

**CASE STUDY FOR INCORPORATION OF MOBILE TECHNOLOGY IN
MATERNAL, NEONATAL AND CHILD HEALTH (MANOSHI) PROGRAM
AT BRAC HEALTH**



NEED AND OPPORTUNITY, AND CURRENT STATUS

Maternal mortality is one of the biggest healthcare concerns in Bangladesh – with a current maternal mortality rate (MMR) of 570 per 100,000 live births¹. Bangladesh is significantly behind other South Asian countries in this indicator, despite being ahead in many other areas. Eighty percent of maternal deaths in Bangladesh happen in rural areas where there is a significant scarcity of skilled birth attendants ¹. Most women die of hemorrhage, followed by anemia ^{2,3}, hypertensive disorders, eclampsia, obstructed labor and abortion.

One important reason why many pregnant mothers succumb to death or preventable miscarriages is that it is expensive for government or non-government health organizations to track pregnant mothers to assess their level of risk and prioritize its limited resources for targeted intervention. A model in which community health-workers use ICT to gather real-time information about pregnant women and send to a specialist can help to address this gap and help health organizations take precautionary measures about risky cases of pregnancies.⁴

After extensive studies of BRAC's health services for mothers, neonates and children in rural and urban areas (MNCH and Manoshi, respectively), ClickDiagnostics has developed a mobile phone-based solution for streamlining BRAC's data collection procedures in Manoshi, enabling BRAC to take a more pro-active approach in strategizing and reaching the women most in need in the urban slums.

ClickDiagnostics is in the concluding stages of piloting this solution jointly with BRAC, and after the completion of the project in January, will support BRAC in refining the model and scaling up for nationwide implementation in MNCH and Manoshi projects, and possibly also in BRAC Health's other programs.

EXISTING SYSTEM OF BRAC HEALTH PROGRAMME'S (BHP) MANOSHI PROJECT:

After studying in great detail the data flows and collection procedures of Manoshi (urban), ClickDiagnostics identified a multitude of ways in which a mobile phone-based data collection system could simplify procedures, streamline data collection, eliminate redundancy in paperwork, strengthen monitoring and management capacity, and enable pro-active and real-time intervention strategizing at various levels. The findings of the system study were as follows:

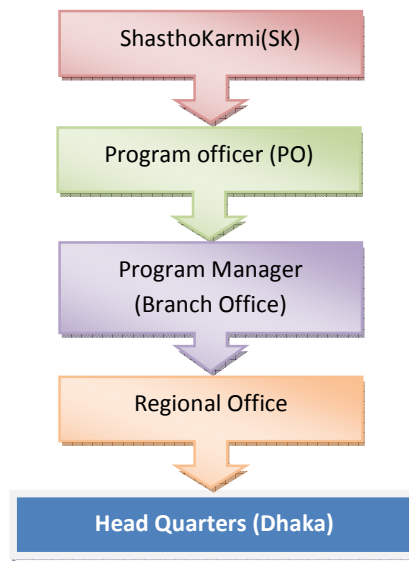
Health Volunteers, or *ShasthoShebikas* (SS), are volunteers from the community itself, and are the frontline workers of BRAC. They go door-to-door and identify pregnant women (if any), sell medicines and get incentives if they refer risky patient to BRAC's medical center. They are often not educated and are therefore unsuitable for using mobile phones to gather patient data. Each SS covers 200 households (population of 1,000) approximately.

¹ UN Children's Agency (UNICEF) State of the World's Children Report 2008, <http://www.unicef.org/sowc08/report/report.php>

A Health Worker, or *ShasthoKarmi*(SK),has~10 SS under them, therefore having a coverage area of 2,000 households (10,000 population). They have extensive data collection duties, and have at least SSC level education (10 years of schooling). They rotate through all the households in 3 months, visiting 35 HH per day and updating basic household data. They also visit 8-10 pregnant women (and several children of 0-5 age) under their supervision each day, and fill up a data card for each patient (mother or child) during the visit. They learn about new pregnancies from the SS, visit and register those new pregnant women and give them data cards. At the end of each month, the cards from all SKs are brought in for data entry into a MIS system, from which reports can be generated.Head Office can therefore access the information only after it gets into the system, which can takemore than a month from the collection of the data.

Three SKs are managed by a Program Organizer (PO), who has a variety of duties including data collection, verification, crisis management, providing information and advice to patients, referring complicated cases and ensuring follow up, organizing community information events, etc. All the POs and SKs in a Branch are supervised by a Branch Manager, who is the in-charge for their respective branch.

Existing Flow Chart of Patient Information and Work-in-Progress:



The lowest level of physical infrastructure under the Manoshi Programme are the Delivery Centers (*Birthing Huts*), each of which covers 2,000 households (population of 10,000). Two Urban Birth Attendants (UBAs) and one Community Midwife (CMW) works at the birthing huts. CMWs have paramedic training, and provide their skilled care during delivery. Their activities are supervised by the Programme Organizer and coordinated by the SK.

There are MBBS doctors at the regional office level, each of which covers approximately 3 branches. These doctors get called by phone (from SKs or their supervisors) to deal with complicated situations, and are required to visit the patients. Their time is not utilized optimally due to extensive travelling required before they can see a patient and give them medical advice.

RATIONALE FOR INTEGRATION OF M-HEALTH PLATFORM

- **Inability to make strategic interventions based on data:** There is an up-to-one-month time lag between data collection and entry into MIS, rendering the information ineffective for making strategic interventions to improve health outcomes of patients. In some cases risky patients are susceptible to complications/complex births or even miscarriage/death during this time lag, which could be prevented if the doctors in the regional office had the advantage of real-time data flow about patients. Therefore, the vast majority of the extensive amount of data that is collected about each patient is of almost no use other than general reporting.
- **Monitoring:** POs and BMs have no means to track the work of SKs in real time. Therefore, the performance of the SKs are often measured only on a monthly basis, by which time the SK has probably already missed their target. Supervisors also have to backtrack the work of SKs in order to monitor them, requiring them to re-visit the same patients and waste enormous amounts of time in travelling around.
- **Ease of use and logistics of data card:** The data card is made in a concise tabular format to save space and avoid large printing costs, but covers a lot of data fields. The format (questions are not complete sentences) is congested and unintuitive, and often difficult for little-educated SKs to understand, who intentionally or unintentionally leave some fields empty. Also, the error rates in data cards are extremely high. To fix the erroneous/incomplete data, the cards have to be sent back and forth each time between branch and SK. Moreover, it is extremely difficult, if not impossible, to add another question to such a questionnaire at a later point, because of space limitations in the card and the immense logistical costs of printing and deployment afresh.
- **Wastage of resources in data entry operator:** The data entry operator positioned in each branch office only has work for the first few days of the month when he enters the data from the previous month's data cards into the MIS system. The remaining days of the month, he is mostly idle, and is paid a relatively modest salary because of his computer expertise.
- **Patient prioritization not possible:** Perhaps the biggest challenge in the current system is in identifying the risk level of each patient, and therefore in prioritizing limited resources for providing special care in these cases. First of all, the identification mechanism depends greatly on the skill level of the SK, which often varies quite a bit (based on intellect, dedication, experience, duration of training, etc.), and also susceptible to the high turnover rates that are prevalent. Moreover, the patient interviews conducted during each visit are directed towards collecting the data for the predefined fields, and not towards a sophisticated differential diagnosis of the risks of each individual patient. It cannot simply be expected of an SK to possess the level of medical knowledge necessary for identifying the level of risk and conducting such diagnosis accurately.

Secondly, SKs are expected to visit each pregnant mother once every month. In this system, the extremely high-risk patients are sometimes left out and cannot be prioritized as appropriate since it disrupts the SK's usual schedule.

On the other hand, CMWs, who have some degree of paramedic training and therefore possess higher skills, do not have well-defined work schedule according to priority and needs. Eventually, their skills are often not properly utilized in addressing the patients most in need. The doctor also cannot use his limited time to address the patients mostly deserving specialized treatment.

CLICK'S SOLUTION FOR INTEGRATION OF M-HEALTH

ClickDiagnostics proposed a simple and yet powerful mechanism for data collection, which would eliminate most, if not all, of the bottlenecks faced by the Manoshi programme. Under the system, health workers would possess a mobile-based data collection software which would enable them to collect only the information required for each patient in a simple one-by-one question format with multiple choice answers. The software would also let the SK take pictures of the patient, and voice record any open-ended responses. They would then send this collected data to the server through GPRS internet.

The data would be viewable on a secure web page where the doctor would be able to provide feedback based on the patient's information directly to the SK's mobile phone. An automated risk assessment algorithm would also analyze each patient's data and categorize the patient into a risk category based on predefined criteria. Based on pre-set rules, the server could also generate automatic alerts to different tiers of the Manoshi personnel.

The system would also generate automatic work schedules for SKs, prioritizing higher risk patients. The supervisors would be able to monitor the data sent by SKs cumulatively and individually in an intuitive but powerful graphical reporting cum monitoring tool. SMS alerts would be generated to supervisors for workers missing their daily/weekly/monthly targets. IN this way, the system would become more efficient.

The objectives of the pilot project to test the above system are outlined below:

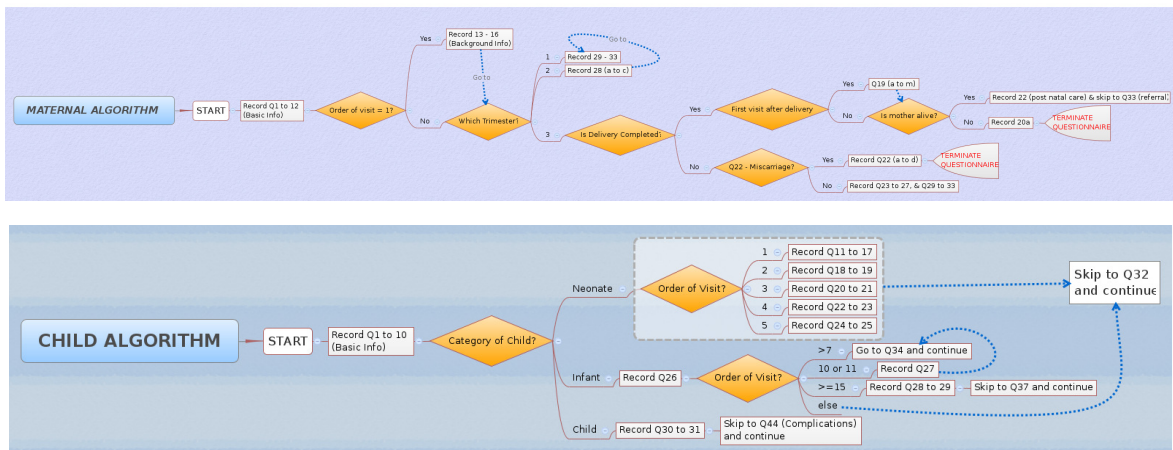
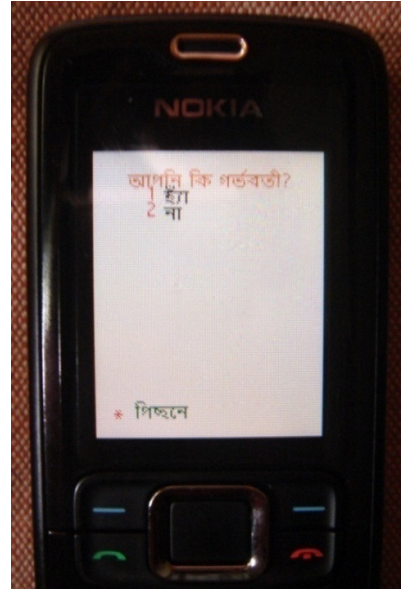
- Build a cost-effective mobile-phone based solution for data collection and remote health risk screening for maternal, neonatal and child health
- Develop an efficient and automated scheduling system for health workers
- Test an automated risk assessment system on the basis of pre-defined algorithm
- Develop a tool for real-time report generation and monitoring

The pilot would cover all areas of the Manoshi programme, including Maternal, Neonatal and Child health. Nine SKs in 3 branches of Dhaka would comprise the pilot intervention area, covering 18,000 households and approximately 2,000 pregnant women.

Progress so far

- **Data collection module** has been developed on a Nokia 3110c mobile phone (Cost~\$90), with capability for:
 - Complete Bangla interface
 - Secure log-in
 - Flexible decision tree
 - Range/type validation and cross-validation of data
 - Photo capture from within software
 - Voice records within software to record open ended data
 - Dynamic update of questionnaire algorithm through GPRS internet at any time without need for physical update
 - Offline data collection and storage for synchronization later (when internet is available)


- **Sophisticated algorithms with built-in decision tree** has been developed to collect data for:
 - Pregnant women and mothers at all levels – ANC, delivery, PNC, etc.
 - Children at all stages – neonatal, infant, child



- Health workers have been trained (including practice time) for a few hours each, after which they have administered the maternal and child module, and have been sending the data to the server, without any significant problems over last two months

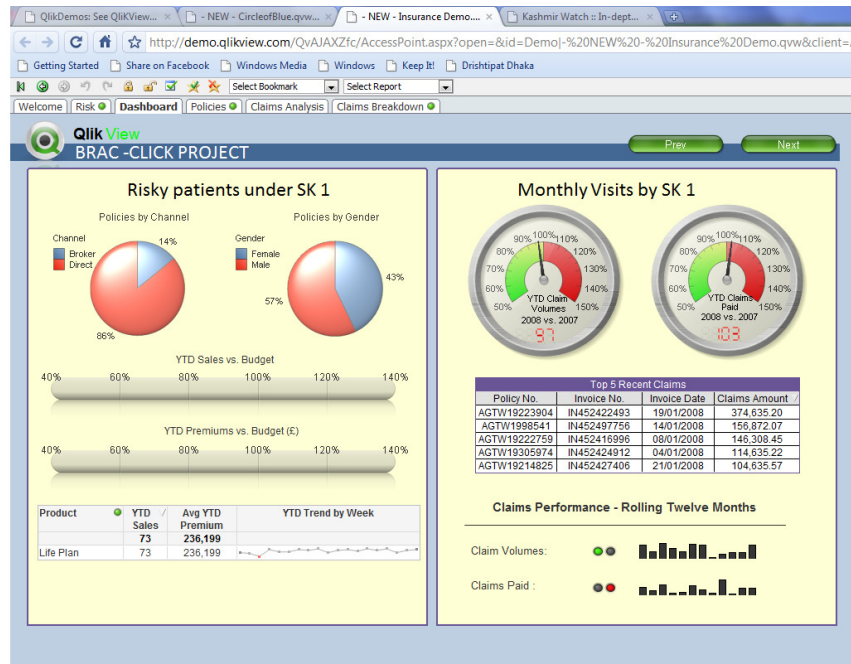


- **A patient record viewing module** has been developed where patient's information and picture(s) can be viewed as soon as it is sent from a SK's mobile phone. A doctor can scan the information and provide feedback in a text box which is immediately sent to the SK's mobile phone, possibly while the SK is still in the house of the patient.

Patient Details		Audio Download:			
Record Date:	4th November, 2009	File Name	Size	Save	Desc
Record Time:	13:22:07 [12 hours ago]	FhName.amr	2.054k	Save	Desc
House Hold No:	2900	HhName.amr	4.358k	Save	Desc
		HusbandName.amr	2.31k	Save	Desc
		PatientName.amr	2.054k	Save	Desc
		Right Click the link and save audio file with amr extension			
Interview Information		Patient Pictures			
SKID [NUMBER]	10				
HhID [NUMBER]	2900				
Area [NUMBER]	37	PatientPic.jpeg			
SSID [NUMBER]	62	Right-click here to download pictures			
PatientName [CHOICE]	x				
PatientPic	1				
BirthControlSystem [CHOICE]	d				
StageOfPatient [CHOICE]	a				
LastMenseDate [NUMBER]	66				
Age [NUMBER]	35				
HaveDiabetes [CHOICE]	NotKnow				
HaveAsthma [CHOICE]	No				
TakenTT [CHOICE]	Yes				
PrevPregNum [NUMBER]	5				
DeadChildNo [NUMBER]	0				
Mr [NUMBER]	0				
CaesareanNo [NUMBER]	0				
Apocotomy [CHOICE]	No				
DeadChildWithinAWeek [NUMBER]	1				
DeadChildWithin1Year [NUMBER]	1				
DeadChildWithin5Year [NUMBER]	0				
DeadChildAfter5Year [NUMBER]	0				
AgeOfLastChild [NUMBER]	9				
BleedingEver [CHOICE]	No				
DeliveryConflict [CHOICE]	No				
EverEclampsia [CHOICE]	No				
EarlyDeliveryEver [CHOICE]	No				
		<p>Doctor's feedback:</p> <div style="border: 1px solid black; height: 80px; width: 100%;"></div> <p style="text-align: right;"><input type="button" value="Send"/></p>			

- **An Automatic Risk Categorization algorithm** has been developed with the help of medical experts and BRAC Health doctors to categorize each patient into one of three distinct risk categories (high-medium-low). The categorization is done automatically as soon as the patient data arrives to the server, and can be sent to the SK with customized advice even when a doctor is not present. Alerts can be generated to SKs and their supervisors as soon as a high risk patient is found. This enables the system to be proactive in identifying and treating the highest risk patients, and therefore in preventing future complications and emergencies, and even avoiding deaths.
- **An automatic work scheduling algorithm** is currently being developed to inform the SKs of their visit schedules. It is being designed to prioritize the high risk patients with more frequent visits than low risk ones. The schedules can be viewed from the mobile interface, and each patient is automatically checked off as soon as they are visited and their data is sent to the server.

- A **Real-time reporting and monitoring tool** is currently being developed to provide an intuitive graphical interface for managing cumulative and individual data, generate reports, track milestones and targets, monitor the work of different levels of personnel, and prepare performance reports.



- A **thorough evaluation** of the entire intervention is being conducted, complete with baseline and follow up surveys and FGDs. An elaborate cost benefit analysis has also been conducted, and the preliminary results show that the intervention costs less than the existing system.

Benefits achieved through Click's Solution

	Previous System	Click System
REPORTING	<ul style="list-style-type: none"> - Data digitized once a month, hence reports only in monthly intervals - Needs data entry operator at each branch. - 4-5 days spent in reporting 	<ul style="list-style-type: none"> - Real time reports anytime anywhere - Work of data entry operator minimal
MONITORING	<ul style="list-style-type: none"> - Monitoring possible only at end of month - POs and BMs need to follow trail of SKs 	<ul style="list-style-type: none"> - Monitoring at any point in time - Instant SMS alerts if failed targets
LOGISTICS OF DATA	<ul style="list-style-type: none"> - Card sent back when errors detected - Logistics of card delivery to SKs cumbersome - Data transferred to server using pen drives - Questions cannot be changed 	<ul style="list-style-type: none"> - No handling of cards - Data transfer is immediate - SKs can access patient data through mobile phone - Logic and content of questionnaire can be changed at any time, and additional surveys can be conducted at little cost
RURAL EXPANSION	<ul style="list-style-type: none"> - Expansion to rural areas very difficult due to: - Lack of electricity and computers - Data cannot be transported easily with pen drives 	<ul style="list-style-type: none"> - Computers not needed for data entry - Data comes directly from phone
ERRORS WITH DATA	<ul style="list-style-type: none"> - Scope for data errors when SKs fill up card after coming back from visit - Sometimes cards remain unfilled - Problems with data identified at end of month 	<ul style="list-style-type: none"> - SKs must enter data at site - SKs cannot send incomplete information - Validation increases quality of data - Errors can be fixed without hassle
LEARNING	<ul style="list-style-type: none"> - Learning to fill up cards difficult 	<ul style="list-style-type: none"> - Learning very intuitive and easy
PATIENT PRIORITIZATION	<ul style="list-style-type: none"> - Little prioritization on the basis of risk 	<ul style="list-style-type: none"> - Prioritized intervention possible - Doctors and CMWs can be used effectively in only addressing situations that deserve their intervention
MIGRATION TRACKING	<ul style="list-style-type: none"> - Tracking of migration not possible - Patient's unique IDs cannot be maintained 	<ul style="list-style-type: none"> - Dynamically assigned unique patient IDs built within system, enabling better management of patient medical records - Pictures can be used to track down migrating patients, avoiding duplicate records.

