

Chapter 36:

Mobile Electronic Health Data Collection: EpiSurveyor/Magpi and Examples of Use in the Ebola Crisis

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Take-home messages:

- Mobile data collection now offers many options, including data collection via mobile apps for smartphones, as well as for basic text messaging (SMS).
- Many factors, including variance in available hardware, user training, and cellular cost may influence the crucial features required for an effective deployment.

EpiSurveyor: Applying the Lessons of Facebook to Health Data Collection

An early example of self-service software for mobile health surveys was EpiSurveyor, developed starting in 2003, with funding from the World Bank and later supported in a partnership between the United Nations Foundation, the Vodafone Foundation, the World Health Organization, and DataDyne (now Magpi, a technology company founded by the author). EpiSurveyor was designed, originally, for the Palm PDA platform and was later ported to mobile phones. It was created as a tool to allow easier and faster vaccination coverage surveys for those organizations comprising the Measles Initiative.¹

EpiSurveyor allowed in-country staff in poor countries, with just basic computer skills, to create data collection questionnaires/forms online, and deploy those forms using an app running on inexpensive and locally available mobile phones (Figure 36.1). Once the form was on the phone, data could be collected even without an active mobile connection, and then uploaded via the mobile network once a network connection was within reach.

Because it could be deployed on inexpensive, locally-available phones, and required no special computer personnel to configure it, EpiSurveyor removed the two biggest expenses from any mobile electronic data collection budget at that time: the cost of importing hardware devices, and the cost of importing technical specialists.

By eliminating paper, EpiSurveyor also removed the considerable expense of purchasing bulk paper, printing on it, photocopying, and transporting paper forms. In a 2011 report, the World Bank documented a startling 71% decrease in field data collection cost when using EpiSurveyor compared to paper.²



Figure 36.1: EpiSurveyor-based child health survey, Kenya, 2009. (Credit: J. Selanikio)

Within one year of the release of the web-and-phone-based version of EpiSurveyor in 2009, more than 3,000 users had registered for the system. This early success has paved the way for others: six years later, someone wishing to move to mobile data collection has a wide variety of software choices.

Current Options: Newer Technology

EpiSurveyor was renamed to “Magpi” in 2013, and as of the time of this writing it has more than 45,000 registered users. It is no longer the only game in town, however, and a web search for “mobile data collection” will reveal a wide variety of available options.

Most current options for mobile data collection combine a web-based form creation platform (Figure 36.2) with an app running on a smartphone or tablet using

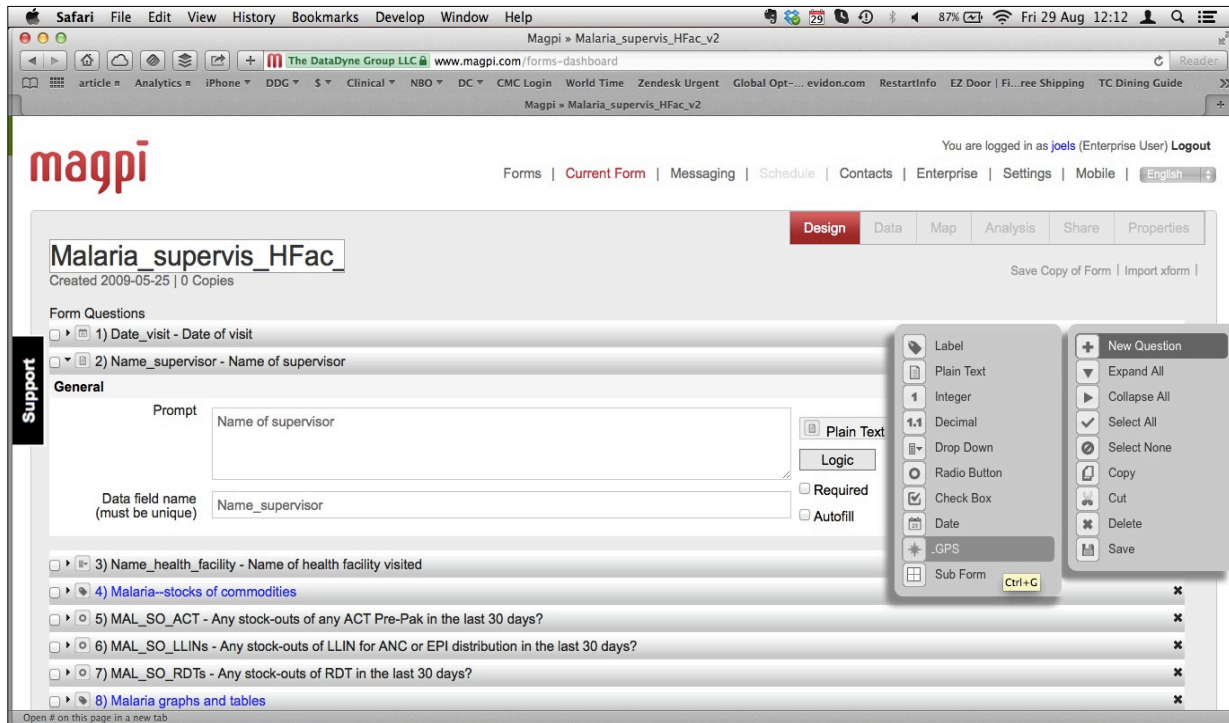


Figure 36.2: Example showing web-based form creation.

Google’s open source Android operating system (e.g. ODK and FormHub) and/or Apple’s widely available iOS devices (i.e. iPhones and iPads)..³ Current systems may differ widely in the level of technical expertise required to set up and operate them.

Data, once collected, can be uploaded via an Internet connection (e.g. cellular internet or Wi-Fi) or in some cases via a cable or memory card. Once uploaded it can typically be visualized in a number of ways, including as a spreadsheet, report or graph. Many systems also allow instant mapping of uploaded data, for real-time geo-analysis (Figure 36.3).

Most systems also allows for the export of collected data to a variety of formats, typically including a text file or an Excel file. A growing number also provide an “API” (application program interface): a method by which the software in question can send and receive data with other systems. Using the Magpi API, for example, it is possible to push data automatically at intervals to Salesforce.com for data visualization. Other applications provide automated notifications: messages that are sent out based on the content of the collected data; a supervisor might be notified, for example, if a reportable disease had been noted by one of the data collectors.

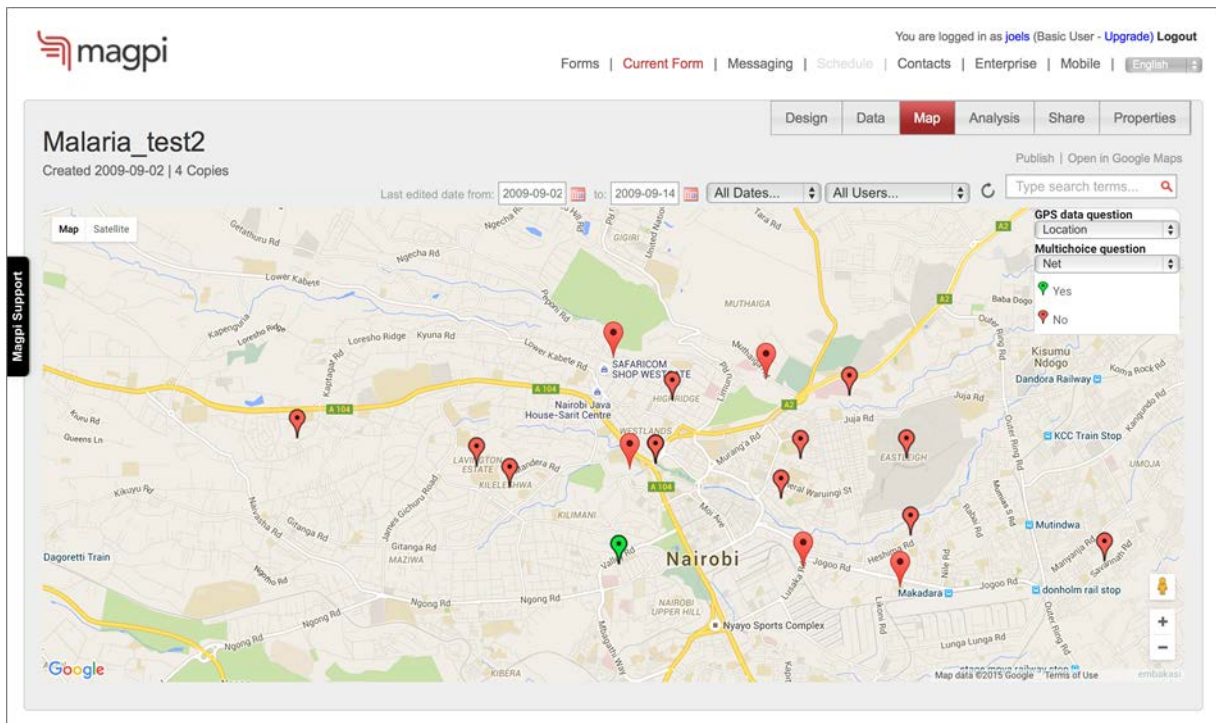


Figure 36.3: real-time geo-analysis in Magpi

Current Options: Older Technology

In addition to running apps on Android or iOS “smart” devices, some new approaches to data collection are being made with an older technology: SMS (“short message service”, also known as text messaging). Data collection by SMS has many disadvantages compared with a modern mobile app running on a smartphone, but it has one very strong advantage: it can be done using almost any mobile phone on earth, even the kind of \$10 no-brand mobile phones now commonly seen in every poor country. Furthermore, SMS messaging can be broadcast across barebones cellular networks and do not require the maintenance of costly mobile data plans on each phone.

The rapid spread of cheap mobile phones, even to extremely remote locations, and the wide availability of SMS-based data collection systems, mean that the global health community has a new option: having rural health workers or key respondents *text in* valuable and real-time health data from the very far afield.

One example can be found in the International Rescue Committee’s use of Magpi’s SMS-based data collection functionality in rural Sierra Leone. There, rural health

workers send one text message a week, containing a unique code followed by two numbers: the number of births in their village over the past week, and the number of deaths in children under five years of age in their village over the past week. Here's what such a "structured" text message might look like if the unique code was IRC123:

IRC123#5#0

That coded text message—signifying five births and zero deaths—would be received by the central Magpi system and added automatically to a web-based database. In aggregate, such data then enables IRC managers to view near real-time statistics on births and child deaths for Sierra Leone from any internet-connected location in the world.

Remarkably, IRC general staff set up this system with no assistance from programmers or technical consultants, and without any contact with the in-country mobile providers.

Importantly, to use this type of structured SMS data collection, the data collector must already know what the questions are: in the above example, she would know that she was to enter the births and deaths. This means that a certain amount of training will be required to familiarize data collectors with the setup.

More recently, some systems have begun offering a second approach to SMS data collection: "interactive SMS". With such an interactive SMS system, unlike the condified "structured" SMS discussed above, the questions are sent out to the user, prompting a specific simple response, in a conversation of sorts. Because the questions are provided to the person providing the data, less or no training is required.

If IRC was to use this interactive approach, the same data as described above might be collected as in Figure 36.4.

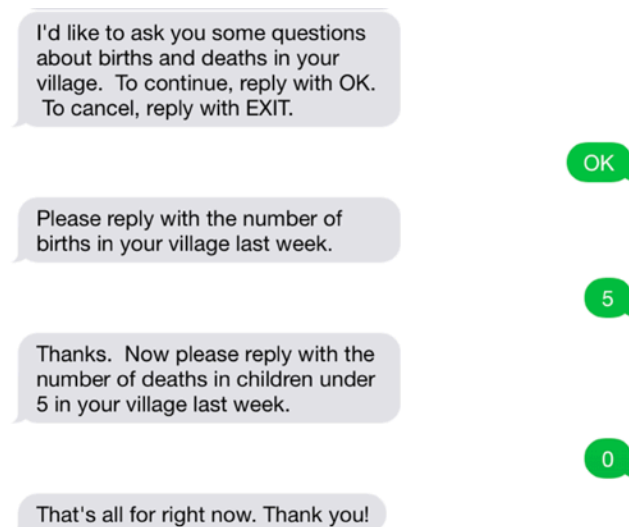


Figure 36.4: interactive SMS data collection

The Ebola Crisis: Examples of Health Data Collection in the Field

There are now many examples in the field of using electronic means to collect data more efficiently than with paper-based forms. The epidemic of Ebola in West Africa over 2014-2015 has provided some of the most recent examples.

The International Federation of the Red Cross (IFRC), as one example, has supported national Red Cross societies in Liberia and Sierra Leone in collecting data about the unidentified dead: those who have died but have no identifying information or accompanying family. Prior to burial, IFRC and the national societies use Magpi to record any identifying information about the deceased, such as notes about clothing, appearance, personal effects—including taking a photo of each person as part of the collected data. The idea behind this is to increase the chances that the families of the many deceased may later be able to determine the final resting place for their loved ones.

The author, while serving as lead physician at the Ebola Treatment Center in Lunsar, Sierra Leone⁴ in December 2014 and January 2015 was also able to pilot the use of mobile electronic data collection within the “hot zone” in order to facilitate the daily collection of clinical patient data by physicians and nurses— replacing a very cumbersome paper-based system.



Figure 36.5: the author electronically recording patient data within an Ebola treatment center in Sierra Leone, December 2014.

Another example comes from the Centers for Disease Control and Prevention (CDC), who are using Magpi's SMS data reporting feature to do surveillance for suspected Ebola cases across several West African countries. In this case, hundreds of data reporters equipped with basic mobile phones send a text message every day with a single number: the number of suspected Ebola cases. In most cases the number is zero, hence this is referred to as "zero reporting" surveillance.

A final example comes from the International Rescue Committee (IRC), who conducted health facility surveys in the affected countries, as part of the process of assessing the need for supplies and staff to combat the epidemic.

Discussion questions

For which data collection scenarios, and in which settings, might the use of mobile apps on smartphones be optimal for data collection? And for which scenarios might SMS data collection be more advantageous? Are there any circumstances under which paper-based data collection might still be justifiable?

¹ Now the Measles & Rubella Initiative: www.measlesrubellainitiative.org

² Schuster C and Perez-Brito C, "Cutting costs, boosting quality and collecting data real-time Lessons from a Cell Phone-Based Beneficiary Survey to Strengthen Guatemala's Conditional Cash Transfer Program", 2011
http://siteresources.worldbank.org/INTLAC/Resources/257803-1269390034020/EnBreve_166_Web.pdf

³ Magpi also continues to support older devices running Nokia's discontinued Symbian operating system.

⁴ This ETC was run by the International Medical Corps (IMC).