Bridging the Communication Gap: Successes and Challenges of Mobile Phone Technology in a Health and Demographic Surveillance System in Northern Nigeria

Henry V. Doctor, PhD[1,2*], Alabi Olatunji, MSc[3], and Abdul'Azeez Jumare, PGD Comp Sc[4,5]

[1]Columbia University, Mailman School of Public Health, Department of Population & Family Health, New York, USA
[2]PRRINN-MNCH Program, Operations Research Unit, Abuja, Nigeria
[3]PRRINN-MNCH Program, Operations Research Unit, Gusau, Zamfara State, Nigeria
[4]PRRINN-MNCH Program, Operations Research Unit, Gusau, Zamfara State, Nigeria
[5]Ahmadu Bello University, Department of Community Medicine, Zaria, Nigeria

Abstract

Maternal and child health indicators are generally poor in Nigeria with the northern part of the country having the worst indicators than the southern part. Efforts to address maternal and health challenges in Nigeria include, among others, improvement in health and management information systems. We report on the experience of mobile phone technology in supporting the activities of a health and demographic surveillance system in northern Nigeria. Our experience calls for the need for the Nigerian Government, the mobile network companies, and the international community at large to consolidate their efforts in addressing the mobile network coverage and power supply challenges in order to create an enabling environment for socio-economic development particularly in rural and disadvantaged areas. Unless power and mobile network challenges are addressed, health interventions that rely on mobile phone technology will not have a significant impact in improving maternal and child health.

Keywords: Public Health Surveillance systems; Public Health Informatics; Nigeria

Introduction

The reported maternal and child health (MCH) indicators in Nigeria are generally poor. In particular, MCH indicators from northern Nigeria are worse. For example, the maternal mortality ratio (MMR) in the north is much higher than the national average, exceeding 1,000 per 100,000 live births compared to fewer than 300 per 100,000 live births for the southern region [1]. Recent studies have revealed that the MMR in Nahuche area of Zamfara State in North West (NW) Nigeria is 1,049 deaths per 100,000 live births [2]. Child mortality estimates are also high as evidenced by the under-five mortality in Nigeria which was estimated at 143 per 1,000 live births in 2010 [3]. Efforts to address these challenges range from interventions aimed at improving the quality and access to maternal, newborn, and child health services by strengthening planning and

training of human resource for health, improving the state of health infrastructure, provision of supplies and commodities (including drugs), and community engagement to promote appropriate MCH behavior and increase demand for maternal health services in general and in particular emergency obstetrics care.

The Partnership for Reviving Routine Immunization in Northern Nigeria (PRRINN); Maternal, Newborn, and Child Health (MNCH) Program (hereafter 'PRRINN-MNCH Program'), received funding from the United Kingdom Department for International Development (DFID) and the Norwegian Government between 2007 and 2008 to revitalize immunization, improve the quality, access, and utilization of maternal, newborn, and child health services in northern Nigeria. The program was initiated by a consortium consisting of Health Partners International (UK), Save the Children (UK), and GRID Consulting (Nigeria) and operates in four states in northern Nigeria: Jigawa, Katsina, Yobe, and Zamfara.

Part of the comprehensive activities of the PRRINN-MNCH Program includes setting up a Health and Demographic Surveillance System (HDSS) in Nahuche emirate of Bungudu Local Government in Zamfara State of North West Nigeria. In collaboration with the Zamfara State Government, the Nahuche HDSS (NHDSS) was established to provide a platform for measuring the impact of the program's interventions and also as a platform for future surveys and trials. A detailed description of the NHDSS set up, design, data collection, and processing procedures has been described elsewhere [4]. The set up activities of the NHDSS included a pilot census in May/June 2009 followed by a baseline census (Sept-Dec 2010) and bi-annual cycles of data collection beginning in January 2011. Trained interviewers collect routine data in rural communities under surveillance on pregnancies, births, deaths, migration, marriages, and vaccination coverage. These data are recorded in registers and reported to the NHDSS computer centre for processing. Trained community key informants (CKIs - volunteers) support the NHDSS data collection activities by routinely reporting key events such as births and deaths as they occur in their communities. As of June 2012, NHDSS had a surveillance population of about 138,000 located in 20,194 households.

In order to determine the probable cause of deaths occurring at the community level, the NHDSS initiated the verbal autopsy data collection system in October 2012. The data collection and processing activities of NHDSS follow the guidelines of the International Network for the Demographic Evaluation of Populations and Their Health (INDEPTH Network). The INDEPTH Network is an umbrella body which provides an international platform of sentinel demographic sites that provides health and demographic data and research to enable developing countries to set health priorities and policies based on longitudinal evidence. As of November 2012, the Network consisted of 44 HDSS sites in selected countries in Africa, Asia, and Oceania [5].

Mobile communication infrastructure and surveillance operations

While the HDSS sites provide data aimed at measuring the impact of interventions and systems to monitor progress towards achieving health-related national goals, the HDSS sites are set up in countries with varying degrees of infrastructure. Except in a few cases, such as Nairobi HDSS in Kenya (focusing on urban slums), virtually all HDSS sites are in rural and under-resourced settings. While a summary of the cross-country variations in the infrastructure of communities

with HDSS sites is beyond the scope of this paper, we focus on the infrastructure of NHDSS in northern Nigeria with respect to its mobile communication capacity in supporting data collection, field management, and data processing activities.

In brief, Nahuche study area consists of 306 villages under the leadership of six district heads of Bella, Gada, Karakkai, Nahuche Keku, Nahuche Ubandawaki, and Rawayya. Literacy levels are very low and infrastructure such as road network, power generation and supply, is inadequate. The general sanitation in the area is poor and the area has a warm climate with temperatures rising to 38 degrees celcius from March to May. Farming is the most common economic activity and unemployment is rampant with associated temporary labor migration of men [4]. Nahuche is benefiting from the substantial growth in mobile telephone subscriptions that has occurred since the 1980s in both developing and developed countries [6]. For example, the NHDSS baseline census of 2010 showed that 40.3% of 19,193 households within the surveillance area had access to a mobile phone. Of interest is the fact that in much of sub Saharan Africa there are more mobile phones than fixed lines [6] and Nigeria is no exception, mobile phone subscriptions have grown. Since the liberalization of Nigeria's telecommunication sector in 2000, the industry has become the key source of new jobs in the economy, employing about 6,000 professionals, and overseeing, indirectly close to half a million jobs [7]. The increases in mobile coverage has many more advantages such as improving what people already do in terms of faster and cheaper communication. For example, in India, fishermen can reduce fish wastage by phoning in advance coastal markets to find out the need for supply. Mobile banking also offers the flexibility and convenience for many customers [7]. The increase in mobile telephones has also led to a growing attraction for mobile telephones as health interventions. This attraction has been influenced by, among other things, the fact that mobile phones are functionally easier to use for people with lower levels of skills than those needed for computers or the internet [6].

Irrespective of whether mobile phones are functionally easier to use for those with lower level or higher level skills, mobile phones have become useful in data collection of health-related information. In the northern Nigeria HDSS at Nahuche, and just as in many other HDSS sites, fieldworkers are expected to communicate to a large extent with the field office-based team and to a minor extent with the data processing team on a daily basis to resolve any data collection problems that may arise in order to expedite data processing activities. However, many times the field-based and office-based teams have problems in communicating with each other due to poor mobile network coverage but also due to limited power supply when the mobile phone batteries gets discharged. The NHDSS study area has virtually no electricity supply from the national grid and majority of households rely on electricity from rechargeable lamps for lighting. For example, the baseline census results on household characteristics conducted in 2010 in NHDSS revealed that 2.5% of the 19,193 households had access to electricity from the national grid and another 0.5% from electric generators [8].

The NHDSS fieldworkers come from households or communities which struggle to access electricity. While field supervisors are expected to visit the fieldworkers on a daily basis in the surveillance areas, field problems that emerge after the supervisors' visits can only be addressed during the subsequent visits by the supervisors or whenever the fieldworkers have enough power on their mobile phones. A more proactive way would be for fieldworkers to fully charge their mobile phones and ensure that they have enough power each and every morning before they start

their work. However, at least within the NHDSS operational setting, fieldworkers are not provided with official mobile phones. As a result, even with a fully charged mobile phone in the morning, they can make and receive calls from their friends and family members. By the time they start making or receiving official phone calls, the mobile phones are on average discharged. Even if they had access to an official mobile phone, recharging the phones would still be a major challenge.

The CKIs also experience similar challenges in mobile communication. While the NHDSS office-based team is able to recharge their mobile phones using power from a generator, they are often unable to communicate with their field staff. We are aware of alternative options to charge mobile phone batteries such as mini solar chargers but their efficacy and duration of charging varies. Some of the available solar panels do not provide optimal solar power during the rainy season. What is needed is a more permanent solution: regular supply of power for community members in Nahuche and Nigeria at large. This is inevitable since the application of mobile health technology or intervention relies, among other things, on the ability of users to have constant power supply for recharging. While the NHDSS efforts to expedite data collection and processing are compromised by the virtually non-existent power supply, future efforts to link the HDSS activities with those of the adjacent Nahuche Health Research Centre in tracking immunization defaulters through mobile phone technology (i.e., alerts on service uptake) will be challenging.

In addition to the very limited power supply is the poor mobile network coverage across many parts of Nigeria. Intermittent mobile network from the providers contributes to the high discharge rate of mobile phones since subscribers often have to keep trying a line for several times before they get connected. Eventually, some of the mobile phone subscribers in the NHDSS study area end up forgetting (except those who are able to save their numbers elsewhere) their mobile numbers since the network coverage is virtually non-existent. Our team has experienced this during data collection of migration events. A respondent who reports that some of the household's members have migrated to another area is asked for the mobile phone number of the migrant. In many instances, fieldworkers are not able to get the mobile numbers because the respondents do not know the numbers. When asked reasons for not knowing the numbers, majority of them sarcastically state that there is no need to know the number since there is no mobile network coverage in their area unless they go to the Zamfara State capital, Gusau.

Related to the poor mobile network coverage are the high tariff charges on communication. Our field workers often complain about high tariff on airtime recharge cards. They are often unable to call the field office at the Nahuche Research Centre due to insufficient airtime on their mobile phones. While high tariff charges can be managed through budgetary allocation for airtime purchases, the power supply and mobile network coverage remain an enormous challenge for field operations.

Future outlook

While we are very optimistic with the effectiveness of mobile technology in the future, health intervention packages, which take advantage of mobile phone technology, are currently a non-

starter in majority of rural communities in Nigeria. How can this problem be addressed? The answer is simple but doing it is an enormous task. Mobile health technologies would require constant power supply and strong network coverage in all communities. Nigeria's power supply is currently erratic and insufficient. Generally, there is no difference between the rural and the urban areas except for the fact that the urban areas by virtue of their status as 'business hubs' tend to push consumers to use electric generators more than often the rural areas. As reported earlier, only 0.4% of the households in the NHDSS baseline census in 2010 had access to electricity from generators. While this is likely to be representative of most rural communities in northern Nigeria, efforts to seek alternative solutions for power generation are inevitable.

The Government of Nigeria through various media has acknowledged the need to find alternative solutions to generate more power for the populace. For example, according to a newspaper report on October 3, 2011, the Director General of the Energy Commission of Nigeria, Prof. Abubakar Sambo, stated that 1% of Nigeria's land area could be used to generate 600,000 Megawatts of electricity using solar energy [9]. Solar energy, described as the best form of renewable energy, has a very high investment cost but the life span of the solar panel could be as long as 25 years if they are properly installed. Nevertheless, some anecdotal evidence shows that in some states in Nigeria solar panels have failed to deliver the expected results due to corrupt practices associated with procurement of substandard panels. Irrespective of this, solar energy is never exhausted unlike the conventional energy of oil, coal, and gas. While some newspapers in September 2012 reported that some petrol (or gas) stations are reporting declines in their sales due to improved power supply [10], the saturation effects of the increased power generation will take a considerable time to be felt by all Nigerians. The reported increase in power generation, estimated at slightly over 4,000 Megawatts as of October 2012, is welcome and will support a lot of business and service delivery activities that rely on power.

While the backbone of the NHDSS field operations relies on mobile technology, there is a need for organizations and stakeholders involved in improving MCH outcomes in northern Nigeria and similar settings to find alternative solutions to address power problems in the intervention areas. The role of power supply in improving MCH cannot be overemphasized in the contemporary world. Drugs or vaccines need to be stored in a cool place (considering the warm weather in Nigeria for a greater part of a year), surgery and other treatment rooms need power, lower level health facilities need to communicate with referral facilities on the need for an ambulance, and many others. To overcome this challenge, the PRRINN-MNCH Program has rehabilitated a number of health facilities in its program states and installed solar panels to ensure constant power supply in all critical areas of health facility operations.

From an operations point of view, mobile technology is critical for NHDSS activities. Field staff, field management, and data processing teams are expected to be in constant communication to report and resolve problems instantly and ensure rapid processing and dissemination of data to policy makers and other stakeholders. To-date, the success of mobile phones in aiding NHDSS fieldwork operations has been dismal. As we get closer to the deadline for achieving the Millennium Development Goals in 2015, the most realistic priority in ensuring the effectiveness of mobile technology in field operations as well as any mobile phone-based health care interventions is to ensure that communities have regular access to power. The NHDSS has set up a system of routine monitoring of health and population dynamics in Nahuche area in northern

Nigeria. However, electricity power supply remains an enormous challenge particularly with recent developments within the INDEPTH Network in which some HDSS sites are piloting activities to migrate HDSS data collection from the traditional and expensive paper-based method to the less expensive mobile-based data collection using devices such as mobile phones or tablets. These devices need constant power supply to charge the batteries since the speed of data collection and processing will depend, among other things, on sufficient power supply for the mobile devices.

Conclusion

What is the future of power generation in Nigeria? From the local media, we hear of increased power generation although the actual reported megawatts vary from one source to the other. Nevertheless, Nigeria's power sector reform initiative which was launched in 2005, recognizes the need to improve power sector performance as a critical step in its efforts to address development challenges. Through the 2010 Roadmap, Nigeria revitalized the challenging process of implementing reforms by outlining the government's strategy and actions to undertake comprehensive power sector reform to expand supply, open the door to private investment, and address some of the chronic sector issues hampering improvement of service delivery [11]. We know that power supply is one of the many challenges Nigeria is expected to address to ensure that the country is on course to meet the MDGs, particularly those related to health. Increased power supply will strengthen, among other things, health management information systems of which the NHDSS is part. We hope that the Nigerian Government, the mobile network companies, and the international community at large will consolidate their efforts in addressing the mobile network coverage and power supply challenges in order to create an enabling environment for socio-economic development particularly in rural and disadvantaged areas.

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Corresponding author

Henry Victor Doctor
Associate Research Scientist
Columbia University, Mailman School of Public Health
E-mail: hvd2105@columbia.edu

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