RESEARCH ARTICLE

Use of social media in a national Tuberculosis Drug Resistance Survey: lessons from the first anti-tuberculosis drug resistance survey in Ghana [version 1; referees: awaiting peer review]

Augustina Angelina Sylverken1,2, Ellis Owusu-Dabo1,2,3, Alexander Kwarteng2,4, Sampson Twumasi-Ankrah2,5, Michael Owusu2,6, Louis Adu-Amoah1,2, Rexford Mawunyo Dumevi2, Rejoice Agyeiwaa Arthur2, Nicholas Addofoh2, Francisca Dzata7, Frank Bonsu7

1Department of Theoretical and Applied Biology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
2Kumasi Centre for Collaborative Research in Tropical Medicine, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
3Department of Global and International Health, School of Public Health, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
4Department of Biochemistry and Biotechnology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
5Department of Mathematics, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
6Department of Medical Laboratory Technology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
7National Tuberculosis Control Programme, Ghana Health Service, Accra, Ghana

Abstract

Background: The widespread use of social media applications on mobile phones indicate that smart phones have become more than just a simple medium for voice calling. Several studies have shown the potential benefit of these social media applications in discussing many health conditions. We report on tracking sample transport by public and private transport providers using WhatsApp during the first nationwide drug resistance tuberculosis (TB) survey in Ghana.

Methods: The survey was conducted between February 2016 and June 2017, and involved 33 TB diagnostic sites selected on the basis of a two-stage cluster randomized sampling design on both anticipated yield and probability proportional to size method. We engaged the services of privately and publicly owned vehicles’ union to transport samples to the central laboratories in Kumasi for further laboratory processing.

We created a mobile social group platform ('National TBDRS') on WhatsApp consisting of two representatives from each site as well as other stakeholders. The purpose was to notify a laboratory team in Kumasi, on the following details of the sample: date and time of dispatch, driver’s name, car number, estimated time of arrival, and bus terminal name.

Results: A total 3077 WhatsApp messages were received during the survey period. Of these, 2879 (93.57%) messages were related to the survey. We observed a positive correlation between the total number of messages received and the total number of well-packaged sputum samples sent ($r=0.89$, $p=0.02$).

There were no major transport delays (11:44±03:50) and all samples arrived...
within a 3-day window from the survey sites.

**Conclusions:** Using WhatsApp as a platform of communication can significantly aid in improving tracking of samples, enhance accountability of for example drivers handling the samples over at a road crossing and communication across health facilities.

**Keywords**
WhatsApp, Tuberculosis, Ghana

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**Corresponding author:** Augustina Angelina Sylverken (asylverken@knust.edu.gh)

**Author roles:**
- **Sylverken AA:** Methodology, Project Administration, Supervision, Writing – Original Draft Preparation
- **Owusu-Dabo E:** Conceptualization, Methodology, Writing – Review & Editing
- **Kwarteng A:** Methodology, Writing – Original Draft Preparation, Writing – Review & Editing
- **Twumasi-Ankrah S:** Methodology, Writing – Review & Editing
- **Owusu M:** Methodology, Writing – Review & Editing
- **Adu-Amaoh L:** Methodology, Dumevi RM: Methodology, Writing – Review & Editing
- **Arthur RA:** Methodology, Writing – Review & Editing
- **Addofoh N:** Data Curation, Methodology, Writing – Review & Editing
- **Dzata F:** Methodology, Project Administration, Writing – Review & Editing

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List of Abbreviations

TB  Tuberculosis
KCCR  Kumasi Centre for Collaborative Research in Tropical Medicine
GPRTU  Ghana Private Road Transport Union
MTB  Mycobacterium tuberculosis
DRS  Drug Resistance Survey
WHO  World Health Organization
NTP  National Tuberculosis Control Programme
NRC  National Reference Center
KNUST  Kwame Nkrumah University of Science and Technology
CHPRE  Committee for Human, Publication, Research and Ethics
AFR/ERC  Afro Ethics Review Committee of the World Health Organization

Introduction

Availability of internet use on mobile phones has resulted in the increased use of social media applications. Current examples of social media application platforms include Facebook, LinkedIn, Twitter, WhatsApp, Flickr and several others. Most of these applications are known to be inexpensive and, more often than not, completely free, and are easy to use and manage. Various studies have outlined key usefulness of these applications as social interaction, information seeking, entertainment, relaxation, communicatory utility, expression of opinion, information sharing, and knowledge about others. While applications such as WhatsApp maybe useful in chatting and/or exchanging messages and pictures, its relevance in tracking infectious samples and logistics in resource-limited settings has not been fully explored. Particularly in resource limited areas, it will be important to explore the use of these applications in health care systems since there are indications that penetration of mobile phones, especially in rural areas, has increased such that there is no significant difference between rural and urban areas. On the contrary, some studies have indicated other usefulness of social media applications especially WhatsApp in discussing (exchanging messages) health-related issues and in the conduct of surveillance surveys. However, the usefulness of WhatsApp in particular in tracking infectious samples when they have been transported from health facilities to central laboratories for processing is yet to be fully explored. There is therefore a need to explore the usefulness of these applications especially in resource-poor countries in sub-Saharan Africa, where access to and use of mobile telephony and social media applications has increased dramatically over the past decade. We report on experiences of tracking transported samples using WhatsApp, during the conduct of the first anti-tuberculosis drug resistance survey for Ghana.

Methods

Facility selection

The survey began in April 2016 and involved 33 TB diagnostic clusters/facilities located in the 10 regions of Ghana (Figure 1). These sites were selected on the basis of a two-stage cluster randomized sampling design on both anticipated yield and probability proportional to size method, as described. Apart from one facility that provided 87 smear positive sputum samples, all the other facilities were expected to send 29 smear positive sputum samples to the central laboratory in Kumasi.

Transportation and training

A privately owned vehicles’ union, the Ghana Private Road Transport Union (GPRTU) agreed to transport sputum samples from health facilities to laboratories. The GPRTU has transport terminals across the country. We held meetings with the regional heads of GPRTU in 10 regional capitals of Ghana as well as with the heads and representatives of drivers of all GPRTU terminals located near the selected health facilities. These meetings were conducted in the local language and where appropriate, a translator was engaged. During these meetings, the aims and objectives of the nationwide TB drug resistance survey were explained and discussed. Assurance with regards to safety in transporting infectious samples was provided. Demonstrations of packaging and sealing of samples was given together with the name and telephone number of the study coordinator and the laboratory receptionist. Training on how to fill the drivers’ part of the specimen transfer form was provided. The urgency in transporting the samples and associated forms to the respective bus terminals in Kumasi was pointed out. On reaching Kumasi, drivers were asked to call the laboratory to pick up the samples. Once the contents of the cooler box were retrieved, the empty cooler boxes were returned to the sending health facility by GPRTU. At each health care facility, two laboratory technicians were to identify who was responsible for transporting the samples and forms to the GPRTU bus terminal. They were also responsible for collecting returned cooling boxes.

WhatsApp platform

A mobile social group platform (‘National TBDRS’) was created on WhatsApp before the start of the DRS. There were two representatives from each of the 33 selected health facilities, and other stakeholders, including the NTP Manager and assistant, the NTP laboratory focal person and a representative of the national reference laboratory, were members of the platform. At KCCR, the principal investigator, survey coordinator, two laboratory technicians in charge of receiving the samples and the laboratory receptionist were also members of the WhatsApp group. The WhatsApp group was used to inform the KCCR team that samples were sent. In addition it was used as a means to track samples and locate missing samples. The following details were shared on the WhatsApp group about each sample: date and time of dispatch, driver’s name, car number, estimated time of arrival and arriving bus terminal name. The health facility sending the sample could opt to send pictures of the vehicle’s number plate as well as the part of specimen transfer form which...
indicated the driver’s details. Some health facilities sent pictures of the actual package as evidence that samples were transported. The team at the receiving end (KCCR) notified the sending health facility once samples had been received and the cooling boxes returned.

Only messages related to the DRS and sample transport were meant to be posted on the WhatsApp group. Survey health facilities were asked to notify the central laboratory at KCCR about logistics such as lack of consumables via the WhatsApp group. The group was administered by the KCCR receptionist and the survey coordinator.

Ethics approval and consent to participate
We obtained ethical approval from the Afro Ethics Review Committee of the World Health Organization (AFR/ERC/2016/02.01).
We also obtained clearance from the Scientific and Ethical review Committee of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology (KNUST) and the Komfo Anokye Teaching Hospital, Kumasi (CHPRE/AP/328/15). Written informed consent was also obtained from each participant at the time of recruitment through signatures and thumbprints.

Data handling and analysis
All messages on the National TBDRS WhatsApp page sent between February 2016 when the page was created and June 2017 when the survey ended were copied into a Microsoft Word document. The document was aggregated into a Microsoft Excel file and cleaned by ensuring that all messages received from the facilities have all be captured. This was then exported to STATA (version 12.0; Stata Corp LP, College Station, TX, USA) for analysis. Descriptive statistics were summarized and displayed as charts and graphs. Pearson’s Correlations between number of messages and number of samples were conducted. A value of p<0.05 was assumed as significant.

Results
WhatsApp messages
A total of 3077 WhatsApp messages were received between February 2016 and June 2017 (525 days) (Figure 2). Of these, the majority, 2879 (93.57%), were related to the survey while 17 (0.55%) were warnings to facilities that sent messages that were not related to the survey (Figure 3). Raw data are available on OSF10.

A total 1958 (63.63%) of all messages were from the 33 survey sites, 1075 (34.94%) from KCCR, the implementers and 44 (1.43%) from NTP who played a supervisory role. The platform consisted of 106 members, with at least three members per site, including NTP and KCCR.

Of the total 1958 messages, each health facility sent a minimum of 5.86 messages and an average of 55.59±23.37 messages during this period. When comparing the number of messages concerning the number of sputum samples received at the central laboratory, a total of 955 sputum smear positive samples were transported from the survey sites. Of this total, 2879 messages were from the survey sites, the highest number 112 (3.89%) was sent by Lawra, a facility in the Upper West region. This facility sent a total of 26 samples out of an expected 29 samples. The least number of messages (2 in total) was sent by Bawjiase and Holy Family Hospital in the Central and Eastern regions, respectively. While Bawjiase sent one sample, Holy Family Hospital sent four samples out of the total 29 samples that each cluster was expected to send. There was a positive correlation between the total number of messages received and the total number of samples sent (r=0.89, p=0.02).

Mode of transportation
Of the total 955 samples received from the survey sites, facilities employed GPRTU, Courier, Metro Mass Transport, VIP and others in transporting the samples. Significantly, a higher proportion of samples were sent through GPRTU services than by any other means. There were no major delays (11:44±03:50) and all samples arrived within a 3-day window from the survey sites.

Discussion
*Mycobacterium tuberculosis* infection poses a major public health concern in several TB endemic countries11. However, despite the existence of well-structured treatment regimens against TB in most endemic countries12, field-related challenges such as transportation/tracking of TB samples to referral hospitals and timely delivery of logistics to health centers, remain to be addressed. Even though some mobile-phone-based health application systems are currently in place, the use of mobile-phone applications to track infectious samples and logistics in a national survey is yet to be explored. In the current study, we assessed the feasibility of using WhatsApp to track samples and logistics among selected health facilities and other stakeholders in the first ever Tuberculosis Drug Resistance Survey (TBDRS) in Ghana. Results of our work on using this mobile-based application indicate the usefulness of using WhatsApp to track infectious samples from 33 survey sites to a central laboratory in Ghana for the first time.

In this study, the majority (94%) of the messages served the purpose for which they were intended and thus correlated with the

![Figure 2. Total number of samples and messages sent by the clusters.](image-url)
number of samples obtained from each facility. However, a few of the messages, i.e., less than 1% were not suitable for the purpose for which the platform was created. This is not uncommon, given that WhatsApp is a social media and that the decision to send a study-related message solely relied on the user, despite several warnings from group administrators at KCCR. Our findings corroborated those of Dorwal et al., who demonstrated the role of WhatsApp in laboratory management systems and improved communication amongst several partners and stakeholders in their facilities. The authors highlighted some user inconveniences, such as the misdirected or irrelevant spread of information. In a similar scenario, social media has been used to facilitate communication between patients and health workers. A recent study in London including an emergency surgical team and patients concluded that WhatsApp is a safe and efficient communication technology for use in clinical settings. The technology has also been explored for medical consultation at hospitals where physicians were not stationed in referring health facilities.

The use of internet-based resources has the potential to maximize distribution of logistics and information especially in resource-limited settings and therefore crucial to curtailing most infectious diseases. In this study, we observed that the ease of transmission of information via WhatsApp significantly facilitated the transport of TB samples from the 33 survey sites in the country despite obvious transportation network challenges by improving communication among several study teams. We show that the highest number of samples and logistics in the current study were sent via GPRTU (72%) compared to other transport services. Interestingly, the highest number of messages 112 (3.89%) and samples (26/29, 89.65%) were received from Lawra Government Hospital, a facility in the Upper West region. Lawra is approximately 530.6 kilometers from Kumasi, which is the farthest among the study facilities from KCCR. What could have accounted for the highest number of messages from Lawra is the type of transportation used to and from this facility. In contrast to many other facilities, where GPRTU was the main means of transport, Opoku Agyemang (OA) transport was the only recognized transport service to Lawra from Kumasi and there was constant communication between KCCR and the facility to ensure timely delivery of samples and logistics. The least number of messages (2 in total) were sent by Bawjiase and Holy Family Hospitals in the Central and Eastern regions, respectively. While Bawjiase Hospital sent one sample, Holy Family Hospital sent four samples out of the total 29 expected samples. This could be due to the fact that there was no direct means of transport from these sites to Kumasi, KCCR, therefore, accounting for the poor performance of these sites during the entire study.

A major limitation of WhatsApp is the security and privacy issues. Given that WhatsApp can replace paper or email for the rapid transfer of information and logistics, serious considerations will be needed to address privacy of patients’ information. Currently, the content of any delivered messages reside directly on the sender’s and recipient’s mobile devices. The Terms of Service of WhatsApp clearly states: “You shall be solely responsible for your own status submissions and the consequences of posting or publishing them.” While WhatsApp is free and can be embedded with multimedia files compared to traditional SMS (messaging) platforms, it can be seen as a time-consuming and inconvenient medium, especially when one has to transcribe all patients’ clinical data by typing.

Although the use of WhatsApp remains to be comprehensively explored in the health sector, data from this study suggest that, the application has enormous potential to significantly revolutionize information transmission/communication among health workers, patients and stake-holders, especially in resource-limited settings. Given that the global strategy to eliminate TB emphasizes the need for country adaptation and prioritization in accordance with the local epidemiology and the healthcare systems, we anticipate that the findings from this study may contribute significantly to bringing this objective much closer to reality in Ghana.

**Conclusion**

The present study shows that the prudent use of WhatsApp, a social media application, can significantly aid in improving
communication across health facilities and tracking potentially infectious samples from remote areas. The application of the platform ensured timely intervention/action, and supported information-sharing amongst partners and stakeholders, which ultimately translated in improved samples transport during the TBDRS study in Ghana for the first time.

Data availability

The data underlying this study is available on OSF. DOI: https://doi.org/10.17605/OSF.IO/58X62

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

Author information

Dr. Augustina Angelina Sylverken is a Lecturer at the Department of Theoretical and Applied Biology, KNUST, Ghana. She is interested in the characterization of novel viruses and public health related issues.

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References