HIPS / ACCESS.MOBILE MHEALTH PILOT

FINAL REPORT

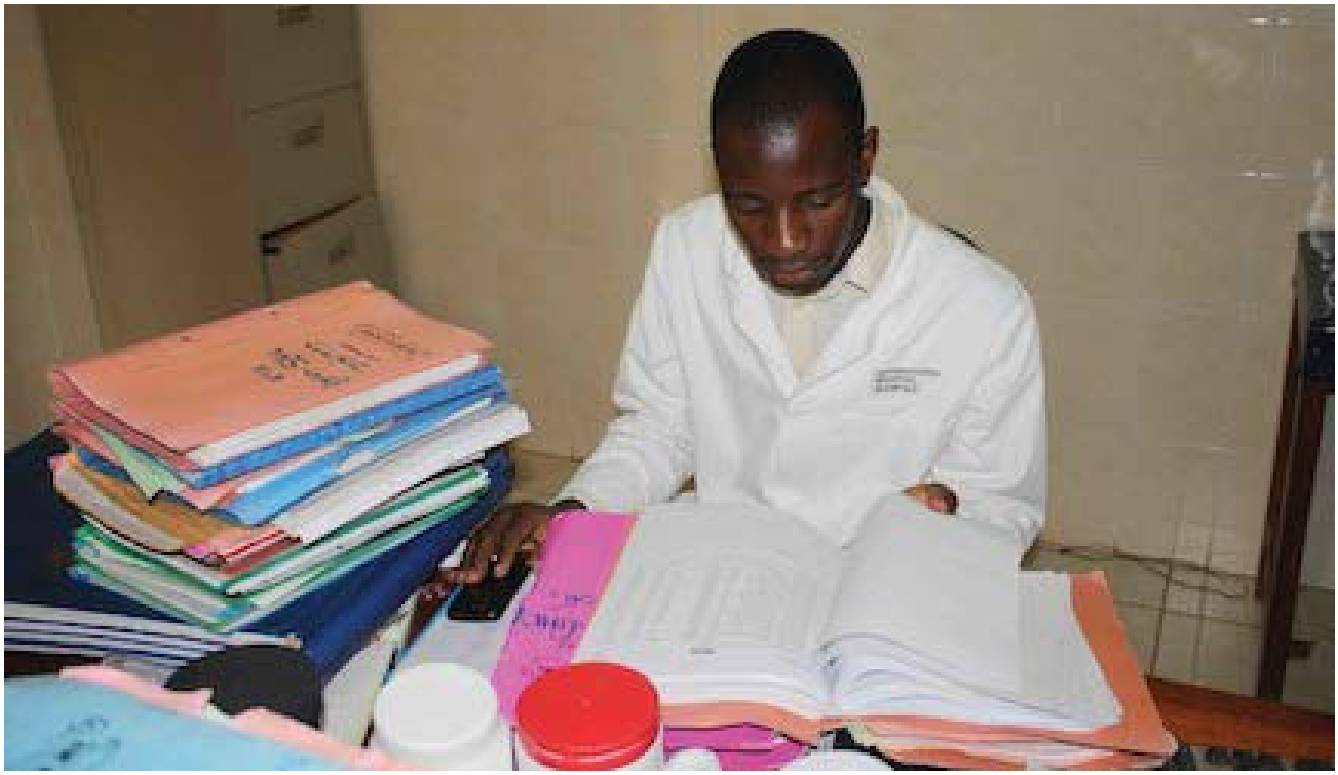

Photo credit: access.mobile, 2012

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HIPS / ACCESS.MOBILE MHEALTH PILOT

FINAL REPORT

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Cardno Emerging Markets USA, Ltd.

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DISCLAIMER

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TABLE OF CONTENTS

EXECUTIVE SUMMARY ..... **III**

INTRODUCTION **1**

HEALTH SYSTEM IN UGANDA **1**

OVERVIEW 1
Village Health Teams (VHTs) *1*
Health Center II *2*
Health Center III *2*
Health Center IV *2*
Tertiary/Regional Hospital *2*
Private Sector *2*
MOBILE HEALTH IN UGANDA 2

BACKGROUND ON HIPS **3**

WHAT IS HIPS? 3
WHY MOBILE? 3

PROJECT DESIGN AND IMPLEMENTATION **4**

INTRODUCTION 4
HIPS CLINIC PROFILE 4
TECHNOLOGY CUSTOMIZATION 5
HOW DATA MOVES THROUGH THE ACCESS.MOBILE SYSTEM 6
SMS OR GPRS? 7
DEVICES 7
TECHNOLOGY DEPLOYMENT 7
Training *7*
Ongoing Support *8*
User Feedback and Product Iteration *8*

LESSONS LEARNED **8**

QUALITATIVE AND QUANTITATIVE SURVEY RESULTS FROM HIPS MHEALTH DEPLOYMENT 9
TECHNOLOGY 10
Even minimal changes to indicators can cause confusion around reporting using a new medium. *10*
For successful uptake of mobile-based data collection, tools should mimic pre-existing processes. *11*
Even using mobile devices, technology limitations may require difficult decisions between the quality of data collected and level of effort required to capture it. *11*
Data collection tools and mobile software will require updates over the course of the project. *12*
USERS 13
User training is a continuous process due to high staff turnover. *13*
Develop a comprehensive policy that covers misuse, loss or theft of devices and other issues related to the mobile phones. *14*
As a mobile project continues, it may become increasingly important to provide incentives to data managers for continued data entry. *15*
DATA 15
There is a need for mobile-based feedback so that sites can know their reporting performance. *15*
When integrating new mHealth technologies, behavior change for data management is to be expected for both central administrators and field-based users. *16*

CONSIDERING RETURN ON INVESTMENT IN MOBILE TECHNOLOGY DEPLOYMENTS **16**

TELECOMMUNICATIONS ASSESSMENTS 17
PRODUCT LIFE CYCLE 17

DEVICE STRATEGY....17
PRODUCT MAINTENANCE....17
ONGOING USER SUPPORT....18
"TAKEAWAYS"....18

EXECUTIVE SUMMARY

In October 2011, access.mobile and the USAID-funded Uganda Health Initiatives for the Private Sector (HIPS) project began a year-long pilot aimed at improving the efficiency and effectiveness of HIPS' data collection processes through the use of mobile for data collection. HIPS is the culmination of a decade of support from the United States Agency for International Development (USAID) for private health sector activities and solutions in Uganda. HIPS is designed to leverage the role of the private sector in improving access to and utilization of health services for Ugandans. The project aims to increase access to and use of HIV/AIDS, tuberculosis (TB), reproductive health/family planning (RH/FP) and malaria services through mid- and large-size employers and private clinics. The HIPS project has four main tasks:

- Expand and strengthen access to and utilization of health and HIV/AIDS services in the private sector;
- Expand the number of Global Development Alliance (GDA) partnerships;
- Capacity Building – support initiatives to strengthen private sector worker/employer associations;
- Develop innovative and proven approaches to support orphans and other vulnerable children (OVC).

With regards to the mHeallth pilot, HIPS used access.mobile's software, which enables both data collection and transfer through the use of structured forms on a mobile device. Approximately 70 HIPS partner clinics across Uganda used the technology for reporting on a monthly and quarterly basis throughout the pilot. The clinics were geographically dispersed, located in urban, peri-urban and rural areas. Partner clinics also had varying patient loads, ranging from just a few patients each day to over 200. A combination of clinics were selected based on access to internet and computers, including both those facilities that had access as well as those that did not.

This document outlines key information about HIPS and access.mobile's year-long partnership. It focuses on open information sharing from the implementation, including development, rollout and scale-up of the mobile pilot. It highlights HIPS and access.mobile's lessons learned, both successes and challenges, around three key areas: technology, users and data. It then discusses the implications of these lessons and how the information can inform future national-scale mobile implementations.

Finally, the document outlines five key take-aways based on the lessons learned throughout HIPS and access.mobile's pilot. First, integration of mobile implementations, especially those in the private sector, into the national health system is essential. Second, significant investment, both of time and money, is necessary in the early stages of a mobile pilot; however, there is significant return on investment in terms of tangible efficiency gains over time. Third, successful mobile implementations continue to innovate over time with a focus on the user. This innovative process—not simply building and implementing a stand-alone solution—is what drives continued gains in efficiency over time. Next, data quantity does not drive data *quality*. Although technology can enable data collection and validation, human behaviors drive quality. The expectation cannot be that because it is easier to collect data using a mobile platform, the data will therefore be better. Finally, product assessments based on data are critical throughout the life of a project to inform decision-making and innovation.

INTRODUCTION

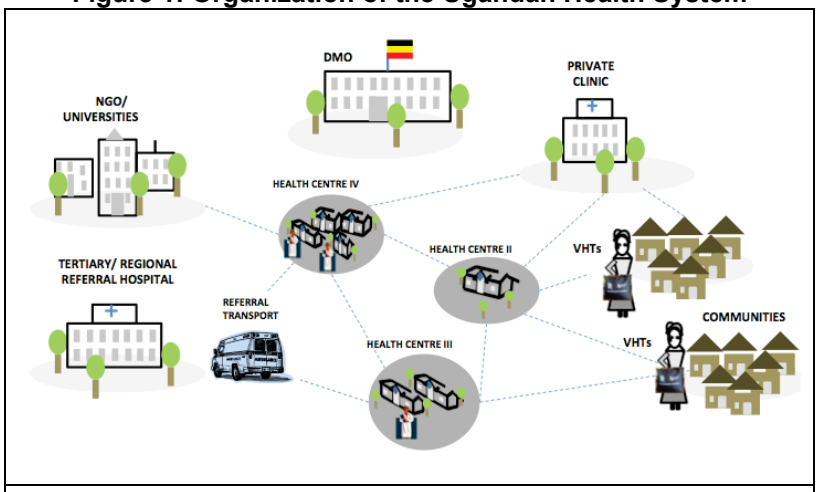
In October 2011, access.mobile and HIPS began a year-long pilot aimed at improving the efficiency and effectiveness of HIPS' data collection processes through the use of mobiles for data collection. access.mobile worked closely with HIPS to create two different mobile platforms that would not only enable mobile data entry for over 70 HIPS partner clinics, but would improve the efficiency of data reporting by clinic data managers in such a way that data could be aggregated on one platform and further analyzed by HIPS staff. Throughout the collaborative pilot process, HIPS and access.mobile worked together closely to troubleshoot any challenges that arose while simultaneously documenting the solutions and lessons learned in such a way that they could and can be used for the scale-up of pilot and mobile technology for development initiatives everywhere. In recent years, there has been an upsurge in the number of piloted mobile projects initiated in the development space throughout low- and middle-income countries, more specifically in Uganda. With this pilot, the documented lessons learned, and recommendations for the way forward, access.mobile is committed to ensuring that not only are mobile solutions developed with the end users in mind, but that the solutions are sustainable, cost-effective and highly efficient. The following document details the lessons learned throughout this pilot process and how they can be used in future mobile initiatives.

HEALTH SYSTEM IN UGANDA

Overview

Uganda's public health system consists of a tiered structure of health facilities and service providers. The structure of this system is outlined below.

Figure 1: Organization of the Ugandan Health System



Source: Uganda Population and Housing Agency

VILLAGE HEALTH TEAMS (VHTS)

Village Health Teams (VHTs) serve as the first point of contact for people living in rural areas. Activities include birth and death registration, management of childhood illness and in some cases drug distribution.

They serve as a link between the community and more formal health providers. VHTs are currently functioning in approximately 75% of the districts.

HEALTH CENTER II

Level II health center facilities are the first point of contact for the VHTs. Basic healthcare services offered at these centers include: first aid, antenatal care, family planning and immunizations. On average, there are six to eight Level II health centers in each district.

HEALTH CENTER III

Health Center III facilities include all functions of the Health Center II as well as simple surgeries, maternal health services and laboratory services. There are approximately three to five of these facilities in each district.

HEALTH CENTER IV

Level IV health centers manage the referrals from Health Center III facilities as well as conduct disease surveillance, data collection, and analysis of national health trends. There are about two to four of these facilities in each district.

TERTIARY/REGIONAL HOSPITAL

Hospitals offer specialized services such as Orthopedics, Pediatrics and more complex surgeries in addition to all the services provided at Health Center IV. There is one hospital in most districts.

PRIVATE SECTOR

Private sector health care in Uganda consists of a number of local and international nongovernmental organizations (NGOs) working in the health sector, health professionals operating their own private clinics, and businesses operating their own private clinics for employees and surrounding communities.

Mobile Health in Uganda

A number of mHealth initiatives have been launched in Uganda over the past five years by a multitude of organizations. Despite the strong potential for mHealth solutions to improve the quality of and access to healthcare, many of the initiatives launched in Uganda lack harmonization and have failed to scale up beyond the pilot phase. In 2008 and 2009, 23 of the mHealth projects that were launched in the country did not scale up after the pilot phase. Due to this issue, the Ministry of Health (MoH) has halted any new mHealth initiatives until a formal eHealth policy and strategy framework has been developed for the health information and management system in Uganda.

In 2010, The MoH in Uganda launched mTrac, an SMS-based data collection tool used to track medication and disease outbreaks, for the purposes of data collection and clinic engagement. This program is implemented in partnership with UNICEF and the World Health Organization. The mTrac system enables public sector health facility workers to submit weekly reports focused on drug supplies and disease outbreaks to the MoH using SMS. Based on the availability of real-time data, these health facilities have better information for decision making around ordering and restocking drugs. The goal of the project is to avoid unnecessary stock-outs of essential medicines, as well as strengthen accountability and transparency for the drugs.

BACKGROUND ON HIPS

What is HIPS?

The Uganda Health Initiatives for the Private Sector (HIPS) project, launched in 2007, is funded by USAID and led by Cardno Emerging Markets USA, Ltd. It works with Ugandan businesses to find cost-effective ways to ensure access to vital health services for company employees, their dependents and surrounding community members. The project has four main objectives, described below.

Table 1: HIPS: Core Objectives

Objective 1	Expand access to and utilization of health services in the private sector
Objective 2	Establish Global Development Alliance (GDA) partnerships to leverage company-sponsored health services
Objective 3	Strengthen private sector employer organizations to support health initiatives
Objective 4	Implement innovative approaches to support orphans and vulnerable children through the private sector

Over 100 Ugandan businesses in 60 districts participate in the initiative, working with HIPS to design and implement comprehensive health workplace programs in the area of HIV/AIDS, tuberculosis, malaria, reproductive health, family planning and support to orphans and vulnerable children. Activities include expanding access to treatment for HIV/AIDS, tuberculosis and malaria as well as the development of behavior change communication materials and peer education programs for employees and surrounding community members. HIPS and their private sector partner clinics provide these services to a large population in Uganda. In 2011, HIPS' catchment area was approximately one million people, while approximately 102,000 received direct services through the program. In addition, the clinics provided HIV testing and counseling to over 61,000 people and provided free anti-retroviral medicines (ARVs) to approximately 4,500 people in 2010.

To promote sustainability, HIPS is also building the capacity of private sector employer organizations such as the Federation of Uganda Employers (FUE) and the Uganda Manufacturers Association (UMA) to undertake the support and partnership role that HIPS is currently providing to Ugandan companies. This includes connecting FUE and UMA to the MoH and the Ministry of Gender, Labor and Social Development to implement national private sector health policies, as well as strengthening their management capacity and service offerings to Ugandan companies.

Why Mobile?

HIPS opted to implement a mobile data collection platform to address their challenges around data collection, analysis and reporting. At the outset of the project, HIPS headquarters faced a number of logistical challenges in gathering data for monitoring and evaluation purposes. HIPS has over 100 partner clinics across 60 districts that are located in urban, peri-urban and rural areas. Using the paper-based data collection process, HIPS partner clinics were required to submit hard copies of their data each quarter. This was especially difficult for clinics located outside of Kampala.

The reporting process required data managers to record patient information in a ledger at each patient encounter, which was then aggregated into monthly indicators. These monthly indicators were then aggregated into quarterly ledgers for reporting purposes, which were sent to HIPS headquarters in Kampala. A member of the HIPS monitoring and evaluation (M&E) team would then enter this data into an electronic format for final reporting internally and to USAID. To ease the burden of reporting for

partner clinics in rural and peri-urban areas, the HIPS M&E team coordinated quarterly, one-day long meetings that all partner clinics were requested to attend. During these meetings, clinics were expected to turn in their previously prepared quarterly reporting forms. However, HIPS headquarters had difficulty collecting this information from partners each quarter, despite the HIPS M&E team's scheduled meetings. Often, clinics' reports were not prepared in time, or were missing indicators. During these meetings, HIPS M&E team's staff were expected to review the data and respond to any inaccuracies present, but there was not enough time to address these issues in one day. The process was time-consuming and expensive for both HIPS and the partner clinics. For HIPS partner clinics, the use of mobile would ease these burdens by allowing clinics to submit their information both monthly and quarterly, decreasing the amount of time necessary for reporting. This would give the HIPS' M&E team time to address any inconsistencies in reporting.

Figure 2: HIPS Clinic Data Manager Sorts Through Paper Records

Source: access.mobile, 2012

Similarly, HIPS wanted to implement a mobile system in order to facilitate information sharing between the private sector and district health authorities. It can be difficult for private facility staff to travel to the district offices and to the MOH for reporting purposes. Facilities usually receive little feedback, resulting in a lack of strong incentive to report the data. A mobile solution may address some of these challenges.

PROJECT DESIGN AND IMPLEMENTATION

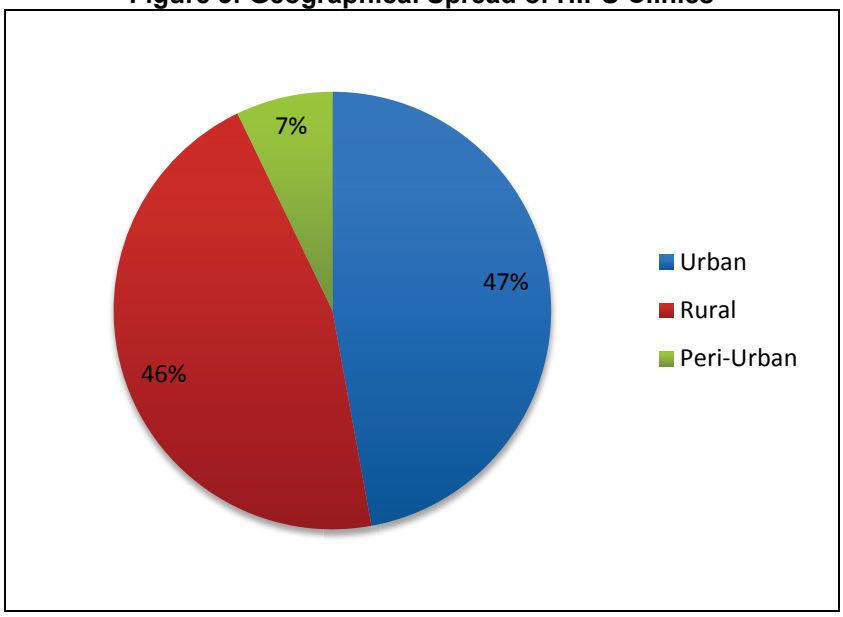
Introduction

In October 2011, access.mobile and HIPS began a one-year pilot program to improve the efficiency and effectiveness of HIPS' data collection process using access.mobile's mobile technology solutions. HIPS and access.mobile collaborated to customize two specific solutions, amHealth and amSupply. Through these two solutions, the pilot program tracked approximately 150 health indicators across HIPS clinics' focus areas.

HIPS Clinic Profile

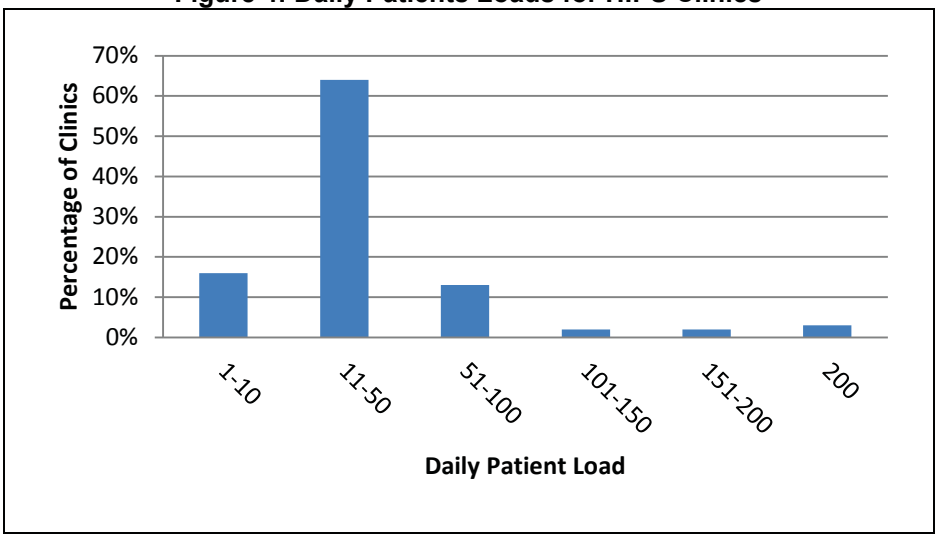
The HIPS project has approximately 100 partner clinics across Uganda. Of the 100 HIPS clinics, approximately 70 clinics participated in the mobile deployment. Many of the 70 sites had limited access to both computers and the internet. HIPS selected geographically dispersed sites: 32 rural clinics, 33 urban clinics, and 5 peri-urban clinics participated in the implementation. A baseline survey of clinics showed that more than 60% of clinics had a daily patient load of 11-50 patients. Twenty percent saw more than 50 patients a day, with 3% of those seeing over 200 patients per day. Approximately 75% had either one or two data managers responsible for reporting to HIPS. In the remaining 25%, 3-5 individuals were responsible for data collection and reporting for their facility. In the baseline survey, clinics reported spending approximately 7.2 hours per week on data collection and reporting. Over 70% of clinics reported difficulty submitting their data on time to HIPS. Similarly, 65% reported that they found the paper-based reporting process inefficient.

Figure 3: Geographical Spread of HIPS Clinics



Source: access.mobile, 2012

Figure 4: Daily Patients Loads for HIPS Clinics



Source: access.mobile, 2012

Technology Customization

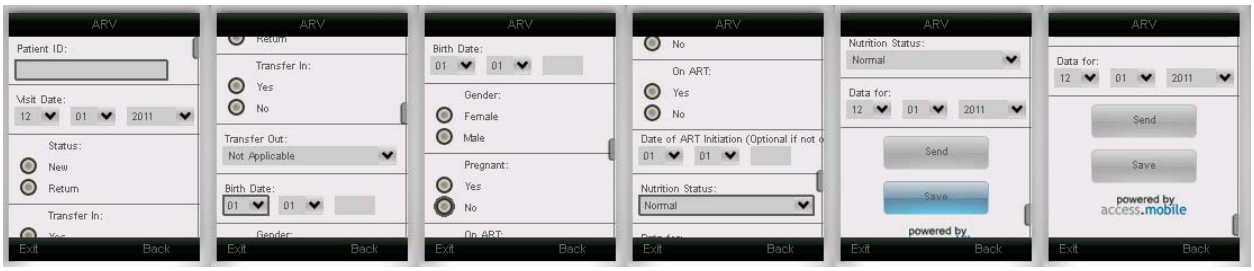
Prior to the technology deployment, access.mobile and HIPS worked closely and collaboratively to customize amHealth and amSupply to meet HIPS' data and reporting needs. HIPS needed over 150 indicators across several paper-based forms for health data and ARV tracking converted for mobile use. amHealth was customized to track HIPS clinical data indicators, while amSupply was customized to track ARV supply chain indicators.

For clinical data collection, HIPS and access.mobile created nine structured Java-based forms to track indicators related to: HIV, TB, malaria and pregnancy, male circumcision, family planning and HIV

testing and counseling. A similar set of six structured forms was created to track ARV pediatric and adult ARV drug regimen stocks.

In order to mitigate any confusion for clinic data managers, forms were designed to mimic HIPS' paper-based reporting data collection processes almost identically; thus, wording and placement of indicators on the Java-based forms remained the same as much as possible. The forms were composed of a mixture of free data entry fields, drop-down menus and radio buttons to enable simple and efficient data entry. An example of a Java-based form is illustrated in Figure 5 below.

Figure 5: Example of Customized Form Created for HIPS



Source: access.mobile, 2012

access.mobile also worked closely with HIPS to customize the web-based dashboard. HIPS administrators and clinic data managers used the dashboard to access information sent via the mobile devices. While HIPS administrators could access data aggregated from all 70 clinics using the web-based dashboards, users could access only their own data. The dashboards were designed to immediately display the information most important to HIPS administrators and clinic data managers, from ARV stock levels to reporting status on forms. Both users and administrators could export data as an Excel document from the website. At HIPS request, access.mobile developed an export functionality designed to mirror the format that HIPS uses to report indicators to USAID.

How Data Moves Through the access.mobile System

Once a user enters information into the form pictured in Figure 5 above and hits the "Send" button at the bottom of the form, all information the user has entered moves as one structured SMS to an SMS gateway. The SMS gateway then transmits it to access.mobile's dedicated servers. Although the information moves through SMS, the user does not have to enter a recipient phone number or short code; the application simply sends the information directly to the dedicated gateway. Once the information is sent through the SMS gateway to the dedicated server, it is available immediately on the web-based dashboards.

During the technology customization process, both HIPS and access.mobile placed significant emphasis on including high levels of security for all information moving through the system. Particular emphasis was given to indicators relating to individual HIV status and other sensitive personal information. To ensure the security of the data entered into the system, access.mobile password protected the forms on the phones and the log-ins on the dashboards. HIPS clinic users and administrators registered with the system and selected their own passwords. These passwords were used to access the forms on the phones and the information online. Key sensitive indicators on the forms were also encrypted when moving through the system. The names of individuals were not used on the forms or associated with patient IDs in the system.

SMS or GPRS?

Many mobile initiatives opt to use GPRS instead of SMS as the conduit to move data through the system because it is often less expensive than using SMS; however, the system used for the HIPS pilot initiative used only SMS. In the initial assessment before beginning the pilot, access.mobile found the GPRS network in Uganda to be unreliable. When the GPRS network is down and a user wants to send information, the application must use caching to keep a copy of that information on the device and then send it when GPRS network coverage is available. This can compromise the real time nature of the system, making it difficult to access up-to-date information as an administrator. For supply chain management, particularly for ARVs, real time data can be essential for decision-making. Although there was a slightly higher cost associated with sending the information as an SMS, the data entered on each form was sent as a single SMS, ultimately making the cost only slightly higher than that of GPRS. The SMS charge with Airtel was UGX 80 per SMS while GPRS was UGX 0.9 per kb. One SMS is approximately 140 bytes, making the GPRS cost per form submission about UGX 0.144.

Figure 6: Phone Used by HIPS Clinic Data Managers

Source: access.mobile, 2012

Devices

HIPS opted to provide clinics with dedicated mobile devices for the pilot. access.mobile's application can run on any Java enabled mobile device; however, deploying devices provided users with a uniform user experience and limited the troubleshooting necessary across multiple devices. HIPS and access.mobile selected the MiFone Q504 as the project device. This phone is a dual SIM feature phone with a full keypad. One SIM in this phone was dedicated to and budgeted for in the project, while clinic data managers could use their personal SIM cards in the second SIM card slot. HIPS covered the costs associated with data transmission. The users incurred no cost. Due to their extensive network coverage to nearly all areas where HIPS has a clinic or health facility, Airtel was used as the service provider for project SIM cards. Two sites did not have Airtel coverage, but could be reached by MTN; therefore, MTN SIM cards were provided to these sites.

Technology Deployment

HIPS and access.mobile deployed the mobile technology in two phases beginning in January 2012. By April 2012, the mobile data collection system was live nationwide and clinic data managers from all 70 sites were trained in how to use the system.

TRAINING

access.mobile and HIPS developed a user-training curriculum designed to cover use of the devices and system, as well as to explain any changes made to the forms in the technology development process. Users were trained in small groups of 12-15 people and provided with a User Support Manual.

Figure 7: HIPS Training Session on Mobile Data Collection System

Source: access.mobile, 2012

ONGOING SUPPORT

Throughout the pilot, two user support staff were available via phone and email to respond to user queries. All Airtel SIM cards associated with the project were placed in a closed user group. The closed user groups allowed SIM cards to be linked together, making communication via phone call free between those linked lines. SMS between lines in the closed user group cost 80 shillings per message. All HIPS and access.mobile users were included in the closed user group, which reduced the cost of communication and empowered clinic users to reach out to HIPS administrators and access.mobile support staff when necessary.

USER FEEDBACK AND PRODUCT ITERATION

One of the key elements of this mHealth initiative was significant user interaction. access.mobile created a relationship with users where they knew that if they ever had a question or issue, they could call access.mobile for support. Two dedicated user support staff supported clinics in reporting their data using the solution. This created a line of communication with clinic data managers that also became an ongoing approach to get feedback on product strengths and areas for improvement. As well, when new data managers joined HIPS clinics, access.mobile staff could take on virtual, phone-based, training to integrate them into the mobile system. Ultimately, feedback from users led to two updates during the course of the project that improved their experience in mobile reporting. Moreover, by access.mobile offering ongoing user support, this ensured that HIPS did not have to carry the burden of user queries, which could distract from their core work priorities.

LESSONS LEARNED

The following section details the lessons learned throughout the pilot, from the technology customization, rollout and implementation phases. These lessons learned focus on three key areas: technology, users of the system, including both HIPS administrators and clinic data managers, and data management.

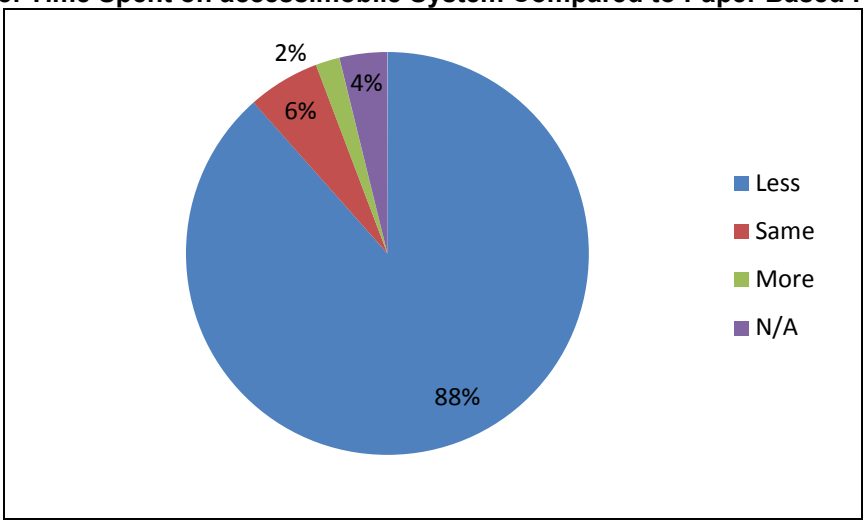
Qualitative and Quantitative Survey Results from HIPS mHealth Deployment

In order to assess the impact of the access.mobile mHealth product, the team conducted a baseline survey, followed by a final survey after the completion of the project. The surveys were designed not only to have a quantitative measure, the degree of the time saving and increase in efficiency as it relates to the HIPS data collection measures, but also to have a sense of the ease of use, customer satisfaction and a centralized feedback mechanism for the users. The surveys were conducted first on paper and then on mobile devices. All data were self-reported by data managers and while some of the numbers regarding time saved may not be exceedingly precise, the qualitative survey supports the strongly positive quantitative results.

The first clear finding from the baseline survey was that clinics found the paper-based reporting system difficult: 65% percent of respondents said it was inefficient overall with 70% having difficulty reporting on time, 53% having difficulty reporting completely and 30% having difficulty reporting correctly.

The introduction and use of access.mobile's system was well-received by the data managers because of ease of use and subsequently, time saved. 88% of respondents reported that they spent less time collecting and processing data using access.mobile's system than they did using the paper based system, 6% spent the same amount of time, 2% said they spent more time and in 4% of the clinics, we were not able to make a comparison with the baseline (Figure 8). Worth note is that the ease and inherent mobility of the mobile system allowed the data managers to collect significantly more data than with the previous, paper-based data collection. That is, data managers were spending significantly less time collecting more health data. Users indicated that the system is convenient and the mobile phone offers flexibility so work could be done from anywhere.

Figure 8: Time Spent on access.mobile System Compared to Paper Based Process



Source: access.mobile, 2012

For monthly reporting of data using access.mobile, respondents reported significant time savings: 50% of the clinics saved over 16 hours per month, 33% of clinics saved over 24 hours per month and 10% of clinics had over 90 hours per month.

Finally, the data transport and security features of access.mobile's system were widely appreciated by users as they eliminated the constraints brought on by remote geography. Users indicated faster submission time than the paper-based system because there was no need to physically transport the forms to HIPS headquarters. Upcountry users were particularly enthusiastic as it was often difficult to send someone to HIPS in Kampala from the more remote locations. As for security, the transport of paper

would often introduce the risk of loss or damage to the paper data and the respondents responded positively to being able to send the data over secure encrypted data channels.

Technology

EVEN MINIMAL CHANGES TO INDICATORS CAN CAUSE CONFUSION AROUND REPORTING USING A NEW MEDIUM.

Overview

As previously discussed, HIPS and access.mobile worked collaboratively to customize access.mobile's pre-existing mobile solutions to meet HIPS' data collection needs. This process began in October 2011 and concluded just prior to the rollout in January 2012. HIPS administrators shared all the paper-based forms the project was using to capture information from their partner clinics. HIPS administrators also explained the process that the average clinic data manager uses to report.

With this information, access.mobile created a proposed structure for the mobile forms. For the most part, conversion to mobile was not a difficult process; however, some indicators HIPS was collecting were wordy when converted to mobile. Wordy indicators created lengthy forms that we believed were not user-friendly on the device we deployed for the project. For the few indicators this issue applied to, words deemed "non-essential" to understanding the indicator were removed, or the question was reworded. Similarly, related indicators were split onto individual forms (i.e. all TB related indicators on one form, all Malaria indicators on another, etc.). For the most part, this format followed the existing structure of the paper forms, but some indicators were moved during this process. Two medical doctors on access.mobile's staff, including a Ugandan medical doctor, ensured that all indicators met HIPS' requirements and that the clinical and epidemiological accuracy of the indicators collected remained throughout the process. When the conversion from paper-based to mobile was complete, HIPS administrators approved the final versions of the forms and any changes that were made to the wording of the indicators in the process.

Outcomes

In summary, there were very few issues related to understanding the mobile forms or misinterpretation of indicators. However, one clear issue arose around an HIV indicator that was moved between forms. This movement affected the data collection process for one quarter and required follow-up with many users. As both the developer and administrative support for the technology, access.mobile was unable to anticipate clinic data managers' altered interpretation of this indicator. However, once the problem was identified after data anomalies began to appear, HIPS and access.mobile staffers contacted the clinics to explain the meaning of the indicator and had them resubmit data. No further issues with data arose as a result of this confusion.

Implications for Future Initiatives

First, it is important to limit indicator changes as much as possible in a mobile technology adaptation process. When it is necessary to make changes, word choice and placement should be carefully considered. Training sessions are also an opportunity to ensure that all users understand all indicators. It is worth note that this was done during the HIPS trainings, but as we experienced, issues still may arise and therefore follow-up and continued support are essential. As HIPS and access.mobile discovered, altering even one word or the placement of the question can change the meaning of an indicator completely. Similarly, if changes must be made, any differences should be comprehensively communicated to users. As access.mobile learned, merely explaining the change was enough to stop the data anomalies.

FOR SUCCESSFUL UPTAKE OF MOBILE-BASED DATA COLLECTION, TOOLS SHOULD MIMIC PRE-EXISTING PROCESSES.

Overview

When determining deadlines for reporting using mobile devices for data collection, HIPS and access.mobile mirrored the prior deadlines used by HIPS for paper-based reporting. Switching from a paper-based to a mobile-based system was an unprecedented change for HIPS clinics. The hypothesis was that if the requirements around reporting times were also changed, clinic and data managers might become confused and reporting could decrease; by keeping the reporting deadlines the same, there would be one less behavior change for the clinics and users.

At the outset of the project, HIPS partner clinics were using a paper-based tracking system to record information at every patient encounter and aggregating this data into monthly ledgers. The monthly ledgers were then aggregated into quarterly ledgers. HIPS administrative staff would then collect the quarterly ledgers and hand-enter that information into their database. The mobile system initially also followed the process of capturing some information at patient encounters and some on a monthly basis, although the patient model was later abandoned.

Outcomes

Ultimately, access.mobile found that the final output on the mobile forms was very close to HIPS' paper-based reporting with only a few required changes. This meant that very little changed in the wording of indicators or the process. As a result, information began moving through the system the day after it went live, indicating that clinic data managers began using the system to enter information immediately. This high uptake was also reflected in reporting rates on the monthly forms. HIPS reported that clinics reported on monthly indicators more comprehensively the first quarter the project was live than ever before.

Implications for Future Initiatives

The hypothesis around the behavior of clinic data managers was correct. Introducing a new system and keeping existing behaviors the same was a benefit overall to the project. In part by keeping the reporting requirements the same, we were able to increase reporting rates and ensure data entry. As much as possible, future mobile initiatives should plan to mirror existing behaviors and processes.

EVEN USING MOBILE DEVICES, TECHNOLOGY LIMITATIONS MAY REQUIRE DIFFICULT DECISIONS BETWEEN THE QUALITY OF DATA COLLECTED AND LEVEL OF EFFORT REQUIRED TO CAPTURE IT.

Overview

When access.mobile and HIPS developed the initial deadlines for clinics to report health indicators, the process was designed to minimize behavior change. This included entering specific indicators for every patient visit. Both access.mobile and HIPS wanted to ensure data quality through the mobile system. Prior to implementation of the mobile process, each clinic aggregated the patient data monthly then quarterly through a paper-based process. By requiring clinic data managers to enter information about each patient encounter on their mobile devices, a comprehensive set of data related to patients would be recorded for further analysis. This information could then be assessed using access.mobile's data analytics to produce monthly and quarterly reports.

In this pilot, each clinic was allocated one device to manage cost. This was the case even if the clinic had more than one data manager. Based on feedback from the clinics during the course of the pilot, partner

clinics with low patient volumes did not have challenges reporting on every patient encounter. However, for clinics seeing over 100 patients per day and with only one device, entering information about every patient encounter became an overwhelming task for data managers. Data managers at these clinics simply did not have time to enter all of the information required. Ultimately, data managers at high volume clinics needed support to enter their data to meet reporting deadlines and were frustrated with the process.

At the clinic data managers' request, access.mobile and HIPS explored other solutions to this problem, such as developing functionality that would auto-populate certain information about a patient when their ID number was entered. The proposed functionality would apply to fields that always remain the same with a patient such as birth date and gender. This functionality adjustment could save larger clinics significant time for data collection. Unfortunately, based on the type of device access.mobile and HIPS used, all of the options explored that would enable auto-populating fields accurately, rapidly, and securely were too slow. For clinics with high patient volume, deploying devices to multiple data managers, each with a mandate to track specific information, could have helped resolve the problem, as baseline survey results indicate that the average clinic has two data managers.

Outcomes

Both user feedback and comfort with the system were instrumental to the success of the pilot. The goal was to find a solution that fit into the behaviors of users while still guaranteeing the same quality of data. Ultimately, access.mobile and HIPS decided to shift the clinics on to a reporting timeline that allowed them to send aggregated information on patient encounters on a quarterly basis, which mimicked the paper-based process HIPS used before adopting mobile technology for data collection. Based on feedback from numerous HIPS clinics, data managers were happier with this model and data reporting for quarterly HIV indicators increased. Though the benefits of a patient data model through mobile were lost, the necessary indicators were all available and other data validation techniques HIPS had been using throughout the course of the project were used to ensure the quality of data. Ultimately, utilizing user feedback and responding with the appropriate solution led to higher uptake of this element of the mobile forms.

Implications for Future Initiatives

Although data quality is essential to mobile projects, real world workflows and the implications of additional work must also be considered when determining requirements for mobile projects. Although implementing mobile solutions can help with data collection and analysis, save time and increase efficiency, it is not a silver bullet that will solve all problems related to data capture immediately. For this particular mobile implementation, constraints such as cost, limitations of the mobile network and data collection behavior as well as workload, limited the feasibility of the patient data collection approach. The interplay of all of these factors must be considered in the planning process to develop a solution that is functional for the implementation environment and target users.

DATA COLLECTION TOOLS AND MOBILE SOFTWARE WILL REQUIRE UPDATES OVER THE COURSE OF THE PROJECT.

Overview

HIPS and access.mobile developed mobile versions of the forms partner clinics were using for reporting based upon the 2011 requirements. These data collection forms were the only tools available at the time; changes to the forms for the 2012 versions had not yet been determined. When the 2012 tools became available, several indicators had been added and several had been removed. Similarly, Uganda's National ARV Guidelines changed over the course of the project. As it was important to capture all of the correct indicators comprehensively and accurately, access.mobile needed to update the software on the phones in

real time when these changes occurred. This carried time implications for staff and cost implications for the project.

Outcomes

access.mobile planned for the necessity of updating forms on users' phones; however, the cost associated with updating the forms was unforeseen. As a result, the updates were technologically possible but carried a significant and unanticipated cost that access.mobile absorbed for the success of the project.

Implications for Future Initiatives

It is inevitable that in these mobile technology rollouts, data being captured will need to be adjusted. As national health guidelines evolve, determined by Ministries of Health, and as programmatic decisions are made regarding indicators to track, adjustments will need to be made to mobile forms. Ultimately, the ability to make these adjustments in a cost-effective manner is a technology requirement that is important for any provider. As well, the level of effort necessary to make these adjustments, particularly when dealing with programs that are tracking several indicators, should be planned at the beginning of a project as an ongoing area of support. It is important to conduct a cost analysis at the project outset to determine the overall cost associated with these updates, both in human resources and in financial costs.

Users

USER TRAINING IS A CONTINUOUS PROCESS DUE TO HIGH STAFF TURNOVER.

Overview

access.mobile and HIPS developed a comprehensive training curriculum for clinic data managers at the outset of the pilot. The curriculum was implemented in a one-day-long training session. Six training sessions were held, with approximately 12-15 users attending each session during which mobile devices were distributed. Users were taught how to use the specific phones, how to access the data collection forms, as well as how to enter, send and save information using the devices. The majority of data managers participating in the training sessions were mobile literate and adapted to the mobile system quickly. As previously mentioned, many began entering information the day after attending the training sessions. As a result, training sessions were planned only for the project rollout with no follow-up trainings scheduled; for users in need of additional support or help, access.mobile staff were available for further training both in-person and remotely.

Outcomes

Shortly after launching the pilot, access.mobile user support staff discovered that the high turnover rates common in clinics in Sub-Saharan Africa also applied to the private sector clinics participating in the project. Over the course of the one-year long initiative, access.mobile user support staff estimate that five clinic data managers left their posts and were replaced by new staff. Many of the former clinic data managers did not train their replacements in how to use the system and new clinic data managers instead received the training manual. access.mobile support staff were available for remote and in-person support to answer any questions that new and existing data managers had. For clinics located in Kampala, retraining the data managers was easy if they needed an in-person session; however, for those users outside of Kampala and in need of in-person training, this was a more difficult process that was conducted over the phone.

Implications for Future Initiatives

It is important to view the user training process as ongoing and continuous due to staff turn over. Mobile projects should plan a midterm training session to introduce any new staff as well as any existing staff requesting or requiring re-fresher training on the device, system and overall process.

DEVELOP A COMPREHENSIVE POLICY THAT COVERS MISUSE, LOSS OR THEFT OF DEVICES AND OTHER ISSUES RELATED TO THE MOBILE PHONES.

Overview

In order to cover the cost of SMS in the pilot and to facilitate communication between access.mobile, HIPS administrators, and clinic data managers, everyone receiving a project device was placed in a closed user group hosted by Airtel. The closed user group allowed all users to make calls to each other for free within the group. SMS messages within the group cost 80 shillings per message. It also enabled clinic data managers to send all of their forms to access.mobile's system via SMS.

While the closed user group had the benefit of facilitating communication between clinics and administrators, it also had associated challenges. Users were given a maximum number of Ugandan shillings to use for data transmission each month. The telecommunications provider allowed each clinic data manager to use this pre-set amount; however, the closed user group was not locked for outside calls. While internal calls were free, those made to outside parties were not. Many users abused the lines, calling friends and family and participating in promotional SMS contests. The closed user group should have been designed to prevent usage outside of the closed group; however, this was not the case and created a challenge. access.mobile was able to work with Airtel to create a solution that set limits on the closed user group thus barring users from exceeding their call and SMS monthly limit. Despite coming to a solution, the excess charges for personal calls and SMS messages from users represented a major and costly issue in the pilot.

Although there were few issues with phones being stolen or lost, several were broken over the course of the pilot. One user ironed the phone in the pocket of his pants, while another dropped and shattered the screen. At the project outset, HIPS purchased a surplus stock of phones in the event of loss or damage and was therefore able to replace the devices. No clinic data manager lost or broke two devices. HIPS also required all staff to sign a waiver stating that at the end of the project, all phones would be returned to HIPS in order to receive the phones. The waiver did not, however, include stipulations for misuse of the devices.

Outcomes

Users who reached the data limit were not able to send information using the mobile system, but instead had to use the devices to call HIPS administrators and report their indicators verbally. This issue was not clearly resolved at the end of the pilot, although users who reached the Ugandan shillings limit often did not repeat this behavior the next month. Ultimately, although the cost limit was low, misuse of the devices became a significant cost in the initiative. All users who lost or broke a device were provided with a new one.

Implications for Future Initiatives

A clear policy must be set for responsibility of the devices, as well as consequences for misuse. These consequences must not be viewed as prohibitive for data managers to enter information. For example, if access.mobile and HIPS required clinic data managers to pay for the overage costs incurred due to the misuse of the phones, other data managers may have stopped reporting information out of fear that they

would reach the cost limit and be required to pay for costs associated with the project. Therefore, this is not a reasonable consequence for data and/or airtime misuse in this type of initiative. However, it is important that device recipients understand that there will be consequences for deliberate misuse of the system or repeated loss or mishandling of the device.

AS A MOBILE PROJECT CONTINUES, IT MAY BECOME INCREASINGLY IMPORTANT TO PROVIDE INCENTIVES TO DATA MANAGERS FOR CONTINUED DATA ENTRY.

Overview

In the pilot's planning phase, HIPS and access.mobile discussed whether it would be necessary to provide the clinic data managers with incentives to enter information. In order to incentivize clinic managers to enter data, HIPS and access.mobile selected a dual SIM phone for data manager use. Data managers would have one SIM dedicated to the project, while they could use their own personal SIM in the second available SIM card slot. HIPS and access.mobile believed that use of the full keypad, color screen feature phone, in combination with the time that would be saved by using the mobile system would incentivize clinic data managers to enter data.

Outcomes

Initially, data managers were very excited to receive the phones. At an initial training, the data manager from a site known for late reporting told HIPS staff that he would now report on time because he liked the phone and did not want it to be taken away. Overall, high levels of reporting remained the case throughout the pilot. However, access.mobile user support staff found that some clinic data managers would turn the phones on only once per month to enter their data when a deadline was approaching. Due to the fact that some data managers were not using the phone regularly, they would sometimes forget to enter information at all.

Implications for Future Initiatives

Although the dual SIM phone did incentivize many data managers to enter information, other incentives should also be considered to ensure that users would continue to enter information monthly when the excitement of receiving a new device has worn off. Incentives can be low-cost, like mobile top-ups to personal lines for complete and on-time reporting. This will likely ensure that users will continue to enter information while providing a cost-effective solution for data entry incentives associated with delayed or incomplete reporting.

Data

THERE IS A NEED FOR MOBILE-BASED FEEDBACK SO THAT SITES CAN KNOW THEIR REPORTING PERFORMANCE.

Overview

One of the benefits access.mobile and HIPS provided to clinic data managers was the ability to access their own data on the web-based dashboard. This served two purposes. The first fundamental principle was that every clinic should have access to their data if they used the system. In the event that data managers could visit an Internet café nearby, they would be able to confirm that HIPS and access.mobile had received their submitted data. It was equally important for clinics to view the system as reliable. If their information was received in real time and this was reflected on their web-based dashboard, data managers would likely continue to enter information. Second, HIPS and access.mobile wanted to ensure

that all clinics, not just HIPS administrators, could access the Excel versions of the documents for their own record-keeping purposes.

Outcomes

Over the course of the pilot, access.mobile and HIPS found that many clinics did not have access to a computer or to the internet. Although some did check their indicators using the web-based dashboard at Internet cafés, most did not. Many would call the user support line to ensure that their indicators had been received, despite the confirmation message displayed on the phone when information was sent.

Implications for Future Initiatives

Although the web-based dashboard did not help all clinics in information management, it did help some. For the remaining clinics with no access to computers, a mobile-based access system should be developed and implemented.

WHEN INTEGRATING NEW MHEALTH TECHNOLOGIES, BEHAVIOR CHANGE FOR DATA MANAGEMENT IS TO BE EXPECTED FOR BOTH CENTRAL ADMINISTRATORS AND FIELD-BASED USERS.

Overview

Although access.mobile and HIPS designed the mobile implementation to mirror existing data collection behaviors, the rollout required behavior change for both data managers at health clinics as well as HIPS staff. HIPS administrative staff shifted to a mobile and electronic system for tracking clinic data. They were expected to log on to the web-based dashboards and check reporting rates each month. This was a significant alteration from the paper-based process for HIPS staff.

Outcomes

HIPS administrative staff and access.mobile user support staff had a collaborative relationship as both parties were committed to the success of the project and willing to alter work processes as necessary. This was a cooperative process that HIPS administrators became more comfortable with over the course of the pilot project.

Implications for Future Initiatives

It is important for the mobile solutions provider to act as a true partner during the uptake phases of the rollout. Providing HIPS administrators – who were receptive to use of the system – with extra help during key reporting phases ensured the success of the project and enabled HIPS to become comfortable with managing data independently.

CONSIDERING RETURN ON INVESTMENT IN MOBILE TECHNOLOGY DEPLOYMENTS

In considering mobile technology deployments, understanding up-front and ongoing cost implications and return on investment is critical. As seen in the HIPS – access.mobile mHealth deployment, there can be substantial up-front inputs in terms of cost, time and user engagement to ensure the adoption of a new technology. One can also observe that the mobile solution in this specific initiative drove substantial value in terms of time-savings and convenience for end users and HIPS, despite some areas where we had to adapt to unforeseen challenges. 88% of clinic data managers reported that the use of access.mobile's data collection solution saved them time in reporting to HIPS.

The best designed mHealth initiatives will require substantial investments and program evolution to get a technology off the ground in a way that drives ongoing value for field based users and programs. There is a need for further study of long-term mHealth initiatives to quantify return on investment over time. This mHealth pilot was one year and thus could not generate such data for longer-term assessment, although various hypotheses can be generated. Worth note, there is significant variation in different mobile initiatives so there is no formula for planning. Each initiative should be assessed with regards to how mobile technology can improve its goals and in its context. While initial inputs may be substantial, significant return on investment can accrue over time as a solution is adopted and then scaled. There are some key categories of issues that one can consider to support the planning process from a technological, programmatic, scale and cost perspective in the short, medium and long term.

Telecommunications Assessments

In the HIPS – access.mobile mHealth rollout, it was important to do an initial assessment of network connectivity across all of HIPS partner sites across Uganda. This involved meeting with various telecommunications carriers and also talking to clinic data managers regarding which networks were most pervasive in their geography. This allowed access.mobile to ensure that all clinics had access to a telecommunications network, which was an underlying prerequisite for the mobile deployment to be effective for every clinic. As a program scales, it is likely that multiple carriers or aggregators may need to be engaged to ensure that all users have network coverage.

Product Life Cycle

An important element of ensuring return on investment from a mobile initiative is that users actually use the technology deployed. The implication of this basic point is a focus early in a program on gaining feedback from users and improving the product to meet their needs. Usually a product will require rapid feedback loops early on to enhance the solution based on unforeseen user requests and bugs. After some time, the product iteration cycle may slow. Therefore, it is important to budget early in a program for this ongoing product adaptation process. But the point is that this up-front investment will pay for itself because as the product increasingly meets user needs, it will experience a higher adoption rate. This adoption rate helps drive economies of scale, which in turn drives return on investment in the medium and long term. Product enhancements should be embedded in the life of a mobile initiative.

Device Strategy

Depending on the mobile initiative, the cost of deploying a standard device may be justified. In other cases, engaging users through their existing device may make sense. Each program should assess the optimal approach based on resources available, the technology deployed and other criteria. HIPS, in its discussion with access.mobile regarding program planning, decided that it made sense to have all clinics on the same device. This enabled a more cohesive approach to training sites on the technology because everyone was using the same device. As well, it made troubleshooting any device related technical matters more cost-effective for HIPS and access.mobile.

Product Maintenance

For any solution, ongoing product maintenance is needed to ensure the system functions appropriately for users. And these maintenance costs increasingly may become a factor as an initiative scales, depending on the underlying technology used. The industry has seen several programs that have not appropriately budgeted for ongoing maintenance costs, thus rendering a product ineffective over time due to the inability of bugs to be fixed and backend upgrades.

Ongoing User Support

In this mHealth initiative, HIPS and access.mobile realized that having ongoing user support was a central factor for the program. When a technology is rolled out, having local user support is important to build rapport with users and ensure that their needs are being met. This cost can also diminish per user over time, but can also drive product insight (described above) and higher adoption rates. In the medium and long term, as a program scales, investing in user support can pay for itself.

"TAKEAWAYS"

Based on lessons learned from our mHealth pilot, below are 5 key "take-aways" to consider.

1. *National Health System Integration is Critical*
    a. It is important to integrate private sector data collection efforts with national health IT systems. Many governments in East Africa, including the MoH in Uganda, are using DHIS2 so this type of integration capability is important for Ministry buy-in. Public – private partnerships are a critical part of enabling these types of integrations.
2. *Long-Term Investments Drive Significant Return on Investment*
    a. Early stage and significant investments are needed up front to ensure that mHealth technologies are appropriate for the context and drive true value for users. However, these investments can yield substantial results in terms of tangible efficiency gains and return on investment accrues over time.
3. *Focus on Users and Driving Value Across the Ecosystem*
    a. A focus on driving value for end users will ensure continual and scaled impact over time. It's not just about building and maintaining technology, but it's about continual product innovation through a relentless focus on product iteration. The private sector has the incentive to do this but the public sector, through product financing, often has a problem with this.
4. *Data Quantity Does Not Ensure Data Quality*
    a. Data quality is critical because it enables effective decision-making vis-a-vis program goals. Mobile data collection can increase electronic data volumes by orders of magnitude. However, increased data quantity does not guarantee improved data quality or usability. Technology can play a key role in improving data quality through data validation functionality and other approaches. But other drivers of data quality are also important, such as data collection tools and approaches, training, and human behavior.
5. *Continual Product Assessments Based on Data are Critical*
    a. In this program, we generated data on user behavior, some of which has been shared in this report. It is essential to be able to derive programmatic decisions in mHealth as well as product innovation based on data.