# Perception of Mobile Phone Data Submission in Real Time Biosurveillance Program by Some Indian Health Workers

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## Abstract

In rural India today all health records are created using paper and pencil. Integrated Disease Surveillance Program located at district level office collates the collected information and enter those records first into an excel sheet for district level trend analysis before transmitting the aggregated results on the website hosted by National Informatics Centre. The entire process of figuring out any unusual increase of a disease thus takes almost 30 days. The system is thus in-effective.  To overcome this situation, Indian Institute of Technology Madras's Rural Technology and Business Incubator, Chennai, and LIRNEasia, Colombo, have successfully pilot tested mHealthSurvey application through mobile phone for patient data collection in the Real Time Biosurveillance Program (RTBP) both in India and Sri Lanka simultaneously during June, 2009 to July, 2010. This paper specifically analyses the perception of Indian Health workers regarding the contribution of mobile phone based data collection adopted in RTBP project. Results indicate that most health workers have positive perception of using mobile phone based data collection. Majority of health workers presume that this is

cost effective, enhance the real time data submission and reduces the workload, as compared to paper based reporting system.

**Introduction**

Real Time Biosurveillance Program provides the ability to detect and monitor a wide variety of health events involving multiple kinds of diseases, including communicable and non communicable as well as reportable and non reportable ones (1). Under the current system in India, patient health data are gathered from healthcare centers using standard paper templates of Form P (Presumptive Surveillance) and Form S (Syndromic Surveillance). These forms are then sent to Integrated Disease Surveillance Program (IDSP) located at the district level Deputy Director of Health Services (DDHS) office. The IDSP staff, then collate the collected information and enter those records, first on to an excel sheet for district level trend analysis of a selected few diseases, followed by transmitting the aggregated results through the National Informatics Center hosted Directorate of Public Health and Preventive Medicine (DPH & PM) website to the state and national levels (2). These tasks are carried out by the data entry operators under the supervision of data manager specifically appointed by IDSP. The entire process can take almost 30 days; it is only after that a human eye can identify if there is any disease outbreak trend in a location (3). The present system has proven to be ineffective in identifying the cases at the appropriate time. For instance, there were several people infected with fever like disease outbreak, *chikungunya,* in the southern part of rural Tamil Nadu in 2010, as it could not be detected until several cases were reported (4).

Considering the lacunae of the present paper based system, Indian Institute of
Technology Madras's Rural Technology and Business Incubator (IITM's RTBI),
Chennai, and LIRNEasia, Colombo, have jointly initiated a two year pilot project of Real
Time Biosurveillance Program (RTBP) both in India and Sri Lanka simultaneously
during July, 2008 to July, 2010 with a financial support of International Development
Research Centre of Canada.

RTBP had three components, namely mobile phone application for patient data collection
(5, 8, 14), T-Cube Web Interface (TCWI) for event detection and Sahana alerting
protocol for message dissemination (6, 7, 9, 10). The Health workers at primary health
centres and health sub-centres digitize the patient health records using the mHealth
Survey application. This application developed by IITM's RTBI can be accessed on any
java-enabled mobile phone (8). The data entered by the health workers immediately
reaches a server accessible by IDSP office. Epidemiologist at IDSP office analyzes data
using TCWI, which is an internet browser based tool to visualize and manipulate large
temporal and spatio-temporal data sets to pin down the epidemiological events (6, 7, 9).
The health alerts information are then issued to health workers on their mobile phones
using Sahana alerting module which is a Common Alerting Protocol content standard for
the interchange of warnings, alerts, and situational awareness (10).  The present study
was designed with the objective of understanding the perception of Indian Health workers
regarding the contribution of mobile phone based data collection adopted in RTBP
project.

**Methodology**

The survey research was conducted with the 27 health workers (One sector health nurse, three staff health nurses and 23 village health nurses) who were involved in mobile phone data collection in the Real Time Biosurveillance Program that was pilot tested between June 2009 and July 2010 at four Primary Health Centers and 24 Health Sub Centers affiliated to Thiruppathur block of Sivaganga district in Tamil Nadu, India. A well structured questionnaire containing health workers' profile and their perception level on mobile phone data collection was used to collect the data from each health worker. The perception level was measured using a Likert scale, a psychometric scale commonly used in questionnaires and survey research. The survey was conducted through face to face interview. The collected data were analyzed using SPSS software. Statistical tools such as frequency, percentage, mean, standard deviation, ANOVA and Independent t-test were employed.

The health workers submitted the data from their respective health center during June 2009 to July 2010. On an average of 217 health records was submitted each day through mobile phone by all the health workers. Over a period of fourteen months 91066 records were collected. On a daily basis, the collected data were analyzed through TCWI by IDSP office and the unusual or disease outbreak trend was observed through this software and disseminated in the form of short messaging services (SMS), email and web through Sahana messaging and alerting module.

In studying of the adoption of information systems/technology, Technology Acceptance Model (TAM) is one of the most widely used research models, referred to by many studies (11). It is important that measurement of acceptability of the mobile phone based data collection should be conducted with the actual users through survey. According to TAM, an individual's behavioral intention to use a system is determined by two beliefs; perceived usefulness – the degree to which a user believes that using a particular system will enhance his/her job performance and perceived ease of use - the degree to which individual believes that using the system will reduce physical or mental effort. TAM provides a basis for tracing the impact of external variables on internal beliefs, attitude and intentions (11). Therefore, a survey was conducted specifically with 27 Indian health workers involved in RTBP project to assess the perception level of mobile phone based data submission.

**Results**

**The health workers profile**

Table 1 summarizes the health workers' profiles such as age group, education, number of years of present service and primary health centre where they worked. All the health workers were female with majority of them (70.37%) in the age group of 41 to 50 years. About 51.85 per cent of health workers had studied up to $10^{th}$ standard while 48.15 per cent had studied up to $12^{th}$ standard. A majority of the health workers (59.26%) had been working in the present healthcare services for the past 16 to 25 years. With regard to number of participants from the respective primary health centre in the present study, there were nine from Sevenipatty, eight from Thirukostiyur and Keelasevalpatty and

Nerkuppai had each five. All these 27 health workers were actively involved in the mobile phone data collection process in the RTBP pilot project prior to this study.

**Table 1: Profile of health workers (n = 27)**

| Profile | Frequency | Percentage | Mean |
|---|---|---|---|
| **Age group (in years)** | | | **43.52** |
| 21 to 40 | 8 | 29.63 | |
| 41 to 50 | 19 | 70.37 | |
| **Educational qualifications** | | | |
| 10th Std | 14 | 51.85 | |
| 12th Std | 13 | 48.15 | |
| **No. of years of present service** | | | |
| 0 to 5 years | 7 | 25.93 | |
| 6 to 10 years | 2 | 7.41 | |
| 11 to 15 years | 2 | 7.41 | |
| 16 to 25 years | 16 | 59.26 | |
| **Primary Health Centre** | | | |
| Thirukostiyur | 8 | 29.63 | |
| Nerkuppai | 5 | 18.52 | |
| Keelasevalpatty | 5 | 18.52 | |
| Sevenipatty | 9 | 33.33 | |

**Perception on contribution of mobile phone in patient data submission**

Table 2 presents the overall distribution of health workers' perception towards contribution of mobile phone in patient data submission in the Real Time Biosurveillance Program. Majority of the health workers (66.67%) felt that Mobile phone made a significant difference, while only 33.33 per cent felt that the contribution was moderate. On the other hand, none of the health workers felt that it was not useful.

**Table 2: Overall Distribution on Perception towards contribution of Mobile phone (n = 27)**

| Level | Frequency | Percentage |
|---|---|---|
| Low (0 – 1.33) | 0 | 0 |
| Moderate (1.34 – 2.67) | 9 | 33.33 |
| High (2.68 – 4) | 18 | 66.67 |

**Mobile phone contribution in patient data submission**

Based on the field experiences from the two year RTBP pilot project, a total of seven

potential contribution criterions of using mobile phone in patient health records

submission were identified. All of the seven contributions were surveyed with the health

workers. They were asked to indicate the level of each potential contribution using scale

of 0 (no contribution) to 4 (very high). Analysis done for each contribution is presented in

Table 3. Besides showing percentage distribution for each scale, this table also shows

value of mean score for each contribution.

**Table 3: Percentage distribution of Mobile phone contribution in patient data submission**

| Roles | Percentage (n=27) | | | | | |
|---|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** | **Mean** |
| Enhancing ease of mobile phone use | 0 | 3.70 (1) | 29.63 (8) | 48.15 (13) | 18.52 (5) | 2.81 |
| Mobile phone is useful | 0 | 0 | 22.22 (6) | 55.56 (15) | 22.22 (6) | 3.00 |
| Willing to use mobile phone replacing the current paper based system | 0 | 0 | 29.63 (8) | 33.33 (9) | 37.04 (10) | 3.07 |
| Mobile phone is an efficient and cost effective tool | 0 | 0 | 18.52 (5) | 66.67 (18) | 14.81 (4) | 2.96 |
| Saving time in submitting data | 0 | 0 | 18.52 (5) | 70.37 (19) | 11.11 (3) | 2.92 |
| Enhancing data submission in real time basis | 0 | 0 | 37.04 (10) | 62.96 (17) | 0 | 2.62 |
| It is benefitting health workers in reducing workload as compared to paper based system | 0 | 0 | 14.81 (4) | 51.85 (14) | 33.34 (9) | 3.18 |

As per the participants, the largest impact was in terms of "it is benefitting health workers

in reducing workload as compared to paper based system (M= 3.18)." Also, "Willingness

to use mobile phone replacing the current paper based system (M= 3.07)" and "Mobile

phone is useful (M= 3.00)" also scored high. Participants felt least enthusiasm for

"enhancing data submission in real time basis (M= 2.62)". This low perception could be due to the fact in their current work load, the health workers were asked to follow their existing paper based system along with entering the data on mobile phones. The survey on the whole shows that the mobile phone is a powerful tool in submitting patient data as compared to the paper based system.

**3.4. Differences on perception of mobile phone contribution in patient data submission amongst people with different age, education and location**

To understand how different participants, belonging to different location, age group and education background, felt about this new technology,  ANOVA (Analysis of Variance) and independent t-test were employed and the results are presented in Tables 4 & 5.

**Table 4: PHC dependent response with selected Independent variable using ANOVA**

| Variables | N | Mean | S.D | F | P |
|---|---|---|---|---|---|
| **PHC** | | | | 5.252 | 0.007 |
| Thirukostiyur | 8 | 3.04 | 0.372 | | |
| Nerkuppai | 5 | 2.51 | 0.436 | | |
| Keelasevalpatty | 5 | 2.63 | 0.424 | | |
| Sevenipatty | 9 | 3.27 | 0.374 | | |

**Primary Health Centre (PHC):** To understand the responses from different locations (PHCs) ANOVA test was carried out (Table 4). The analysis of variances (ANOVA) shows that there is a significant difference in perception towards contribution of mobile phone between the centres (F Value 5.252, p>0.05). The highest mean score recorded for those who worked in Sevenipatty PHC (M=3.27), followed by those who worked in

Thirukostiyur PHC and the lowest mean score recorded by those who worked in

Keelasevalpatty (M= 2.63) and Nerkuppai PHCs (M = 2.51).

Independent t-test was used to identify the correlation between the responses and the

respondents' level of education. The level of education was categorized into two, one was

education up to high school (up to $10^{th}$ std) and the second category was those who had

secondary school (up to $12^{th}$ std) education. The analysis shows that there was no

significant difference found amongst the two groups studied (Table 5). For high school

(up to $10^{th}$ std) M was 2.78, S.D was .3951 and for those who studied up to $12^{th}$ standard

M was 3.12, S.D was .5146; t (27) was - 1.965, p was .061. It was reported that those

with higher education have more positive perception on mobile phone contribution

compared to those with lower education standards (12, 13).

**Table 5: Comparison in mobile perception between level of education and age group using Independent t-test**

| Variables | n | Mean | S.D | t | p |
|---|---|---|---|---|---|
| **Level of education** | | | | | |
| $10^{th}$ Std $12^{th}$ Std | 14 13 | 2.78 3.12 | .3951 .5146 | -1.965 | .061 |
| **Age group** | | | | | |
| 21 to 40 41 to 55 | 8 19 | 3.2321 2.8195 | .3813 .4734 | 2.178 | .039 |

Does the health workers' age group indicate any difference in their perception towards

this experiment? As per the age of health workers, it was decided to divide in to two

groups such as 21 to 40 and 41 to 55. Based on the independent t-test done, it was found

that there was significant difference in perception among the two groups between 21 to

40 (M = 3.232, S.D = .3951) and 41 to 55 health workers (M= 2.8195, S.D = .4734; t (27) = 2.178, p = .039). These results go with the formative evaluation study of RTBP where it revealed that younger the healthcare workers were, the more capable they were of using mobile phone for data collection (14). In the early field experiences of RTBP pilot project (4) shows that age factor did influence the phone usage in data submission. This study is also evident in findings from a study of mobile adoption at the Bottom of the Pyramid (BOP), where youngsters had preferred more to use mobile applications beyond voice (15).

**Discussion**

All the health workers, who took part in RTBP pilot project, had positive perception for the experiment. By and large, mobile phone data submission is cost effective and is doable on real time basis. It also reduces the workload and eliminates the need to carry 20 kgs of paper for data collection every day. Younger health workers are more ready to adopt this new technology and process. Based on the outcome of the study, it is suggested that the state level office of Directorate of Public Health and Preventive Medicine and Integrated Disease Surveillance Program, located at the district level, should come forward to further deploy the technology. Both these departments have responsibility of collecting patient health statistics and taking preventive measures in order to protect spreading of disease to other areas or region.

Mobile phone is now a days affordable and can be used by the health workers efficiently. During the pilot, it was observed that health workers are already given a mobile phone

each by health department; use of mHealthSurvey application, developed in the RTBP project, would be easy to use. mHealthSurvey application can work on any Java-enabled mobile phone to collect and transmit digitized patient health records. The data collected using mHealthSurvey is submitted through GPRS (General Pocket Radio Service), which is readily available in standard mobile phones now. The mHealthSurvey application was built to store the data on the mobile phone memory in the absence of GPRS connectivity (termed as offline mode) and later transmit when a connection is established. Each health record takes as little as 2 Kilobytes of memory and does not pose a threat of overloading the mobile phone's memory (i.e. can easily store hundreds of records). Besides the mobile phone memory can be increased if larger quantity of data needs to be stored in the offline storage (16).

**Conclusion**

It was thus concluded that most of the Indian Health workers have positive perception regarding the contribution of mobile phone based data collection adopted in RTBP project. Majority of health workers presume that this is cost effective, enhance the real time data submission and reduces the workload, as compared to paper based reporting system. The outcome of this study encourages the Directorate of Public Health and Preventive Medicine and Integrated Disease Surveillance Program to make use of mHealthSurvey application through mobile phone that was developed in RTBP project for patient data submission in real time basis to replace the existing paper based systems. This could further be effectively utilized by the health officials for monitoring the disease

counts. If there is any disease outbreak, the concerned health workers can also be intimated via a sms or a voice call on their mobile phone immediately.

**Acknowledgement**

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