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Collecting Integrated Disease Surveillance and Response Data through Mobile Phones

Luba PASCOE[1], Juma LUNGO[2], Jens KAASBØLL[3], Ismael KOLELENI[2]
[1] *Dar Es Salaam University College of Education, P.O Box 2329, Dar es salaam, 255, Tanzania*
Tel: +255 022 2850415, Fax: +255 022 2850952, Email: lubapascoe@yahoo.com
[2]*University of Dar Es Salaam, P.O Box 35091, Dar es salaam, 255, Tanzania*
Tel: +255 022 2410657, Fax: +255 022 2410029,
Email: jlungo@udsm.ac.tz, ismailkoleleni@gmail.com
[3]*University of Oslo, P.O Box 1080 Blindern, Oslo, 0316, Norway*
Tel: +47 22852410, Fax: +47 22852401, Email: jensj@ifi.uio.no

Abstract: This study focuses on improving the routine reporting of health data by identifying the challenges associated with timely reporting of routine data from the primary health facilities to the district and determines how mobile phones can be used to overcome the problem and thus enhance information use for action at all levels of the health system.

Findings have indicated that, timely reporting of routine health data face challenges such as poor infrastructure, remoteness of the health facilities from the district where they have to submit their reports as well as transport costs that health workers have to incur in order to submit their report. Facing these challenges, this research revealed that the use of mobile phone application built in the District Health Information System database can provide an easy, cost effective and reliable means for reporting of health data. Over a period of 5 months, the data completeness and timeliness improved from 50% to 89%. This implies that the routine reporting of around ten data elements through mobile phones is feasible. The study recommends rigorous supervision, which among other things checks for data quality and correctness.

Key words: Integrated Disease Surveillance and Response, Routine reporting of health data, Information and Communication Technology, Mobile phone, mobile reporting.

1. Introduction

A growing number of developing countries are using mobile technology to address health needs. The mobile Health field is remarkably dynamic, and the range of applications being designed is constantly expanding. Key applications for mobile technology in health in developing countries are [1]:

- Education and awareness
- Remote data collection
- Remote monitoring
- Communication and training for healthcare workers
- Disease and epidemic outbreak tracking
- Diagnostic and treatment support

In 1998 the World Health Organization adopted the Integrated Disease Surveillance and Response (IDSR) Strategy linking community, health facility, district and national levels in the African region. IDSR implies that health workers must identify cases of priority infectious diseases and should report them regularly to the next level of the health system. This enables the suspected cases and outbreaks be investigated and confirmed immediately, using laboratory confirmation whenever possible so that resources and personnel can be mobilized to implement appropriate outbreak or public health response. In Tanzania, cases and deaths for <5 years and 5+ years for diseases such as cholera, measles, plague, yellow fever, animal bite and rabies are to be reported weekly from more than 6,000 health facilities.

The IDSR strategy emphasizes on the importance of feedback to the levels that reported the suspected cases or outbreaks so as to ensure their continued cooperation and to inform them of the investigation and response results.

Completeness and timeliness of IDSR reporting have been poor, often due to slow data flow from the facilities added by poor transport mechanism. In the rainy season, transport is a major challenge in many rural areas where most of the health facilities are situated, thus difficulties in submitting their reports to the districts on time. An alternative option is to use mobile networks available in most of rural areas. A large number of mHealth projects have been launched, but the large majority have been research projects, often disconnected from the official reporting systems [2].

A noticeable exception is a surveillance system for reporting through SMS in Madagascar, where a timeliness rate of 89% within 24 hours has been achieved [3]. In Uganda, hundreds of health workers have used PDAs provided by the Ugandan Health Information Network to collect health data in the field. Not only has this solution resulted in significant cost savings (25% in the first six months) but health workers report increased job satisfaction due to the greater efficiency and flexibility provided by the technology [1]. Also a study from India points to users who would not return to the paper reporting, since the mobile phone reporting saved time [4].

About half the Tanzanian population have mobile phones [5] and the Global System for Mobile communication (GSM) network covers areas where the large majority of the population lives [6]. Conditions were therefore favourable for establishing IDSR reporting through mobile phones in Tanzania.

2. Objectives

The objective of this study is to find out

1. Whether mobile phones can be used to improve the timeliness and completeness of IDSR weekly and monthly reporting, and
2. How mobile phone reporting is received by the health worker, and
3. How it impacts their work.

3. Methodology

The study was done in two districts in Pwani region in Tanzania; Kibaha town district with 39 health facilities and Kisarawe district with 20 facilities. Most of the roads in these districts are impassable with motor vehicles during the rainy season.

The action research project consisted of finding requirements and testing of the application. Data collection was done by interviews of 15 health workers in the facilities and district offices, getting them to talk through step-by-step on what they do for IDSR reporting. Document analysis encompassed the facility level reporting tools such as ad hoc forms, registers and checklists. Observations through fieldwork and the experience of living there become an important addition to the other data gathering techniques.

After conducting data collection, descriptive analyses (analytic memos) were written, to help formulating preliminary analyses of the data.

4. Technology Description

The district office is entering statistical health data into a national database developed from the District Health Information System 2 (DHIS2) platform [7]. This is a free, open source platform, which can be tailored to any reporting needs, and where the user organisation is in charge of defining the data elements and indicators of their installation.

The DHIS2 also has a mobile phone module, so that data can be reported from a phone and entered directly into the national database and data can be returned to the phone. This architecture thereby allows extending the national database with a mobile phone interface into villages without electricity. In this sense, it differs from many stand-alone mobile phone applications, where the data is not distributed further than the receiving computer.

The technology works on the lowest cost Java enabled phones. The phones have a built in application, which transmits SMS to the server. The server has an installed GSM modem and it converts the SMSs and imports the received data into the DHIS2 database.

The mobile phone module of DHIS2 was used for developing the handset application. The functionality is presented to the user in a series of steps. After selecting the date, the user needs to enter the data element values in a sequence, see Figure 1. The form has thirteen data elements which report data on the cases of diseases for less than 5 years, cases of diseases for above 5 years, Deaths due to the disease for less than 5 years and Deaths due to diseases for above 5 years.

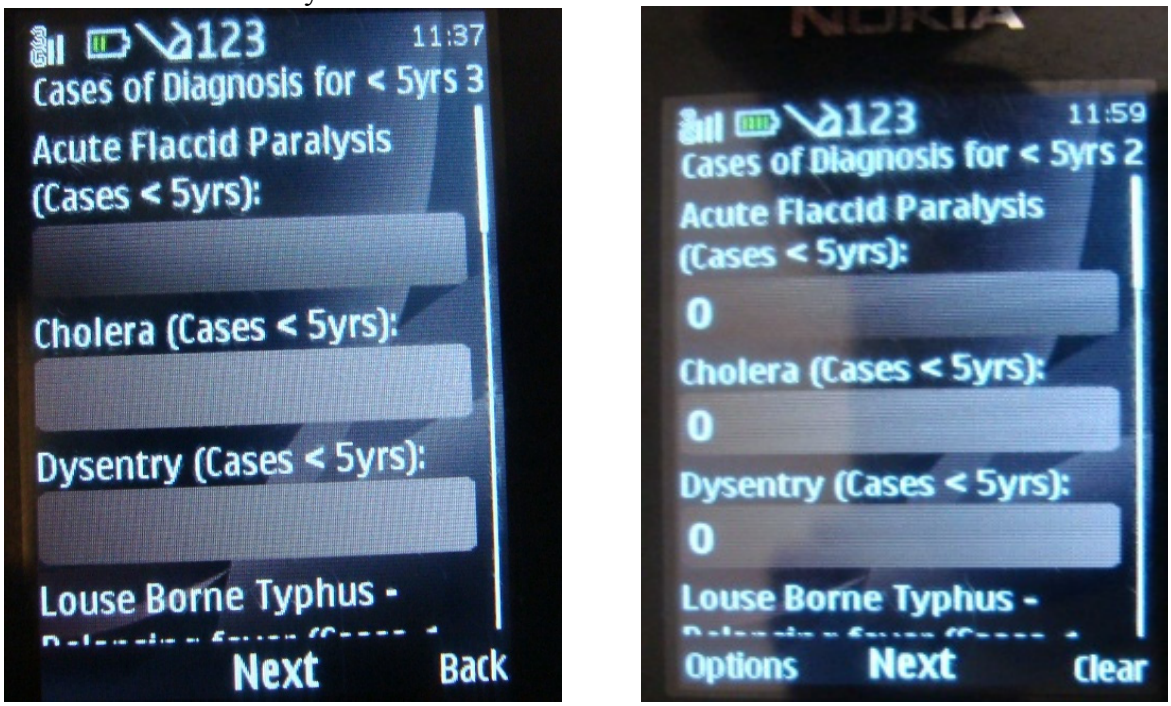

Figure 1: An empty and filled form for the cases of diagnosis for less than 5 years of the IDSR application on a Mobile phone.

When all the fields are filled on the forms and the NEXT button on the last page is selected, a page appears that asks if you want to send the report as seen in Figure 2. To send the message click on the YES button and the message will be sent.

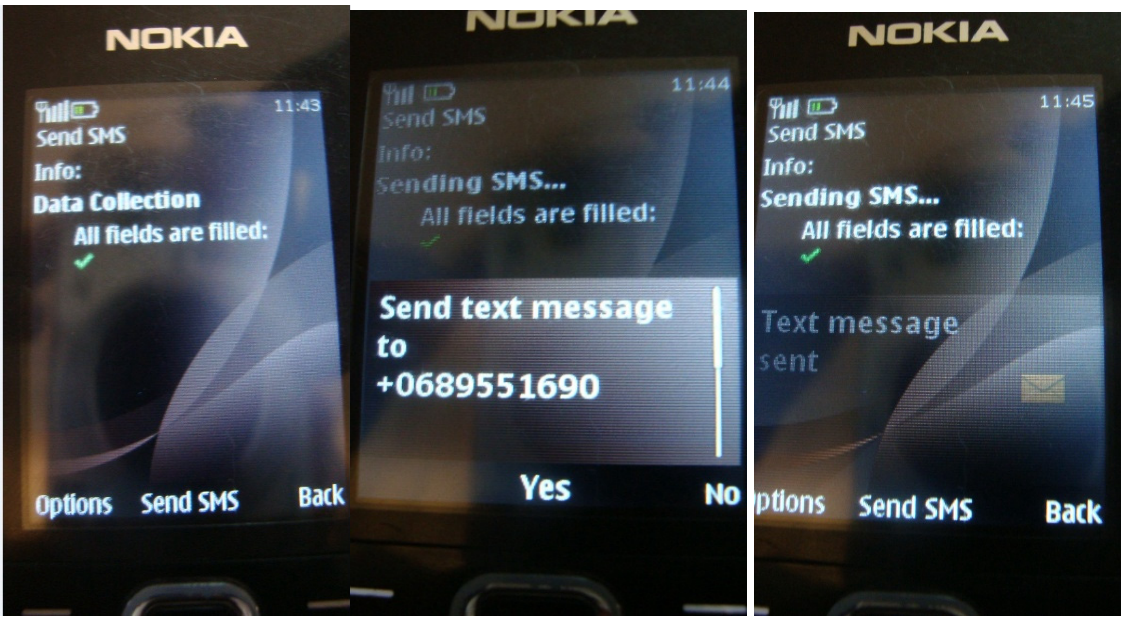

Figure 2: Figure showing the pages for sending the reports of the IDSR application.

At the server side, automatic import of messages occurs when the SMSs get received from the phones while the SMS Service is running. If the service is not running, the messages will be stored in the computer and can be imported when starting the SMS Service software.

Upon receipt of the weekly report, the DHIS2 application sends an acknowledgement SMS to the health provider. If the report is not received during the week, the message below is sent to the health provider.

"Your report for this week is not received"

5. Results

During the implementation of the mobile module, health workers were introduced to the report forms that resembles the normal forms and has the same data elements, the only difference being it is in the mobile phone.

After the training, most facilities were able to adopt the new reporting means through mobile phones for the IDSR data. Even though they had to fill in the paper forms for the IDSR reports as well, the reporting of this weekly data was sent by mobile phone and the paper reports were submitted to the districts with the monthly reports.

Transport of a paper form was substituted by the pushing of the buttons. The health workers admitted to have more time to perform other clinical duties rather than spending time submitting the reports physically. This has been a relief as most health workers perceive that their task is clinical, rather than reporting.

During the reporting of the data the health workers faced network problems, this is obvious due to the fact that the country has GSM coverage gaps. In some areas there are certain points that have a good coverage, thus in order to send the reports, the facility health workers have to be in those points when they want to send the reports so as to ensure delivery of the message to the database at the district office.

The implementation faced challenges on how and who will recharge the credits for the mobile phones. It was obvious that it is difficult for the facility personnel to recharge vouchers to the phones on their own, as it is a bit expensive.

Some health workers were a bit discouraged with the new system due to challenges such as airtime and electricity but were not ready to go back to the old system thus they struggled to adopt new changes by working in both systems. During the research period the

project members observed this problem and decided to incur the cost of reporting through mobile phones at least for as long as the project is still in progress.

Before the mobile intervention, health workers used to report routine health data late to the districts, and these workers had a lot of reasons for their late reporting and follow up was minimal. With the mobile application this practice had to be changed and health workers had to make sure they report on time.

Since the application is stored in the phone, the user can accidentally delete it. This poses a challenge because once deleted the user has to request assistance from the DHIS2 team so that they can reinstall the application. The possibility for the reinstallation to be immediately after deletion is minimal as these health workers stay in the remote areas where access is a problem.

At the districts, they received reports from the facilities, that is, the IDSR reports that were sent through mobile phones and these reports were directly stored into the DHIS2 database at the district level. Now, the district data officers had to analyze these reports and retrieve the relevant data from the DHIS2 for further processing and exporting to the regional level.

Technical challenges have been encountered during the implementation. There is a need for competencies in mobile-based applications development, to permit the development of mobile phone based data entry forms as well as the need for DHIS2 team to have knowledge of the server side. Such competencies are limited in Tanzania.

Also incompatibility of platforms was another technological challenge faced as some of the modems from different providers were not compatible.

6. Business Benefits

The reporting frequency improved from 50% before the intervention to 89% three months later, see Table 1.

Table 1. Completeness and Timeliness of Reporting

Month	Completeness	Timeliness
January	89%	0%
February	89%	0%
March	89%	89%
April	89%	89%
May	60%	60%

For the first two months, the timeliness is 0% because the data was entered during the training period. So the timeliness could not be evaluated. In the last month the completeness and timeliness have dropped because the facilities submitted data for only 3 weeks but the completeness and timeliness are calculated for a month, that is, 4 weeks.

The 11% that did not report in March and April are different facilities. The reason given was personal problems. It is only a single facility that could not report due to loss of the mobile phone that had the IDSR application installed.

7. Conclusions

Completeness and timeliness of the reports have improved significantly. This result corresponds to the findings from Madagascar [3], with performance at the same level. After having used the phones for a longer period in Tanzania, completeness would probably improve more.

Facility and district health workers are happy to use mobile phones for reporting, since they save time and funds for transport, as it was also found in India [4]. This is in line with

the argument by Archer [8] that in order to be adopted by health service providers, mobile phone solutions need to provide significant tangible benefits, as there are multiple competing demands.

Travelling from a facility to a district office incurs payment of bus fare, which in most cases far exceeds the price of sending a text message. Mobile phone reporting also saves time health personnel spends on travelling. Considering the shortage of health staff in most African countries, relieving them from administrative tasks will benefit the health services.

For initial project set up, the phones constitute an investment cost. The price of phones is falling and their capacity is improving. Soon cheap phones, which health workers typically will own, can be used for installing the reporting software. This will remove the hardware investment costs.

The IDSR data reported consisted of ten numbers each week. Most data reporting in the health services comprise hundreds of numbers to be reported monthly. Due to the small size of the display keyboard, using mobile phones to report a large quantity of numbers might bring many errors or be too strain. Finding the optimal number for a reporting session is an open question for further research in this field.

It is also researched that, sending a report that comprises of more than one SMS triggers technical problems in the transfer [9]. Switching to GPRS removes this obstacle while introducing the need for more elaborate phones and network services. Both the SMS and GPRS solutions require specific software to be installed on the phone, which again requires support services for the reporting software. Support can be lessened when the phones have web browsers, such that no software installation is required for the phones. This seems to be the most reliable solution for reporting more than 160 characters of data. Smartphones with browsers are currently beyond the financial capacity of health staff, but the decreasing costs will enable this within a few years.

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