![SDSI - Sustainable Drug Seller Initiatives]

SUSTAINABLE DRUG SELLER INITIATIVES (SDSI) PROJECT

UGANDA

THE USE OF MOBILE PHONE TECHNOLOGY TO IMPROVE ACCREDITED DRUG SELLER SERVICES

A consolidated report based on research, situational and options analyses, and stakeholder input

MARCH 2013

Prepared by Avytel Global Systems for the Sustainable Drug Seller Initiatives Program

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FOREWORD

The Sustainable Drug Seller Initiatives (SDSI) program continues Management Sciences for Health's efforts in Africa to involve private drug sellers in enhancing access to essential medicines. It builds on two previous MSH programs, which focused on creating and implementing public-private partnerships using government accreditation to increase access to quality pharmaceutical products and services in underserved areas of Tanzania and Uganda. SDSI's goals include ensuring the maintenance and sustainability of these public-private initiatives in Tanzania and Uganda, and introducing the initiative in Liberia.

In Uganda, SDSI objectives are to enhance the accredited drug shops' long-term sustainability, contributions to community-based access to medicines and care, and ability to adapt to changing health needs and health system context. In order to achieve these objectives, SDSI commissioned local organizations ("contractors") to assess various components of the Accredited Drug Shop (ADS) initiative and develop recommendations for improvements.

Annex 1 provides further information about each component and identifies the contractor and their objectives. Nine factors affecting ADS in Uganda were examined.
1) ADS Regulatory System
2) Supportive Supervision
3) ADS Seller Training
4) Mobile Technology
5) Geographic Information Systems
6) ADS Associations
7) ADS Supply Chain
8) Engaging ADS Consumers
9) Community-Based Health Initiatives

The Avytel Global Systems addressed the feasibility and utility of using mobile technology to improve ADS service and operations and undertook three primary activities and prepared a report on each, as follows:
- A situational analysis based on qualitative and quantitative data on the topic gathered through extensive interviews and use of questionnaires;
- Analysis of the options for future action;
- A workshop, followed by a larger meeting, with stakeholders so they could review and comment on the analyses and conclusions.

Avytel submitted its findings in three reports, one on each of the above. The reports were then compiled into this single report.

ACRONYMS AND ABBREVIATIONS

ACT   artemisinin combination therapy

ADS   Accredited Drug Shop

DADI   District Assistant Drug Inspector

DDI   District Drug Inspector

DHIS2   district health information system version 2

GIS   geographical information system

ICT   information and communication technology

MOH   Ministry of Health

MSH   Management Sciences for Health

NDA   National Drug Authority

PSU   Pharmaceutical Society of Uganda

RDT   Rapid Diagnostic Test (kits)

SDSI   Sustainable Drug Seller Initiative

SMS   short message services

SURE   Securing Ugandans' Right to Essential Medicines (Program)

USSD   unstructured supplementary service data

WHO   World Health Organization

1. EXECUTIVE SUMMARY

Uganda has a decentralized health care system with many responsibilities devolved to the district level. As identified in the situational analysis, district health officials have control of data sent to the national level, because they collect data from the local drug shops and pharmacies and then send it to the national level in form of reports. However most of this reporting is manual and information takes time to reach the central level due to transport costs.

Furthermore, in response to the survey, 42 percent of the drug shop respondents indicated that they report in person, introducing further delays in the reporting cycle. Of those interviewed, 51 percent indicated it took longer than one month to communicate with the National Drug Authority (NDA) or the District Drug Inspectors. This prevents evidence-based decision-making at the central level because the data is not sent in real time and may not be available by the time decisions are being made. By using mobile technology, this gap in communication will be reduced considerably.

The use of mobile phone technology to monitor stock levels in class C drug shops will also reduce discrepancies in the national drug supply chain because it will be possible to identify in real time those areas where there are stock-outs of certain drugs and where there is over-supply or under-consumption. The situational analysis also identified various mHealth projects already underway and at various stages of implementation.

A nearly identical project to the current initiatives by NDA/MSH to use mobile phone technology to address the drug supply chain was conducted through a collaboration between the Uganda Ministry of Health (MOH), FIND, the Earth Institute at Columbia University, and the World Health Organization (WHO) (1). The project's aim was to demonstrate feasibility (including cost, timeliness, and compliance) of a short message service–based (SMS-based) approach to support the management and rollout of RDTs by Uganda's National Malaria Control Program (1). The project demonstrated that SMS-based reporting of stock levels has the potential to greatly improve ACT stock management and local drug redistribution (1). If these learned best practices, albeit on a small scale, are transferred to the national drugs distribution network, there is evidence that health outcomes will improve significantly in Uganda.

The project demonstrated that SMS-based reporting of stock levels has potential to greatly improve artemisinin-based combination therapy (ACT) stock management and local drug redistribution. If these learned best practices albeit on small scale are transferred to the national drugs distribution network, then there is evidence that health outcomes will improve significantly in Uganda.

During the Options Analysis phase, details of the proposed system, the systems architecture and functionalities, and the entire conceptual model for the proposed mobile telephone solution were examined. The available mobile telephone technologies were also evaluated with recommendations giving priority to SMS and unstructured supplementary service data (USSD) technologies. Avytel concluded that the most feasible and recommended solution is the option of implementing a mobile phone–based system using available technologies such as SMS and interactive voice response to disseminate as well as collect information from the drug shops.

Use of the SMS and USSD technologies will allow for sustainability and acceptability of the system, unlike other available mobile phone–based technologies. The situational analysis identified that the majority of the handsets used by the drug shop owners and sellers had basic features and were not advanced. The users were also comfortable with the use of SMS, as opposed to other advanced mobile phone features.

Based on our assigned task of assessing and developing a strategy on the feasibility and utility of using mobile technology to strengthen the Accredited Drug Shop (ADS) services in the areas of product availability and quality, we recommend that the proposed mobile technology should, at a minimum:

1) Facilitate efficient drug seller **registration**;

2) Provide for **reporting systems** on such aspects as expired drugs, counterfeits, adverse events, management reports, and drug recall notifications;

3) Enable **strategic communication** by NDA to ADS operators on such issues as new drug guide lines;

4) Enable **mobile money transactions** and other business-to-business payments, receiving registration and accreditation of payers;

5) Provide **interactive voice response** to disseminate general information in addition to SMS, USSD and web-based information access.

6) Be **compliant with existing laws and regulations** in the communications sector

7) Contribute to the regular NDA **reporting to the MoH,** through the output of the mobile technology;

8) Be **scalable** to address the needs of all stakeholders: NDA, MSH/SDSI, MoH and its officials (DADIs), ADS owners and sellers, transporters, bankers, wholesalers, retailers.

2. BACKGROUND

2.1 MOBILE TECHNOLOGY AND ACCREDITED DRUG SHOPS IN UGANDA

In Uganda, availability and access to drugs is a problem in both the public and private sectors, especially in remote and underserved rural communities. In addition, the public cannot be assured of the quality of drugs in the Uganda market. The issues of access and quality are aggravated by a lack of communication, monitoring, supervision, and reporting tools within the health sector, which could be used to report and give feedback on the effect of accessible channels for drugs, The SDSI program builds on Management Sciences for Health (MSH) strategies for enhancing access to medicines and ensuring quality services from ADS providers.

The use of mobile and wireless technologies to support the achievement of health objectives (mHealth) has the potential to transform the face of health service delivery across the globe. A powerful combination of factors is driving this change. These include rapid advances in mobile technologies and applications, a rise in new opportunities for the integration of mHealth into existing eHealth services, and the continued growth in coverage of mobile cellular networks.

2.2 SURVEY TOOL FOR DEVELOPMENT OF A SITUATIONAL ANALYSIS

The primary objective of the Avytel Global Systems survey was to gather information to use to assess and develop a strategy on the feasibility and utility of using mobile technology to strengthen ADS services in areas of product availability and quality. We undertook the following:

- A needs assessment regarding the implementation of mobile-based technology to improve access to essential pharmaceutical products and services in remote areas.
- Identification of existing mHealth projects using mobile technology and assessment of the ADS reporting system.
- Analysis to understand ADS and Class C drug shop business operations and how mobile technology can be used to improve their operations.

We surveyed ADS owners and drug sellers to determine their practices and perceptions regarding use of mobile technology: questions covered their knowledge of how to use handsets functions, the availability of network providers with coverage, availability of phones desired for the service, and how they perceive that they might benefit from use of mobile technology in their work.

3. METHODOLOGY

3.1 SURVEY ADMINISTRATION

The survey tool was designed to collect data from drug sellers of class C drugs in five locations: Kamuli, Kyenjojo, Mityana, Kibaale, and Kamwenge. The tool included adaptations of some questions previously used in a similar survey in Tanzania as well as questions previously used in Uganda.

The study leader called the survey participants to a central location to take the survey. We used face-to-face Interviews to administer the questionnaire. Afterward, we visited the individual shops for observation and further confirmation of the data collected on the questionnaires.

Management officials at both local and national levels were also interviewed. Their inputs are also captured as part of this report.

3.2 DATA COLLECTION AND CHALLENGES

The survey was conducted across the four districts in one week, between Monday, September 3, and Monday, September 10, 2012. The challenges encountered during data collection included:

- The poor road network, which made visiting the areas time-consuming;
- The study team could not visit one of the study sites, Kibaale, due to Ebola

3.3 DATA MANAGEMENT AND PRESENTATION

A detailed data capture tool with specific sections for each category of respondents was used. A database in Access was constructed and used by all study experts at Avytel's offices to capture the data. The data were captured on each of the study expert's computer and then combined into one dataset in Microsoft Excel. This report presents the results using diagrams, tables, and figures, in addition to descriptive narrative.

4. FINDINGS

Survey respondents represented two groups: ADS owners and sellers, managers of public organizations, and managers of private organizations.

4.1 SURVEY RESPONSES FROM ADS OWNERS AND SELLERS

4.1.1 Social Demographic Characteristics

We visited a total number of 59 drug shops in four districts, as shown in table 1.

Table 1. Distribution of participants in the survey across four districts

Location	No. Visited
Kamuli	26
Kyenjojo	5
Kamwenge	9
Mityana	19
Total	59

The median age group of the survey population was between 20 and 30 years. The minimum age group was under 20 years, and the maximum age group was 51+ years, as shown in figure 1.
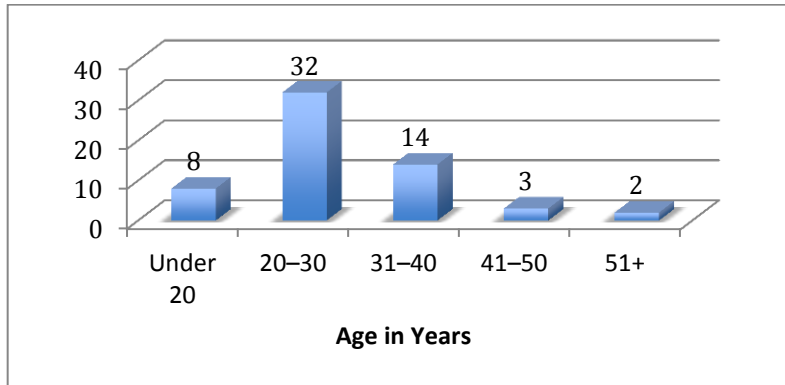
Figure 1. Distribution of study population, by age

In total there were 11 male and 48 female participants. They were distributed among the categories of owner, dispenser, and owner-dispenser, as shown in figure 2.
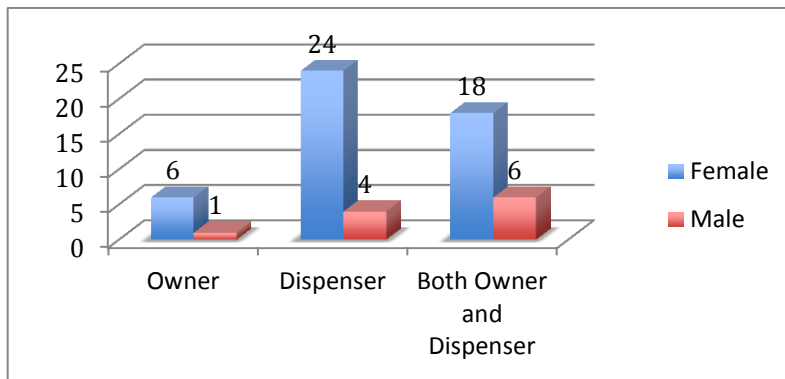
Figure 2. Distribution of survey participants by gender across ownership categories (N=59)

The level of education of the owners and sellers were assessed; the distribution across gender is represented in figure 3.
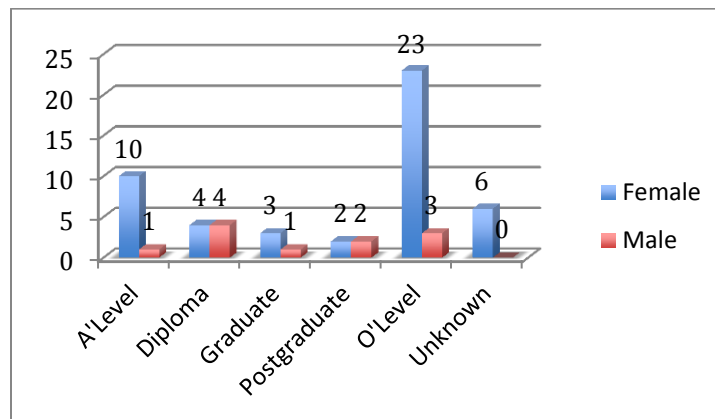
Figure 3: Levels of education of drug sellers and owners, by gender

4.1.2   Accreditation and Business Performance

As part of the survey's objective, we set out to find out the drug sellers and owners views on ADS initiatives and service delivery, regarding the level of assistance with the NDA, and the frequency of communication with the drug inspectors.

The drug sellers and owners were interviewed to gauge their opinions on the dependence of their sales and service delivery on ADS initiatives and innovations. Figure 4 summarizes the results.
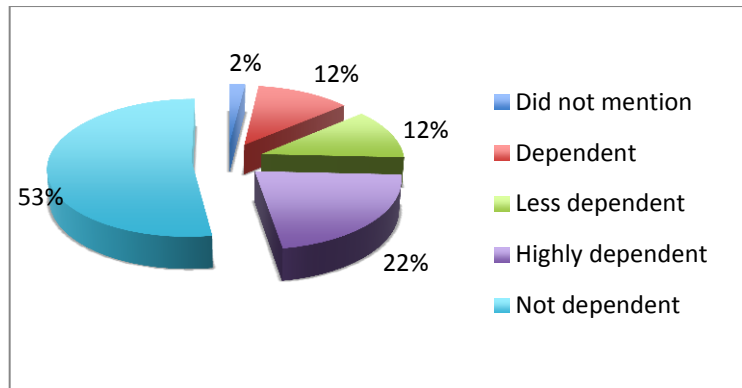
Figure 4: ADS owners' and sellers' perceptions of the dependence sales/service delivery on ADS initiatives

In addition, the drug sellers and owners were asked to rate the level of assistance they receive from NDA regarding the challenges they face. The findings are summarized in figure 5.
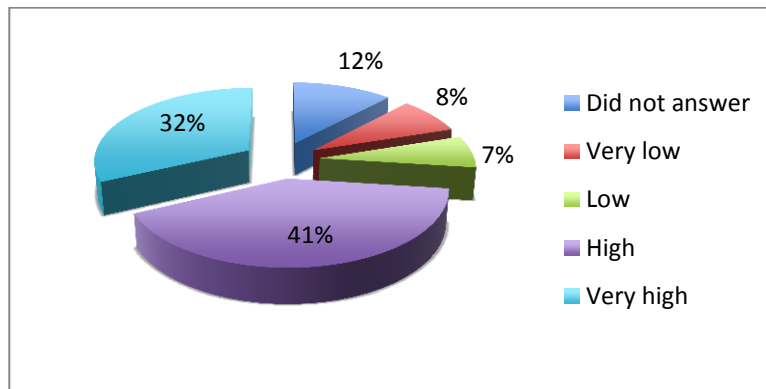
Figure 5. How sellers and owners rate the level of assistance received from NDA

We also set to find out frequency of communication between the sellers, owners, and NDA inspectors. The findings are shown in figure 6.
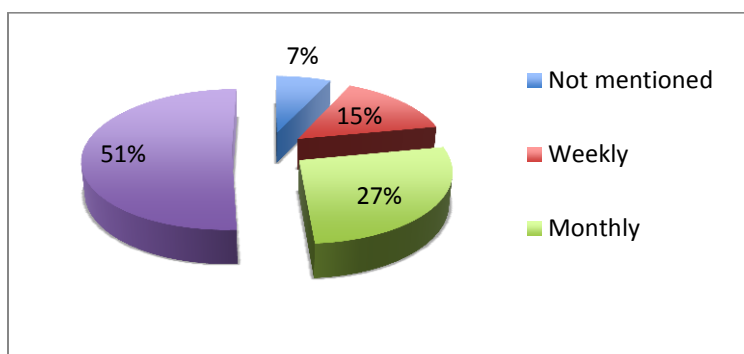
Figure 6: The frequency of communication between the sellers, owners, and NDA inspectors

4.1.3 Medicine and Inventory Management

Other survey objectives were to understand the drug supply chain and to establish if the owners and sellers had any form of record keeping for tracking their inventories. In addition, we also wanted to establish if they had any drug management processes regarding feedback on expired drugs and adverse drug reactions. We also wanted to establish the mode of communication used to place orders for more stock, as well as the mode of transport and method of payment used by the drug sellers and owners. The figures below display the findings.
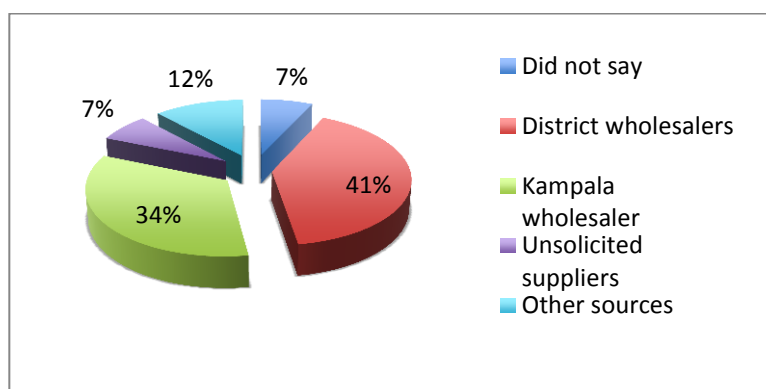
Figure 7. Sources of supply for medical materials

The frequency and type of record keeping among the sellers and owners is as shown in table 2.

Table 2. Distribution of standard business management records

	Daily	Weekly	Monthly	Less often than monthly	Not used
Stock book	10	13	23	5	3
Record cards	19	0	5	0	8
Order books	8	9	4	3	7
Receipt books	11	8	5	3	8
Others	14	1	0	0	1
Others specified	Sales book, Patient's record book, Expiry book, Purchase book				

Regarding drug management and adverse reactions, the sellers and owners were asked if they reported the cases of expired drugs. The results appear in figures 8 through 13.
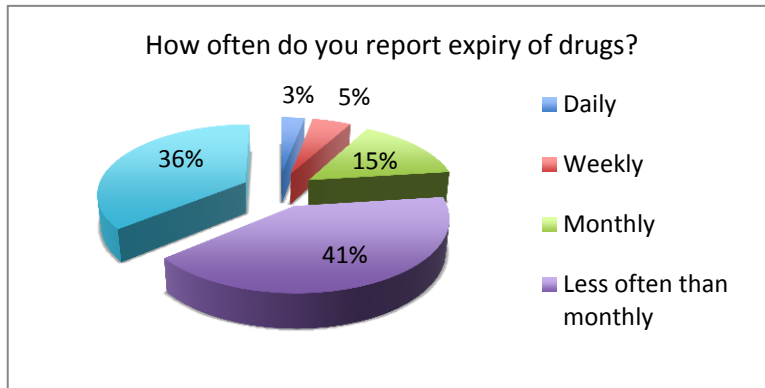
Figure 8. Percentage of sellers/owners who reported cases of expired drugs
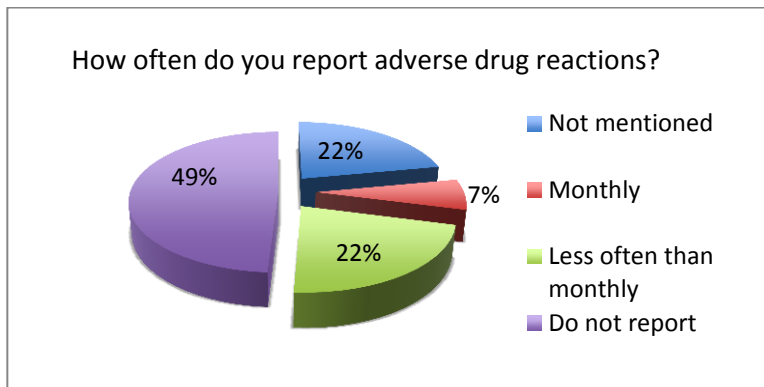
Figure 9. Frequency of reporting adverse drug reactions

The drug sellers and owners were also asked if they received any feedback from regulatory authorities on reporting cases of adverse drug reactions. The results are shown in figure 10.
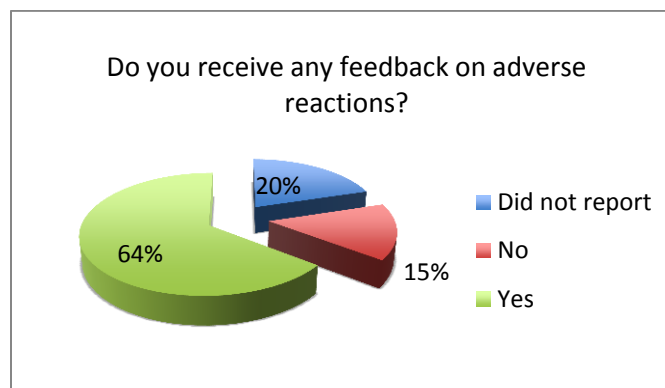
Figure 10. Distribution of sellers and owners who received feedback after reporting adverse drug cases

The findings on the modes of communication and payment when placing orders for drugs appear in figures 11 and 12.
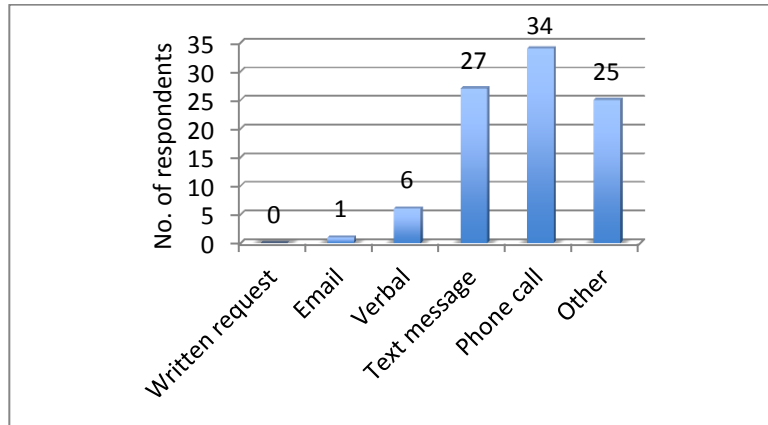
Figure 11. Mode of communication when placing orders
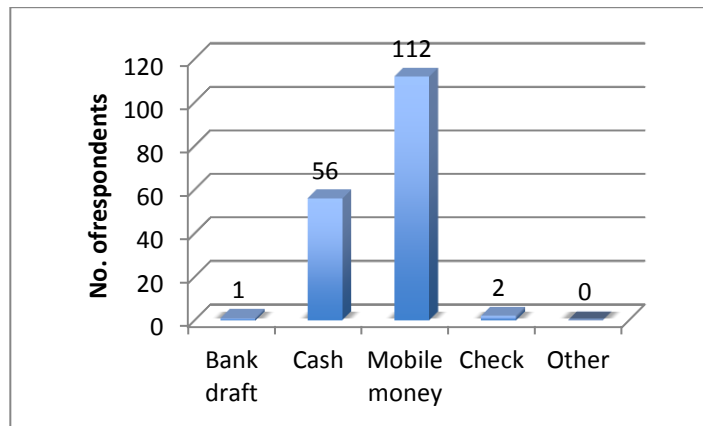
Figure 12. Mode of payment used to purchase supplies

4.1.4   Management Information Systems

This section of the survey sought to establish the drug sellers' and owners' current state and opinions regarding aspects of management information systems: access, knowledge, affordability, perceptions, benefits, and the cost implications of using mobile phones in their businesses.
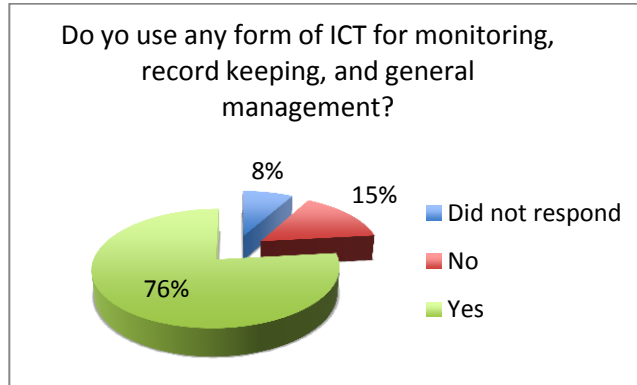
Figure 13. Use of information and communication technologies
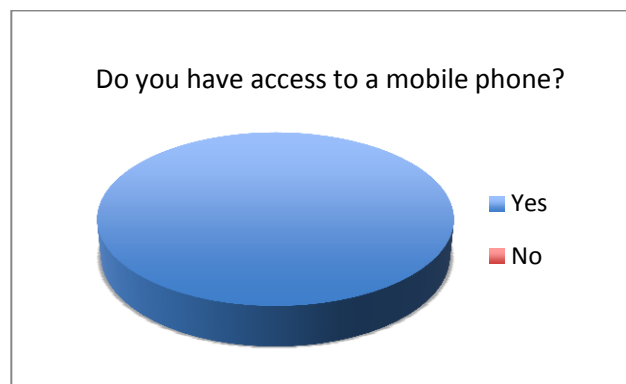
Figure 14. Access to a mobile phone
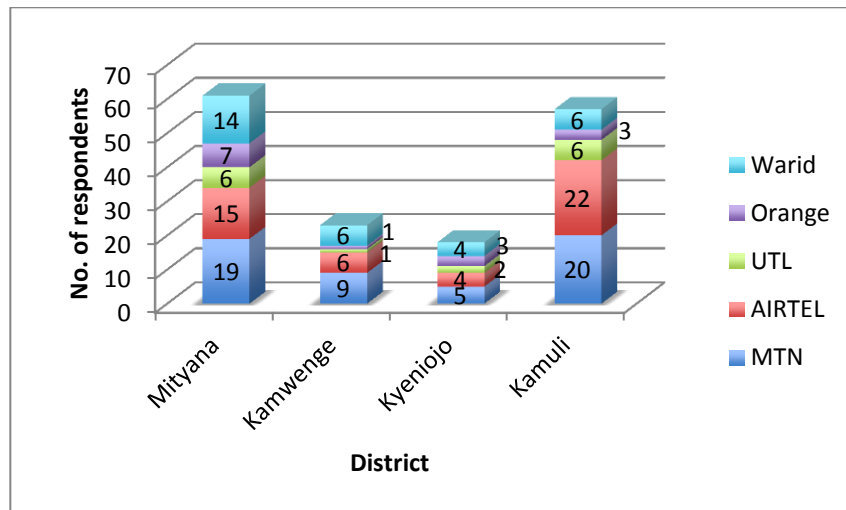
Figure 15. Satisfactory availability of telecommunication networks, by district
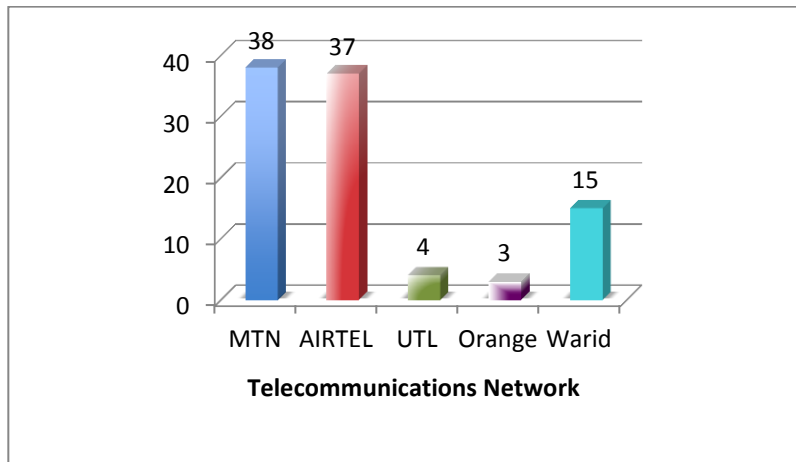
Figure 16. Affordability of mobile services across the various telecommunication networks
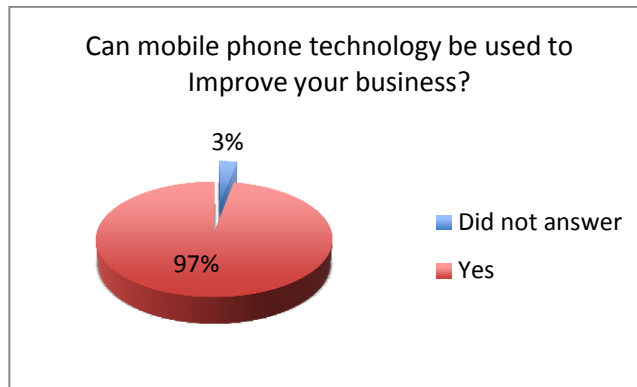
Figure 17. Opinion regarding use of mobile technology to improve their business
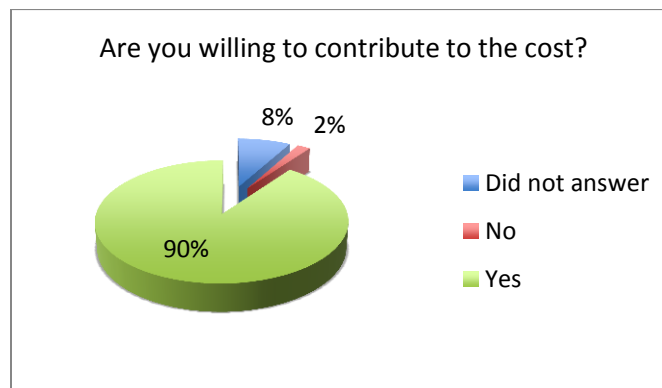
Figure 18. Willingness of the seller/owner to contribute to the cost.
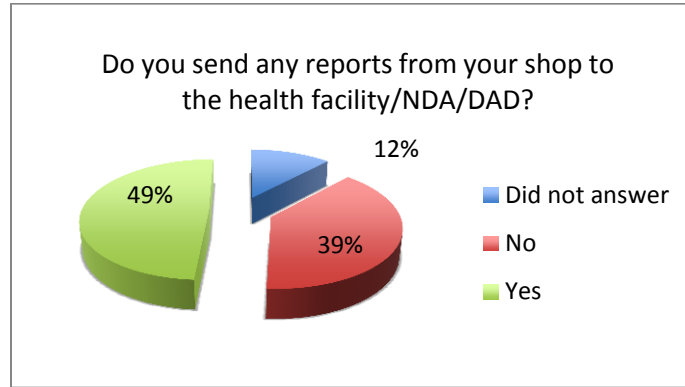
Figure 19. Assessment of whether the sellers send reports to the NDA
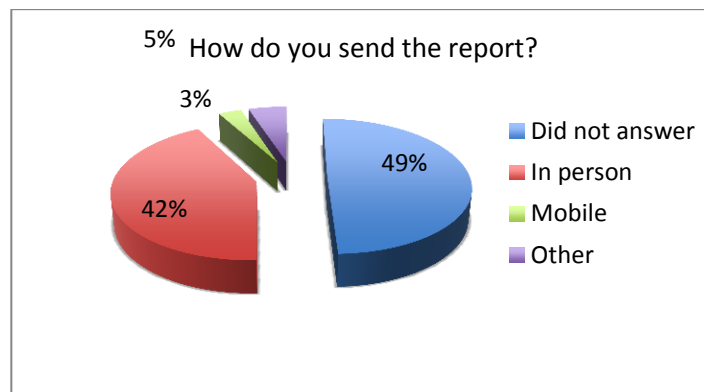
Figure 20. Assessment of the mode of sending reports to the NDA
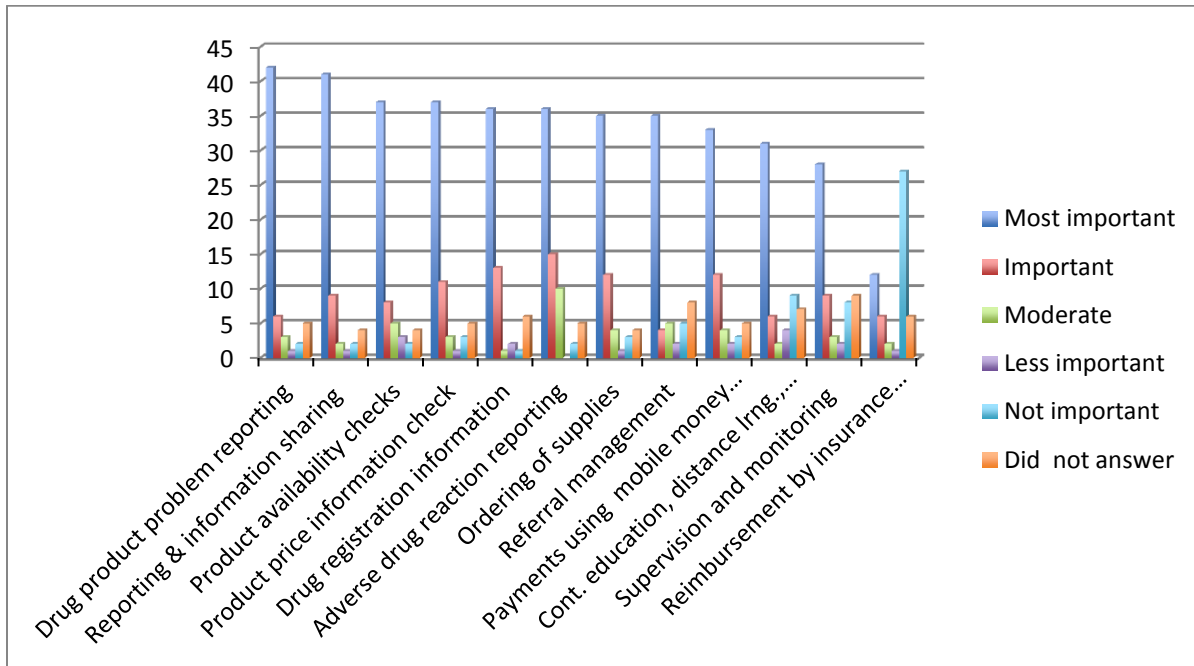
Figure 21. General assessment of activities that can be improved using mobile technology

4.1.5   Patient Registration and Follow-Up

Finally, we intended to find out if drug sellers and owners had records of clients who purchased drugs from their shops and the category of patients, their access to referral and emergency services, and the distance to the nearest hospital/health center. Figures 22 and 23 present the findings.
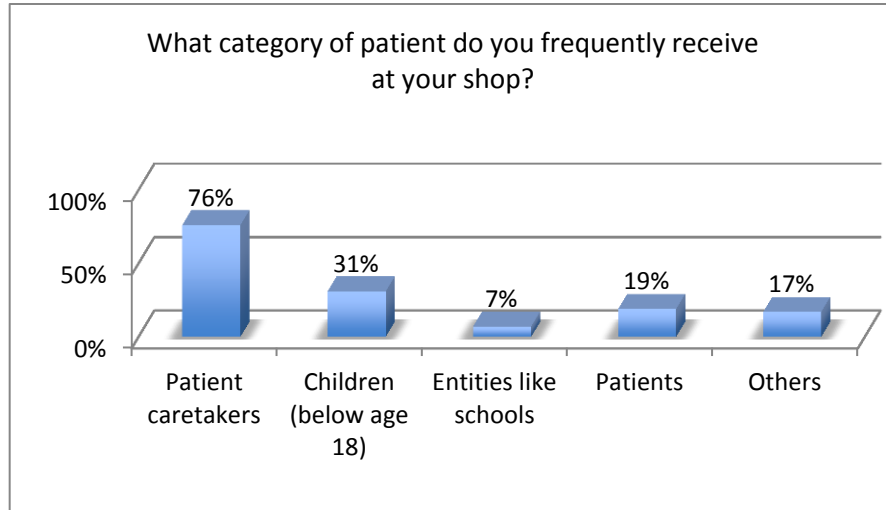
Figure 22: Patient categories that visit the drug shop
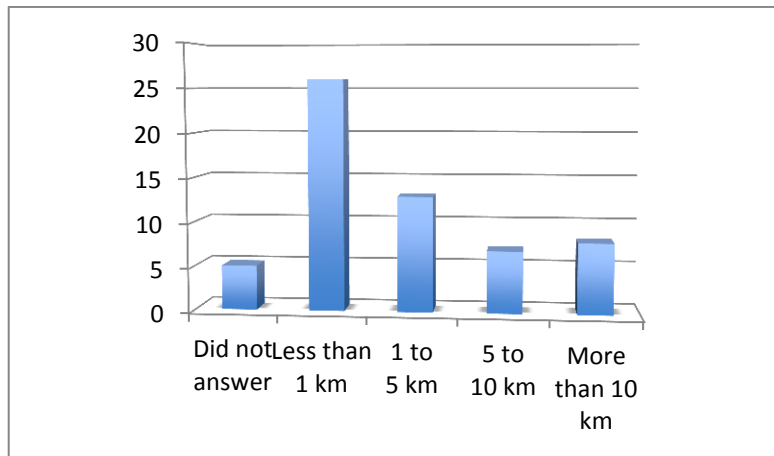
Figure 23: Distance estimated between drug shop and nearest hospital/health center

4.2 INTERVIEWS WITH MANAGEMENT OFFICIALS AT LOCAL AND CENTRAL LEVELS

In addition to surveying and visiting drug shop owners and sellers, we interviewed management officials at both the local and central levels, as well as representatives of international organizations.

4.2.1   Local-Level Management Officials

At the local level, we interviewed the following officials. Their responses to the questions we posed follow.

Location**: Mityana**
Job title**: Senior Clinical Officer/District Assistant Drug Inspector**
Job: **Inspection of drug shops and health facilities**

1. Usage of information and communication technology (ICT)

Do you have access to a computer?

- Yes

If yes, how do you use it in your work?

- Used for compilation of data and submission of reports, for example to SURE [Securing Ugandans' Right to Essential Medicines Program]

2. What is the process of accreditation of ADS/Class C drug shops?

- Sensitization of stakeholders in the district
- Pre-inspection of drug outlets
- Identification of trainees
- Training of operators of drug shops
- Regular inspection and supportive supervision of trained drug shop operators
- Continuation with sensitization of the public about ADS project using radio talk shows

3. Communication with ADS

- ADS operators are informed through phone calls and the letter system about any issues of concern
- Radio system is also used to communicate to ADS sellers

4. Systems in place for daily management of processes

- None

5. Plans you have on migrating to management information systems?

- None

6. How do you perform monitoring, audit, supervision of ADS, and reporting?

- Through physical movement to areas of concern
- Acting on provided information by parties involved

7. Frequency of visiting ADS and Class C drug shops.

- Often

8. Purpose of the visit(s)?

- Compliance with licensing
- To monitor product availability and quality
- For educational purposes
- To track inventories

9. Perception of using mobile phone technologies to improve ADS services.
   - Benefits: Access to information with minimal cost
   - Challenges: Poor network problems, privacy of some information

10. How can mobile phone technologies improve supervision and monitoring of ADS?
    - By making access to information about any drug seller or from NDA much faster

11. Is there any existing infrastructure to support an mHealth project (equipment, staff, software)?
    - Yes

If yes, what are they?
   - Computers and mobile phones
   - Mobile network

If yes, is there an opportunity to expand the existing infrastructure to accommodate additional mobile applications?
   - Yes

12. Priority areas in which mobile phone technology can be used to improve ADS services?
    - Sharing information about new medicines, medicines with poor quality
    - Provision of feedback between supervisor and drug seller.

13. Do you share regulatory and other key information to ADS or MSH, MOH, CDC?
    - No

If no, why?
   - There has been no effective mechanism to do so.

14. Do you think mobile phone technologies can assist?
    - NDA/Government. Yes we have had some, for example mTrack for resource center
    - Local communities

15. Are there existing mHealth projects in your district?
    - mTrack for submission of weekly surveillance and lab reports on malaria, ACTs, and other conditions
    - DHIS2 for submission of monthly reports from districts to the MOH (resource center)

16. Priority areas where mobile phone technology can be used to improve ADS services
    - Monitoring and supervision
    - Reporting of expiries drug reactions and deregistered medicines.
    - Data audit can be carried out, surveys could also be done.
    - Could be a solution to sharing information in health, including medicines

Location**: Mityana**
Job title**: Medical Clinical Officer**
Job role **: Chairperson of the Drug Shop Provider Association**

1. Usage of ICTs

Do you have access to a computer?

- Yes

If yes, how do you use it in your work?

- Mainly it is meant for storing information concerning members who have registered their drug shops, clinics and pharmacies,
- Drafting letters to be retrieved as hard copies or sometimes using an email to send a soft copy.
- To utilize the stored information to evaluate the progress/failure of the association.

2. Do you think mobile phone technology can assist?

- Yes. It minimizes the expense of transportation, it saves time and enables one to commit in other duties.

Location**: Kamwenge**
Job title**: Senior Dispenser/Drugs Inspector**

1. Do you think mobile phone technology can assist?

- Yes. It can assist on drug registration information, new guidelines, drug recall information

Location**: Kamwenge**
Job title**: Health Management Information Systems Focal Person**
Job: **Data management and analysis**

1. ICT usage in daily work?

- Data analysis, entering raw data, and storage

2. Existing mHealth projects in the district

- mTrack (medicine monitoring)
- DHIS2

3. Benefits of using mobile phone technology in ADS monitoring and supervision

- It will also make it easy on transportation expenses

4. Information collection from drug shops

- Sent monthly by some shop owners

5. Existing ICT infrastructure at the district

- Computers, printer, Internet connectivity

6. Correspondence with other stakeholders

- MOH: weekly disease surveillance

Location: **Kamuli**

Job title: **Senior Dispenser/Drugs Inspector**

1. Access to a computer?

- No

2. Accreditation process

- Pre-inspection following a question about standards required by NDA, marks are awarded, and thereafter selection will take place
- NDA will again go and inspect those drug shops selected for training

4.2.2   National-Level Interviews

At the national level we visited the following officials.

Job title: **Pharmacist/ADS Trainer**

Organization: **Pharmaceutical Society of Uganda**

1. Access to a computer?

- Yes

If yes, uses

- Sending email, reports, entertainment, reading

2. Process of NDA accreditation

- Pick application from the District Assistant Drug Inspector (DADI). Complete the application.
- Return the form to DADI, must be returned with accreditation training certificate
- DADI carries out inspection of premises
- DADI makes report and sends to Regional Drug Inspector

3. Purpose of visit to ADS and Drug C shops

- Check compliance with licensing
- Monitor product availability and quality
- For educational purposes and training

4. Priority areas that mobile phone technology can be used to improve ADS services

- Making orders
- Education, (capacity-building)
- Product follow-ups (post marketing, surveillance of medicines)

Job title: **Child Survival Systems Strengthening Specialist**
Organization: **UNICEF**

1. mHealth projects:
   ▪ mTrack

2. Geographic areas of implementation:
   ▪ Full rollout in Western, Central, South Western Uganda

3. Implementation stage:
   ▪ National rollout by November

4. Health priority areas:
   ▪ Surveillance of drugs, drug stock-outs, and tracing of drugs

5. Opportunities to link mTrack to other projects:
   ▪ Yes, also looking for add-on applications to enhance of the functionality of mTrack

6. Technology used on mTrack:
   ▪ Mobile phone technology.

7. Linkages with other mHealth projects:
   ▪ DHIS2; integration

8. Challenges:
   ▪ Lack of lists of health centers and unique identifiers

9. Type of phone:
   ▪ Any type of phone with any operating platform

10. Uses of mobile technology:
   ▪ Disease surveillance
   ▪ Real-time data center

11. Challenges experienced:
   ▪ Network problems
   ▪ Poor quality
   ▪ Dropped calls
   ▪ Delayed message delivery

Job title: **Inspector of Drugs**
Organization: **NDA**

1. Access and usage of ICTs:
   ▪ Prepare documents and reports

- Send e-emails
- Send memos
- Internet

2. Accreditation process:

- The drug shop must be licensed by NDA
- The drug shop should meet accreditation standards for premises, i.e., glass shelves, hand washing facility, counting tray, records maintaining
- Drug seller has to attend and pass the ADS training
- The drug shop is then accredited

3. Monitoring, audit, supervision of ADS and reporting:

- Inspect the shops with the district inspector on issues of personnel premise, record keeping, and management of common illnesses
- Fill checklists and prepare a report for head of inspectorate services

4. Purpose of visit:

- Compliance with licensing
- To monitor product availability and quality
- For educational purposes

5. Challenges observed in the current ADS supply chain management

- The current law doesn't support some of the drugs stocked by ADS, but we are in the process of its revision.
- There are no restrictions on pharmacies to sell to only licensed shops.
- Illegal drug shop operators
- Counterfeit medicines

6. Perception of using mobile phone services to improve ADS services

- Information flow is very fast.
- Easy to use
- Most people own phones
- Reduces paperwork
- Reports done quickly
- No manipulation of results

7. Priority areas that mobile phone technology can be used to improve ADS services:

- Sending immediate reports after inspection or support supervision to the center for compilation
- On-spot examination/training at ADS
- GPS technology to locate the shops easily
- Reports on adverse reactions
- Can help Identify illegal shops

8. Correspondence with other stakeholders

- There is a steering committee that is composed of representatives from MoH, WHO, PSU [Pharmaceutical Society of Uganda], NDA, and the districts

5. SITUATIONAL ANALYSIS: CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

In conclusion, the option of implementing a mobile phone–based system using available technologies such as SMS and interactive voice response to disseminate as well as collect information from the drug shops is the most feasible and the recommended solution.

This is supported by the findings that all the drug shop owners and seller have access to a mobile phone, so there is no initial cost of providing the required devices to implement the system. The level of education of most drug sellers is above O level, meaning that training on usage of any mobile phone technology systems will require minimal effort.

Most survey participants indicated that there was availability of mobile phone telecommunication networks in their areas of operation, thereby confirming the feasibility of establishing a mobile phone-based solution. There was also consensus that the telecommunication network services were affordable, with the majority of the survey participants indicating willingness to meet the costs of using the technology to improve their sales and services.

5.2 FEASIBILITY

From our findings in the situational analysis, the use of mobile technology to support the management of drug shops for SDSI initiatives is feasible. This is true for the following reasons:

1) Almost everyone has access to a mobile phone, meaning there is no initial cost of providing the required device to access the system.

2) The levels of education of most drug sellers is above O level, meaning that training on usage of any mobile phone technology systems will require minimal effort.

3) The communication between NDA/DADI inspectors takes over a month; through the use of mobile technology this gap can be bridged.

4) Frequency of reporting expired drugs took over a month for most of the survey participants due to communication and transportation challenges.

5) Majority of the participants also submitted their reports in person and received no feedback at all.

6) Reporting and Information flow will be faster.

7) There is a significant reduction in costs due to transportation. This was identified by most shop owners and officials.

8) Most survey participants indicated that there was availability of mobile phone telecommunication networks in their areas of operation.

9) There was also a consensus that the telecommunication network services were affordable with a majority of the survey participants indicating willingness to meet the costs of utilizing the technology to improve their sales and services.

10) The process of accreditation and inspection can benefit from mHealth technology since accurate and up to date information from the drug shops can be sent much faster and efficiently.

The situational analysis identifies that other initiatives are already on the ground, such as the mTrack by UNICEF. Their willingness to partner with others can be exploited because they already have an existing system. Further technical understanding of their system can be explored in the future to indicate how easy it is to integrate with other mHealth initiatives; this was beyond the scope of the survey.

6. OPTIONS ANALYSIS: CONCLUSION AND RECOMMENDATIONS

6.1 A THREE-TIER ARCHITECTURE

We propose a three-tier architecture that will collect data from the field with the use of mobile phones. A central server will function as the main point for data processing. The central server will store the database as well as a web-based application that will be used to configure the system and produce reports via a web browser.[1]

To ensure the sustainability of the proposed system, we suggest the use of SMS and USSD-based data collection tools to send and receive information from the drug shops to the central server, and vice versa. Our situational analysis determined that this mode of implementation has already been tried in numerous projects. This approach also provides MSH/SDSI the opportunity to partner or collaborate with other projects that are already at an advanced stage of implementation. This means the functionalities of the system that need to transmit and receive data will be implemented through the use of SMS.

A local provider to provide a toll-free number as well as host the server and perform SMS aggregation will need to be identified. From the situational analysis, 100 percent of the respondents indicated that they have access to mobile phones, while 97 percent confirmed that the application of mobile phone

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[1] In the project by FIND to monitor malaria in Gulu and Kabale districts of Uganda, the pilot phase used an SMS-based system that runs on RapidSMSTM. The infrastructure consisted of an SMS modem for receiving and transmitting messages and a laptop computer to act as server for the system.

technology in their supply chain activities would improve their businesses. This means that the potential risk of resistance as a result of introducing an SMS-based system to drug sellers is greatly reduced.

To ensure that the system is also user friendly, interactive voice response will be used to provide supportive features such as answers to common user queries and recorded instructions on the use of the system. The interactive voice response will also be useful in delivering user-friendly messages to the end users on the process of accreditation and licensing by the NDA.

6.2 OTHER AVAILABLE MOBILE PHONE–BASED TECHNOLOGIES

We have presented use of the SMS and USSD technologies as the preferred option for implementing a solution for use in Uganda's ADS supply chain because they will allow for sustainability and acceptability of the system, unlike other available mobile phone–based technologies. The situational analysis identified that the majority of the handsets used by the drug shop owners and sellers had basic features and were not advanced. The users were also comfortable with the use of SMS, as opposed to other advanced mobile phone features.

The other options that might be considered, but will be costly to implement and sustain, are:

1) **Wireless application protocol (WAP).** WAP is a protocol that allows a mobile phone user to access services such as the Internet and other web-based systems over a browser installed in the phone. The technology is limited to high-end mobile phones, which may not be available to the majority of local drug shop owners and sellers in the country. Furthermore, it may not be sustainable in terms of requiring the users of the system to upgrade their handsets from time to time. This invariably brings in more costs than users may be able to afford. This might tempt the drug sellers to pass on these costs to their customers, making the drugs more expensive and therefore less affordable to the general community.

2) **Mobile phone–based application software:** This requires the development of an application that is installable on the end users mobile phone handset. While this approach may be suitable in terms of ensuring ease of data validation as well as presentation, it suffers from the same challenges identified under the WAP technology. The mobile phone handsets currently available to most users in rural areas are limited to voice calling and sending/receiving short text messages. For example, the option of using such technology requires either handsets that support JAVA or have an Android-based operating system. Furthermore, if this approach were used the majority of the users of the system would need to be trained to use the system. Training costs would be required, in addition to the cost of providing Java-enabled handsets or handsets running advanced operating systems, such as Android or iPhones. In addition, a system developed on this platform may be difficult to sustain in the long run.

6.3 AN OVERVIEW OF THE PROPOSED SYSTEM

The end user at the class C drug shop will access the system via a toll-free phone number with a basic handset using SMS or USSD

The user will send an SMS string to a toll-free number. This SMS string will have an established protocol. e.g., "DRG" for drug registration as a prefix and then other details will follow the prefix. This will go to a central server equipped with a modem. The central server will process the string and send feedback to the user based on the request.
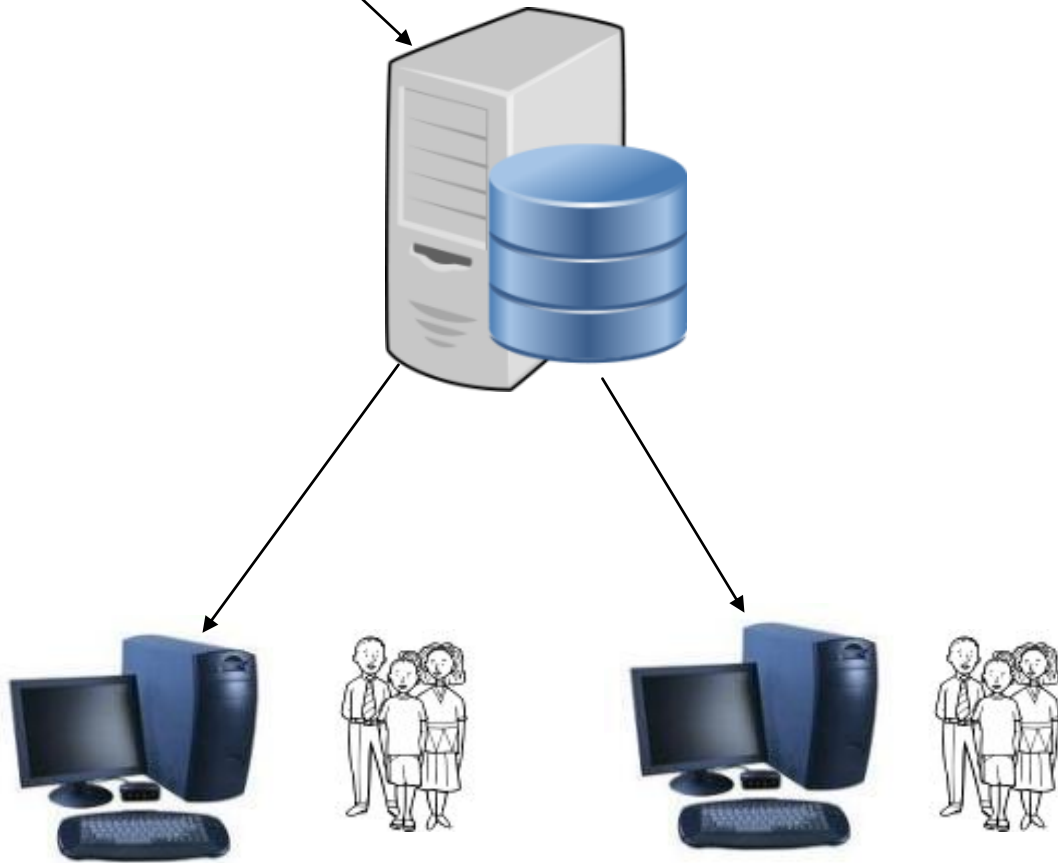
End users at remote sites will access the system via a web-based interface and view reports of aggregated data, as well as perform other functions such as drug ordering and capturing of drug details as well as those of drug sellers, depending on their roles.

6.4 FUNCTIONALITY OF THE PROPOSED SYSTEM

The proposed system will have the following capabilities: registration of drug sellers and batches of medicines purchased; reporting of expired drugs and adverse events; district-level management of drug inventory as well as record management and accreditation (both optional); mass notification of important information, such as drug recalls; and generation of management reports and alerts. These features are described in sections 4.3.1 through 4.3.8.

6.4.1   Drug Seller Registration

The system will be open to all drug outlets, even the non-accredited ones, for registration of a drug seller. This will allow for the building of a national register of drug sellers and will help in the accreditation process. The process requires the drug seller to send an SMS to a toll free number, using the format shown below:

DRUGSHOPNAME#DISTRICT#OWNER#PP/ID Number

The system that does SMS aggregation at the server will receive the text, process it, and send a message to the sender of either success or failure. If the registration is successful, the system will generate a unique outlet identifier and send it to the sender; otherwise it will send an error message. (If the USSD option is used, the process will be the same, except the user will be required to fill in a sequence of fields representing the string format above.)

During accreditation, NDA will collect additional outlet details, which can then be updated at the district NDA office. Furthermore, the details can be captured as part of the licensing process by the NDA for national scale-up of the system in the future.

For payments of any registration fees, the NDA will have to obtain a business number from the mobile service providers. This means that the NDA will collaborate with the mobile money transfer service providers to facilitate transfer of payment information from their end into the NDA system. To make registration payments, the drug sellers will enter the business number and then the outlet identifier, which will have been sent at registration. This will get to the mobile money transfer service providers, who will then send the electronic data from the system to the proposed NDA system.

6.4.2   Registration of Drug Batches Purchased

To ensure that drug quantities in the drug seller shop are visible in a central system, the shopkeepers will fill in a stock book and then send an SMS/USSD to the central system, using the toll-free number. The SMS to be sent will use the following format:

Registering Prefix#Outletid#batch number#quantity

The drug registration cards at the outlet will be as follows:

\<Register drug_prefix	\<Outlet ID	\<Batch_number	\<Quantity	\<Expiry date
DRG	01	nnnn	nnnn	dd/mm/yyyy

6.4.3   Reporting of Expired Drugs

To report expired drugs the workflow will be similar to the one for ordering, only that the prefix will change to a suitable prefix, such as EXP.

\<Expiry_prefix	\<Outlet ID	\<Batch_number	\<Quantity
EXP	01	nnnn	Nnnn

The system will send an alert to the sender on the status of the reporting in real time. It will send an error message if the format of the received message is inconsistent with the established protocol.

6.4.4   Reporting Adverse Events

To report adverse events, the process flow will involve indicating the outlet ID, the batch number of the drug, the caretaker/Patient last name and first name, the national ID / Passport number and a keyword for the adverse event. To maintain simplicity only the prefix in front of the data will change, as shown below.

\< Adverse EVENT	\<Outlet ID	\<Batch_number	\<National ID/pp no.	Customer name	Customer name
ADV	01	nnnn	nnnn	Xxxx	Xxxx

6.4.5   District-Level Drug Inventory Management (optional)

At the local district level, the workflow takes the following approach: The NDA district office will capture information about all the medicines from the drug registration cards into a web-based mHealth system that indicates the:

- Batch number (defined coding system detailing medicine category, manufacturer, country of origin) to keep track of updating the stock levels and unit medicine (e.g., expired);
- Date of manufacturing;
- Expiry date;
- Quantity (i.e., boxes, packets/number of capsules, tablets, etc., as determined by MSH)

The system for central inventory management will be bar-code enabled to ensure faster data capture.

6.4.6   District Level Record Management and Accreditation (optional)

At the local level, the NDA District Accreditation Office will issue predesigned recording tools to the outlets, which will use them to capture the data noted above and then transmit them to the NDA District Accreditation Office via SMS. These records will enable reconciliation checks to ensure accuracy of data in the electronic system. Furthermore, due to the simplicity—as well limitations of SMS and USSD applications—not a large volume of data may be sent at once. Thus further data may be collected at the outlets and used to update the electronic data at the local level.

6.4.7   Mass Dissemination of Important Information

The system will have a feature that allows mass texting to registered outlets of any information that the NDA would like to disseminate. This will include, but not be limited to, information on new drugs, recalling of drugs as well as guidelines on how to dispense drugs. In addition, the system will have interactive voice response so that the drug sellers themselves can dial a toll-free number and listen to guidelines relating to administration of drugs.

6.4.8   Management Reports and Alerts

Expired Drugs Report. The NDA office will be able to receive all the Expired drug report messages, which will be automatically consolidated by the system to produce an "Expired Drugs" report at the ADS. NDA can then arrange to dispose of the expired drugs, and inform the affected ADS using SMS.

Drug Sales and Inventory Movement Report (optional). The system can assist NDA in monitoring the number of outpatients and the health conditions per outlet in the network and, therefore, to plan for adequate quantities of medicine throughout the country. The report indicates the level of inventory held at each outlet and the number of outpatients per outlet per day. Periodic analysis of lifespan of medicine will give an indication of expired stocks still in circulation. With this report, the NDA head office is able to enforce compliance with medical regulations and monitoring and ensure that the public is consuming only the right medications. The proposed solution will be able to extract reports on the most prevalent ailments in the various regions, hence helping in management decision-making to make available the most needed drugs in the regions that require them. The reports will also aid in stock replenishments in times of need (e.g., seasonal demand).

Incomplete Registration Information for ADS. The proposed mobile telephone–based solution will enable NDA to follow up with affected drug shop owners for overdue tasks and complete the registration process in the system; any exceptions can be addressed in a timely fashion, ensuring accurate identification, follow-up, and continuous feedback.

Other Reports

- *Registration Payments Reports*. The system will enable ADS to pay registration fees using mobile money transfer system, and also to produce reports showing the outlets that have paid as well those that have yet to pay. Regular alerts or reminders will also be sent to those who have not paid for accreditation.
- *Audit Reports* such as user access levels (to control fraudulent stock orders).
- *Monthly/weekly reports*. The system is capable of generating periodic reports customized to client specifications on any or all of the above transactional activities.

6.5 THE CONCEPTUAL MODEL

This conceptual model (figure 24) indicates the relationships between the various interacting entities
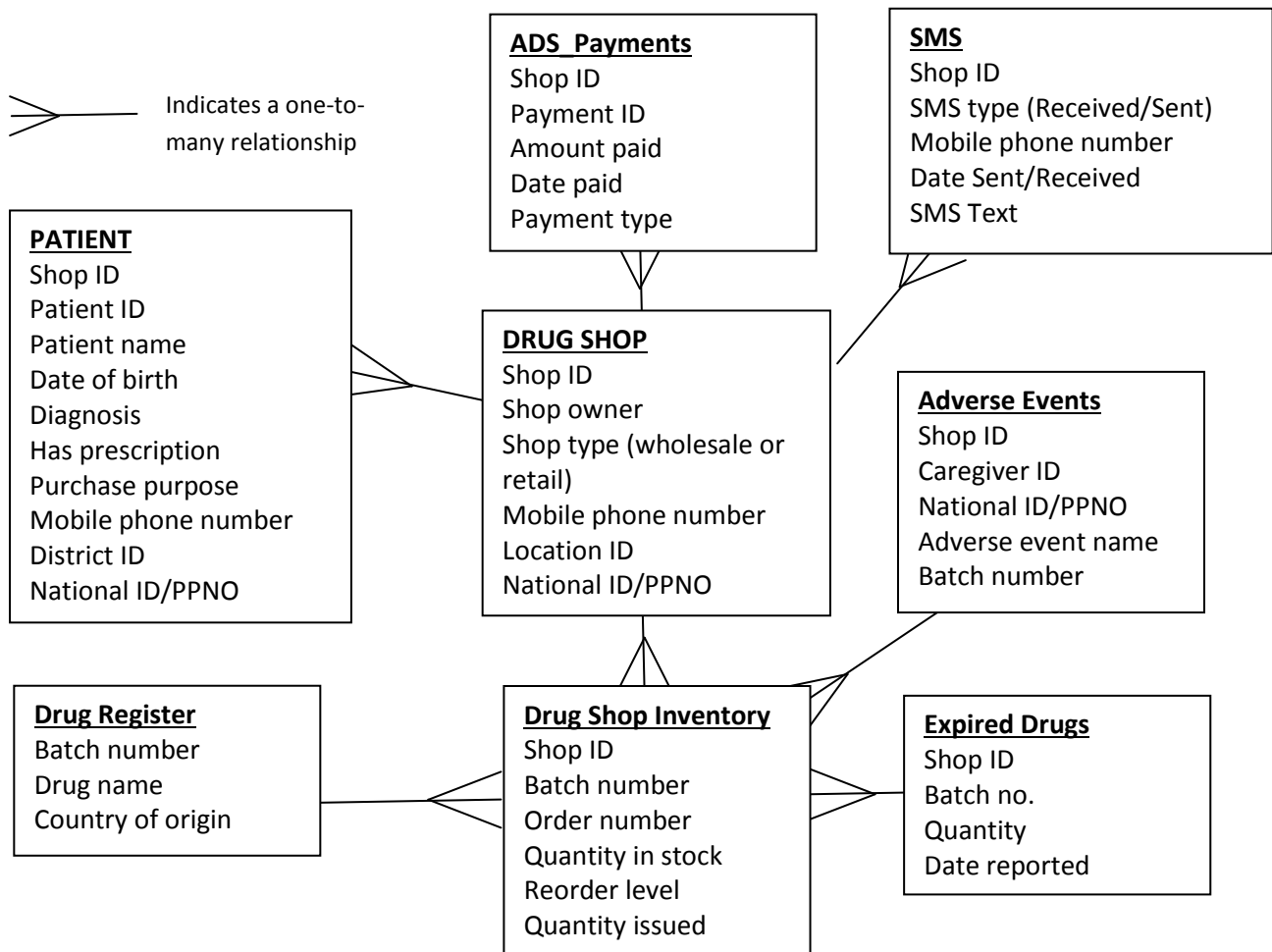
that are required for the mobile phone–based solution to work.

Figure 24. The conceptual model

7. STAKEHOLDER RESPONSES TO THE ANALYSES

7.1 STAKEHOLDERS' MEETING

Avytel facilitated a presentation on the proposed mobile telephone solution for strengthening the ADS services at the stakeholders' meeting, "Sustainability and Maintenance of the ADS Initiative." MSH/SDSI organized the meeting, which took place on October 29 and 30, 2012, in Entebbe.

We presented stakeholders with a summary of our findings from both the situational analysis and options analysis regarding the implementation of a mobile phone–based system for ADS operations for their consideration. In addition, we indicated the system functionalities and specifications recommendations for the proposed mobile technology implementation.

7.1.1 Results of Workshop Prior to the Plenary Session

At the day-long workshop on October 29, stakeholders worked in groups, as group work was judged the most effective methodology for the presentation, discussion, and derivation of considered options.

All consultants were assigned to activities with similar areas of study. Consequently, we were allocated to Group 3 ("Incorporating Mobile Technology and GIS to improve ADS Services") together with M/s G1 Logistics, a consultant whose area of activity is the development of a Geographical Information System (GIS) for NDA. In these discussion groups, other stakeholders, including representatives of NDA, reviewed the consultants' presentations, made comments, suggested amendments, and finally worked out refined recommendations for presentation to the plenary stakeholder's meeting scheduled for the following day.

A summary of the key findings and recommendations that we presented to Group 3 appears in Annex 2.

At the conclusion of the workshop, Group 3 adopted the following refined recommendations, concluding that mobile phone technology should be adopted to:
- Facilitate efficient drug seller registration.
- Provide for reporting systems on such aspects as expired drugs, counterfeits, adverse events, management reports, and drug recall notifications etc.
- Enable strategic communication by NDA to ADS operators on such issues as new drug guidelines
- Enable mobile money transactions and other business-to-business payments, receiving registration and accreditation of payers.
- Provide Interactive voice response to disseminate general information in addition to SMS, USSD and web-based information access.

Group 3 further recommended that:
- The mobile solution should be compliant with existing laws and regulations in the communications sector.
- The output of the mobile telephone–enabled system should be part of the regular NDA reporting to the Ministry of Health.

- In addition, NDA should partner with telecommunications operators at service level agreements.
- NDA should establish facilities and infrastructure for supporting ICT operations (software and hardware for GIS and mobile technologies).

7.1.2 Plenary Stakeholders' Meeting

The plenary stakeholder's meeting took place on October 30, 2012, and was attended by all the implementing partners, as well as the various invited stakeholders. The Rt. Hon. Rebecca Kadaga, the Speaker of Parliament of Uganda, graced the meeting and delivered the opening speech. Thereafter, she took a group photograph with all the participants and wished them fruitful deliberations. The MSH Director in Uganda and the Executive Director of the NDA also addressed the meeting.

The methodology employed for the effective presentation, discussion, and adoption of recommended options was for the various implementing partners to deliver their findings and recommendations, as agreed upon in the previous day's work groups. In addition to our Microsoft PowerPoint presentation, we able to demonstrate a prototype mobile telephone application; members of the audience participated enthusiastically and appreciated the real-time applicability.

The prototype demonstrated the following functionalities of the proposed mobile phone technology for ADS:

- Using the mobile phone to initiate ADS registration;
- Reporting adverse effects of drugs sold to consumers;
- A search menu that ADS can interrogate to obtain technical details about a specific drug.

Members of the audience who volunteered for the demonstration were able to send SMS texts (with guidance from the our team) to a test phone number and obtain instant acknowledgement of their message as well as feedback messages containing the required information. The Avytel consultant also demonstrated to the audience the back-end record of SMS messages as they would be reported at the central server.

This demonstration was, indeed, further confirmation of the feasibility and utility of mobile phone technology in strengthening the ADS services.

8. RECOMMENDATIONS

In conclusion, the outcome of the situational and option analyses and stakeholder meeting is that the most feasible and therefore recommended solution is to implement a mobile phone–based system using available technologies such as SMS and interactive voice response to disseminate as well as collect information from the drug shops.

This was ably supported by the findings from the field and the deliberations in the stakeholder's meetings, as well as the prototype demonstration.

Based on our assigned task of assessing and developing a strategy on the feasibility and utility of using mobile technology to strengthen the ADS services in the areas of product availability and quality, we recommend that the proposed mobile technology should, at a minimum:

1) Facilitate efficient drug seller **registration**;

2) Provide for **reporting systems** on such aspects as expired drugs, counterfeits, adverse events, management reports, and drug recall notifications;

3) Enable **strategic communication** by NDA to ADS operators on such issues as new drug guide lines;

4) Enable **mobile money transactions** and other business-to-business payments, receiving registration and accreditation of payers;

5) Provide **Interactive voice response** to disseminate general information in addition to SMS, USSD and web-based information access.

6) Be **compliant with existing laws and regulations** in the communications sector

7) Contribute to the regular NDA **reporting to the Ministry of Health,** through the output of the mobile technology;

8) Be **scalable** to address the needs of all stakeholders: NDA, MSH/SDSI, MoH and its officials (DADIs), ADS owners and sellers, transporters, bankers, wholesalers, retailers.

9. REFERENCES

1. Asiimwe, Caroline et al, 2011, "Use of an Innovative, Affordable and Open Source Short Message Service-Based Tool to Monitor Malaria in Remote Areas of Uganda," *American Journal of Tropical Medicine and Hygiene*, 85(1):26-33.

2. http://en.wikipedia.org/wiki/Wireless_Application_Protocol. Last accessed September 30, 2012.

10. ANNEXES

Annex 1. SDSI Partners and Their Activity Objectives

SDSI partners and their activity objectives as related to SDSI's goal in Uganda		
Contractor	**Activity Objective**	**Period of Performance**
Pharmaceutical Systems Africa (PSA)	To document the **ADS regulatory system** and experience in Kibaale, explore options for sustainable ADS regulatory system, and recommend a strategy and needed tools to ensure regular inspection, re-accreditation and enforcement of ADS standards.	August–November 2012
Pharmaceutical Society of Uganda (PSU)	To document the experience of **supportive supervision** teams in Kibaale since start of ADS initiative, explore options for sustainable ADS support supervision, and recommend a strategy and needed tools that would help ensure delivery of quality pharmaceutical services by ADS providers.	August–November 2012
Makerere University- Kampala Department of Pharmacy (MUK)	To review the current **ADS seller training** initiative and recommend short and long-term solutions that will result in the sustainable availability of trained ADS sellers.	August–November 2012
Avytel Global Systems	To assess and develop a strategy on the feasibility and utility of using **mobile technology** to strengthen ADS services in areas of product availability and quality.	August–October 2012

SDSI partners and their activity objectives as related to SDSI's goal in Uganda		
Contractor	**Activity Objective**	**Period of Performance**
G1 Logistics Ltd	To develop a **geographic information systems (GIS)** strategy for Uganda's National Drug Authority (NDA) in order to improve its regulatory capacity over Accredited Drug Shops.	July–October 2012
Ugandan Health Marketing Group (UHMG)	To determine the status of the **ADS associations** and develop a strategy for facilitating the establishment of ADS associations in Uganda.	May–October 2012
Pharmaceutical Systems Africa (PSA)	To assess the **ADS supply chain** deficiencies and identify possible solutions and recommendations for strengthening the ADS supply chain system.	August–November 2012
Coalition for Health Promotion and Social Development (HEPS Uganda)	To identify current needs, experiences, and expectations of selected consumer populations where ADS have been implemented and to develop strategies for **engaging consumers** in ensuring the quality, appropriateness, and affordability of the services provided in their communities.	May–October 2012
Community Integrated Development Initiatives (CIDI)	To identify and characterize **community-based health initiatives** in Uganda to determine the best options for collaboration between such initiatives and ADS in an effort to improve access to medicines.	September–November 2012

Annex 2. Key Findings, as Presented by Avytel Global Systems at Stakeholder Workshop

Survey results

- All drug shop owners and sellers own mobile phones with basic features, so there is no additional cost to implement the intervention
- Most respondents feel that mobile phone technology can improve their business
- Most drug shop providers already use communication technology to manage their business
- Most drug shop providers interviewed were willing to contribute to mobile technology costs for mHealth intervention
- Most drug sellers have an O-level education or above, so training on mobile phone technology systems will be minimal
- There is satisfactory availability of telecommunication networks across districts

Activities that drug shop owners and sellers thought could be most improved by mobile technology include:

- Reporting and information sharing
- Drug registration information
- Reporting problems with products
- Reporting adverse drug reactions
- Product availability checks
- Product price checks
- Ordering supplies
- Mobile money transfer systems for payments
- Referral management

Annex 3. Recommendations Developed During Stakeholder Workshop Concerning GIS Technology

Provision of information

It was recommended that GIS be adopted to provide essential information for regulatory and health monitoring purposes, in particular;

- The spatial location and distribution of ADS
- Licensing status of ADS.
- GIS will enhance NDA's mobile technology in data collection accuracy.
- The generated maps will facilitate the process of monitoring, supervision by NDA secretariat.

Minimum GIS system capabilities to be developed for:

Data Capture

- Develop a Training plan for NDA technical staff in GPS data collection.
- Recruit more ICT staff including Bio-statisticians to manage GIS operation.

Data Processing

- Development of NDA geo-database
- Production of NDA Inspection Maps

Data Presentation

- Web-based maps and Standard datasets

Modalities for engaging other stakeholders

- NDA to consider collaboration with line stakeholders like UBOS
- NDA considers alternative funding for future sustainability
- The output of the GIS enabled system should be part of the regular NDA reporting to Ministry of Health