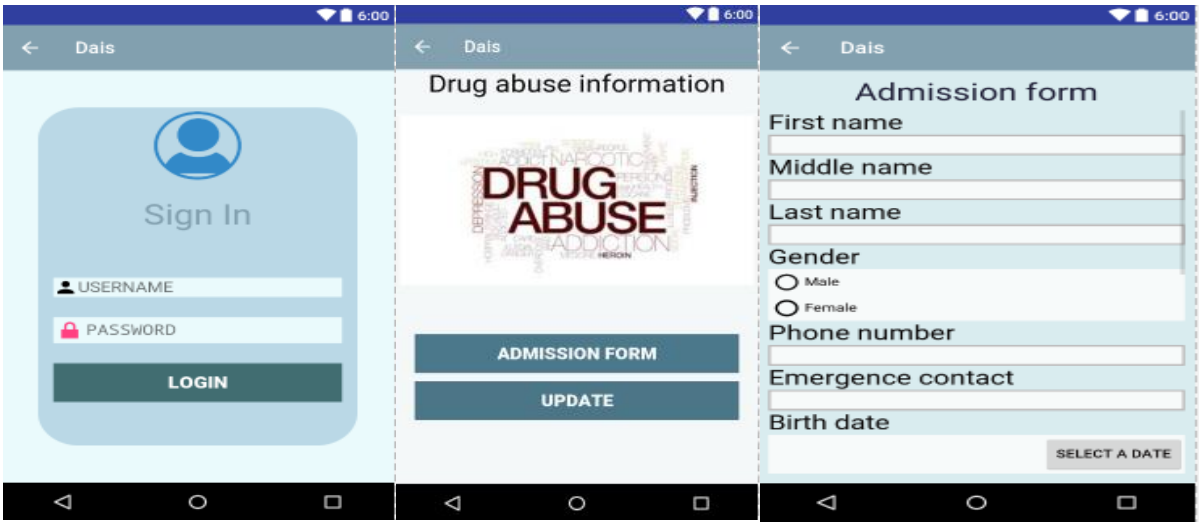

Figure 3. Login and Dashboard and Admission page

Web application: This was developed by using programming languages such as PHP, HTML, JAVASCRIPT and MySQL as a database management. The developed web application called Drug Abuse Information System (DAIS) had several functionalities to enhance storage, reporting and interface for awareness on the drug abuse information including; effects and prevention of drug abuse, location of treatment centers and statistics on the usage of illegal drugs and number of addicts on the treatment. The DAIS starts from the login page which allowed administrator or manager to manage, add/update contents.

i. Community awareness information

DAIS consisted of the pages that provides awareness information about the drug abuse into the community (researchers, society and policy-makers). Figure 15 shows the pages that provide awareness. The menu included the information such as; drug abuse general information (facts on drug abuse, reasons for drug abuse symptoms for drug addiction), effects, prevention and treatment. Also, the system has made the availability of the information like testimonies to encourage youth not to engage on drug abuse, statistics (usage of illegal drugs and number of addicts on treatment) presented in graphs. Additionally, DAIS consisted of the geographical map for locating treatment centers including hospitals and rehab centers. The forum menu in DAIS allowed the community to interact with the web application. The figure below show the main page of DAIS.

Figure 5. Awareness page with links

ii. Data and statistics page

Figure 16 presents the number and statistics for the addicts on treatment and the usage of drugs found on the system. Data were synchronized form the mobile to the web (DAIS) application then presented in graphs. The system enabled automatic update of the data for instance when treatment center admit new patient (addict) the graphs update automatic. Thus gives researchers, policy-makers and decision maker's opportunity to get information and use them accordingly.

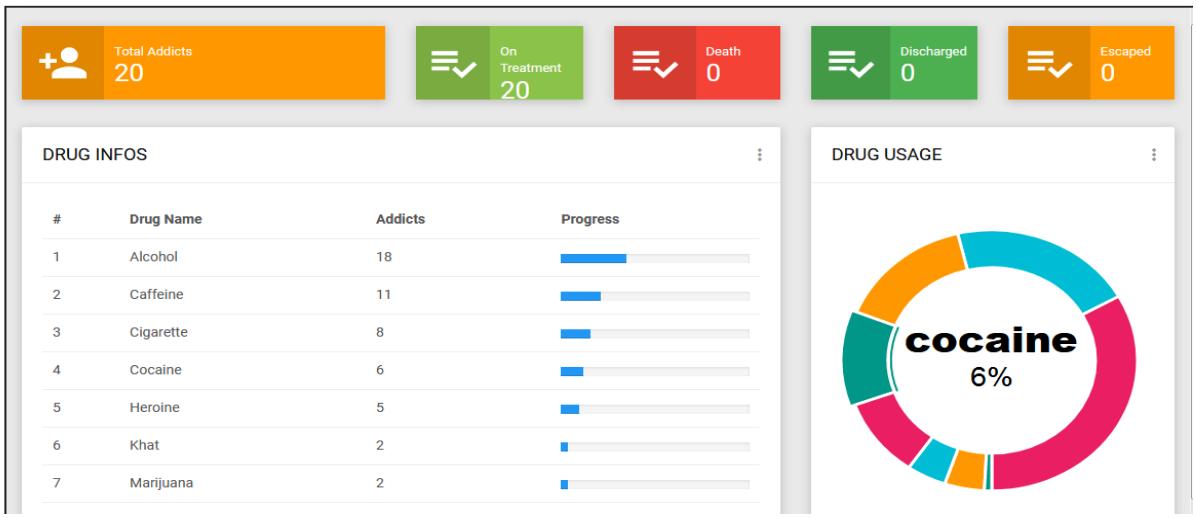

Figure 6. Drug abuse statistics

iii. Manage rehab

The management of rehab centers consists of rehab centers registration particulars such as; Owner details (first name, middle name, last name), gender, email, NGO name, registration number, experience in drugs, rehab name, street, ward, district and region. When the rehab center personnel do registration through a mobile application, the information are being sent to the central database and retrieved through the web application.

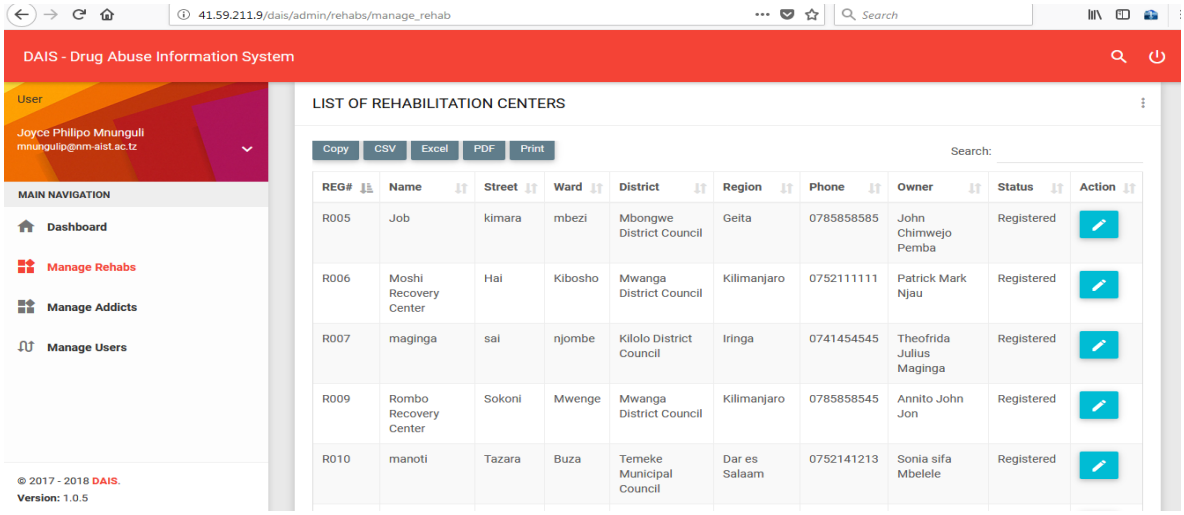

Figure 7. Manage rehab page

iv. Manage addicts

With manage addicts menu the information of addicts from all treatment centers are being retrieved. These information provided by treatment center through mobile application.

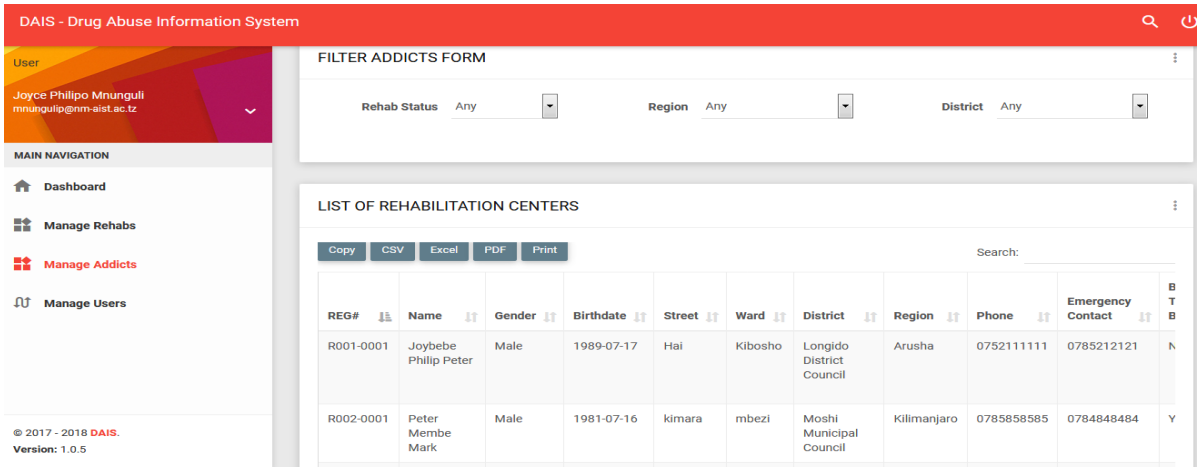

Figure 8. Manage addict's page

Moreover, the developed DAIS is capable of filtering reports according to the region, district and rehabs. The report can be retrieved in excel, CSV and PDF format. In addition, the DAIS allows copying and printing of the rehab and addicts information. The figure bellow shows how addict's information can be filtered.

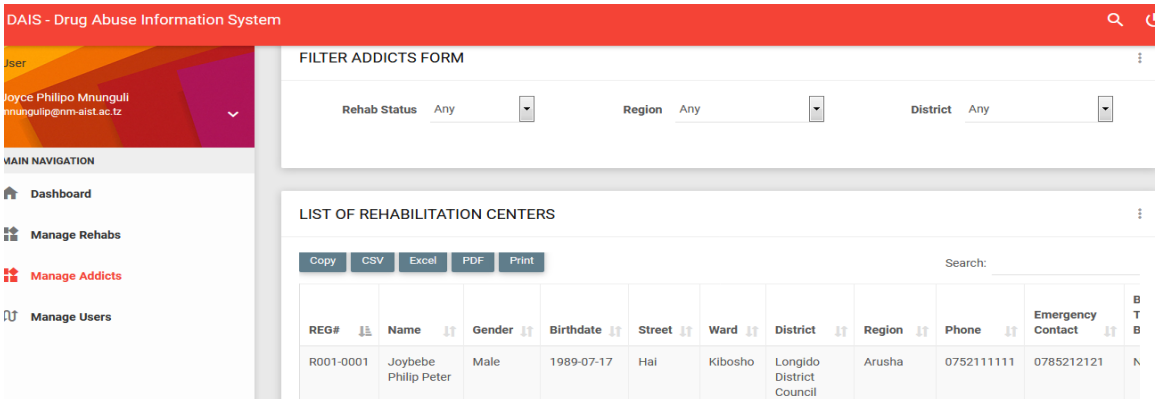

Figure 9. Report retrieval

CONCLUSION

In this paper we have presented the design and development of an integrated web and mobile application for the drug abuse information awareness. Both applications have been integrated to support drug abuse sector activities. The developed applications (DAIS and Waraibu data App) are significant for storage of addict information in order to prevent loss and damage of information which were kept in flat files, reduce time consumption in data collection and reporting. Furthermore, increases reliability of drug abuse information and statistics on drug abuse issues to the scholars, policy makers and the general community.

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POSTER PRESENTATION

Development of a Web and Mobile Based Application for Drug Abuse Information Awareness

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The nelson Mandela African Institution of Science and Technology

Introduction

The harmful use of illicit drugs, "Drug Abuse", is the most frequent problem in the world. The awareness creation of drug abuse information to the community reduces the usage of illegal drugs. The collection and management of addicts' data, statistics about addicts, storage and accessibility of drug abuse information are conducted on paper-based approaches. This results in several problems such as loss of data, time consumption in data collection and delay in reporting. This study aimed to improve accessibility of drug abuse information through development of mobile application for addicts' data collection and web application for accessibility of drug abuse information awareness and retrieval of treatment center reports.

Methods

❖Questionnaire were distributed to the youth of age between 18-40 years to gather general knowledge on drug abuse.

❖Interview and Observation was done to gather information on the weakness and strength of the existing system and the requirements needed for the development of the mobile and web application.

Conceptual design

Mobile Application

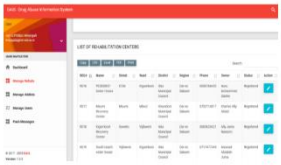
The mobile application is used for daily data collection and reporting of patients details from the treatment centers then submits to the central database.

Results (web application)

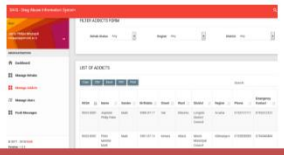
Web application provides an interface for awareness. The application supports storage, reporting and management of rehab and addicts' data.

Statistics on addicts data and the usage of illegal drugs

Treatment centers management



Addicts data management



Web interface for awareness

Conclusion

Drug abuse is still a challenge to several countries including Tanzania. The presence of ICT tool plays a big role in providing awareness on drug abuse information such as effects and prevention, geographical location of treatment centers. Also the ICT tools plays a big role in addicts data collection hence provides timely report and statistics on the number of addicts on treatment and the extent of the usage of illegal drugs.

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