

What experts think about integrating mobile health into routine immunization service delivery in Nigeria

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Background: Routine immunization (RI), like other essential health services, could benefit from mobile telephony and especially from the current trend of their increased use in health service delivery. SMS text messages have been recorded to be highly effective in many settings around the world and could be used for reminders and recalls to improve RI performance in Nigeria. This qualitative study assessed the state of RI services, obtained expert opinion on integration of mobile health (mHealth) into RI, and also identified potential threats to such an initiative.

Methods: In-depth Interviews were held with experts in RI and Primary Health Care from different arms of the health sector in Edo State Nigeria. Their responses were summarized and coded to allow for easy synthesis and interpretation of information.

Results: Among the experts, there was widespread support for the adoption of mHealth services into RI delivery but with a caution on threats to its success, including inconsistent supply of electricity, poor mobile telephone networks, and the possibility of a lack of political will and funding support from the government.

Conclusions: Although RI performance appears fairly satisfactory in the study setting, adoption of mHealth is highly encouraged to sustain the gains. User-friendliness, interoperability and adaptations to fit peculiar financial and health care models must be kept in view while customizing software solutions for this setting. Also, the store and forward system for handling health information appears more appropriate in this setting to maximize the effectiveness of mHealth despite the shortfall in infrastructure.

Keywords: Mobile health (mHealth); routine immunization (RI); SMS reminders; defaulter tracking systems

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Introduction

In the last three decades, the value of immunization against disease has been emphasized by healthcare authorities to such an extent that it is now regarded as an essential health service to modern human existence and its importance could hardly be overemphasized (1). Since its advent with Edward Jenner (2), its effect and acceptance has broadened and deepened across climes and cultures; and

in order to permanently entrench its gains, some form of routine immunization (RI) has been integrated into nearly all healthcare services everywhere. Despite the aforementioned, in Nigeria there exist certain barriers and hindrances to its attainment of maximal efficiency and sustained effectiveness (3). Evident among these are stock-out of vaccines, client dropouts and missed opportunities for vaccination due to forgetting scheduled appointments—all leading to delays in completion of full and timely

immunization according to the Nigerian RI schedule (4).

In 1990, the national coverage for RI using DPT3 as reference was about 80% but this has since reduced with significant heterogeneity between the states of the nation. RI coverage in the last decade ranged from 27% to 114% with a drop in DPT3 from 74% in 2010 to 52% in 2012 (5,6). This depleting efficiency is due to, among other factors, mothers' level of education which have been perennially low, and certain other time-tested utilities which had been ingrained into the operational framework of RI service provision, like home-visits for defaulter tracking, are now hard to sustain and mostly ineffective due possibly to growing changes in the current modes of human interactions and interpersonal relationships (4,7). Hence, the need for neo-technology based utilities like SMS text messages for reminder-recall systems, mobile device-aided logistics management systems, and other technology based client interactive systems for healthcare—especially in this era when technology use is being widely domesticated and mobile phone penetration is high and expanding across all cultures (8).

Text messages are important utilities in a new system of healthcare delivery called mobile health (mHealth) and experts have considered and identified it as one of the key trends reshaping the future of health care (9). mHealth is a broad supportive system within healthcare sectors around the world; and in developing countries, it has the potential to improve the access, efficiency, effectiveness, and quality of clinical and business processes utilized by healthcare organizations, practitioners, and patients (10).

mHealth at the basic level leverages technology platforms to provide information and learning to the patient. This deepens into more complicated platforms of communication between healthcare provider and patient, support for decision making through platforms with analytics, and even support of remote diagnostics and treatment. mHealth is a potential game changer in the delivery of healthcare as there is the potential for applications which could enhance the value proposition for all players in the mobile technology ecosystem (11).

Furthermore, the use of mobile communication technologies in health services can reduce gaps in health-related needs that exist between people. Such needs could include: functional quality of health information, availability of services, affordable cost options, communication infrastructure between client and healthcare providers; and easy to use information can play a predominant role in improving user perception of the health care system (10).

Mobile phone cum Internet based systems have been used repeatedly with success for healthcare in the developed world. A Cochrane systematic review reported that text message reminders increase attendance at health care appointments compared with no reminders or postal reminders. It posited that text messages are nearly as effective as telephone call reminders and with the advantage being less expensive (12).

There have been different adaptations and technological innovations to allow for effectiveness of mHealth services in any environment. Some services are built on cloud-based computing—especially in the developed world where broad band services are rife. In Low and Middle Income Countries (LMICs), the store and forward systems might be more feasible due to challenges with consistent electric power supply (13,14). Interoperability and data portability are also key issues. The kinds of ICT devices and technological know-how already available in the proposed place of implementation must be kept in view. An enabling policy environment would also be invaluable to the successful implementation of this system. All these various methods each have their own strengths and weaknesses (13).

Amidst the innovations and adaptations, certain prerequisites have been identified as a sine qua non to success with the use of mHealth in developing countries. They include user friendliness, low start-up costs, customization to fit into the complexities of local healthcare delivery networks, and adaptation of appropriate financial models (15). Literacy level does not seem to be a barrier in use of mobile phones as there are lots of mobile phone based initiatives in the developing world (15,16). Therefore, mothers' level of education may no longer be too much impedance to child healthcare if mHealth is intelligently adapted.

For these adoptions and adaptations to take-on the right mix of factors, and keep in-view the right constraints and cautions, this new paradigm must gain from the experience of experts, gatekeepers and stakeholders in the health sector, ICT, and even education sectors at LMICs. Else, there may be hindrances from lack of interoperability, low user satisfaction from low IT education, and non-valid software solutions due to inappropriate programming logic from poor understanding of work flow and response cycles in health service systems of LMICs (13).

This qualitative study targeted key healthcare gatekeepers in a Nigerian setting, and they gave a bird's eye view on the state of RI services and also identified and proffered solutions to potential threats to uptake and

utilization of mHealth as its adoption is being considered.

Methods

In-depth Interviews were held with experts in Primary Health Care in Edo State Nigeria. These experts included the State Coordinator of the World Health Organisation, the State Immunization Officer (SIO), and the Local Immunization Officer (LIO) for Egor Local Government Area; the specific site for the proposed pilot study. Each expert had at least 15 years of experience in PHC and coordination of routine and supplemental immunization, and it was a part of their job description at the time of the interview.

During each interview, the officer interviewed was allowed to speak freely with minimal interruption from researcher, although the direction of the discussion followed an interview guide. Each interview lasted between 60–90 min.

To identify patterns and trends surrounding RI delivery, interviews covered the following areas: RI coverage and drop-out rates, barriers/deterrents and opportunity areas for mHealth in RI, importance of donor agencies as it pertains to funding RI in order to provide a proxy assessment for community ownership of RI, their estimations of effect of reminder-recall (R-R) systems in improvement in RI coverage, challenges they envisage in the running of a R-R system in their setting, and knowledge of government policies that would aid mHealth.

The researcher took note of the kinds of emphasis each expert placed on different areas, and converted it to a score between 1 and 3. This was based on the assumption that their emphasis reflected the relative importance they placed on each area.

All in-depth interviews were conducted by the researcher himself, the proceedings were audio recorded, and transcriptions made immediately to ensure contextual appropriateness. Summarization and tabulation was done thereafter.

Advocacy and ethical consideration

This study did not include invasive procedures or administration of therapeutic agents.

Research approval

The proposal for this research was approved by the Ethics committee of University of Benin Teaching Hospital, Benin before the interviews were conducted.

Client consent

A letter of introduction stating the purpose of the interviews was sent in advance to the offices of each of these experts, they each consented to be interviewed, and tentative dates were picked for the interviews based on their itineraries. The final dates and times for the interviews were reached through phone calls.

Limitations of study

At the time of the study, practical knowledge of mHealth in this setting was quite limited. This limited the scope and depth of the interviews. The scores given to each point raised by each expert was quite subjective and based on the researchers perception and judgement. Further prodding was not done to try to limit bias.

Results

The results are presented in three sub-sections: a preamble highlighting comments of RI experts to establish a trend; a thematic analysis table which grouped responses by themes, and a summary section to make findings into actionable points.

The thematic analysis table (*Table 1*) attempts to summarize the responses given by the RI experts to the common questions they were asked during the interview session. Cells with a dash represent areas where the expert gave no opinion. The positive (+) or negative (-) signs were to indicate what kind of effect the factor in question has on RI. Scores of 1, 2, or 3 are an attempt to give magnitude to the good or bad states of each area under a theme.

Preamble

Concerning the use of reminders, all three RI experts all opined in words similar to this: *“This is a very good idea and it would be of immense benefit to routine immunization in this state and beyond.”*

One of the experts, commenting on power constraints as a barrier to the use of mobile phones said: *“If people have found ways to charge their phones and make calls then we shouldn't bother about PHCN (Nigeria's electricity company) in considering if this system would work; and since we have found ways to work with computers in our offices then the text messages can be sent. After all, this system would need the computers to be used for only short periods daily.”*

As touching funding of the initiative, one expert said:

Table 1 Thematic analysis of in-depth interviews with routine immunization experts

Variables	RI expert		
	A	B	C
State of RI in Edo state			
General remark	Fair	Good	Good
Coverage (%)	76	70+	≈70
Knowledge of vaccine antigen that stocked out	DPT, BCG	DPT	DPT
Factors impeding RI performance in Edo state			
Unqualified HWs	–	3–	2–
Shortage of HWs	–	2–	1–
Client migration	–	2–	2–
Antigen stock-out	2–	1–	2–
Payment for service	1–	3–	2–
AEFI	–	1–	–
Distance to HF	–	2–	–
SIAs	–	2–	–
Poor supervision	–	2–	1–
Strategies for improvement on RI			
Training HW	3+	2+	2+
Outreaches	2+	2+	2+
Supportive supervision	1+	1+	2+
Home visits	–	2+	1+
More sessions	2+	–	2+
Advocacy to policy makers	3+	–	–
Integration with IMNCH	–	3+	–
Counterpart funding by LGA	–	–	2+
Redistribution of health workers	–	2+	–
Importance of donor agencies funding RI			
UNICEF	2+	2+	2+
WHO	2+	2+	3+
GAVI	1+	1+	1+
Rotary	1+	–	–
Potential effect of SMS R-R			
Coverage	3+	3+	2+
Dropout	3+	2+	3+
Timelines	3+	3+	2+
Data management	2+	2+	3+
Challenges of SMS reminder system	Government commitment to continuity	Manpower training to actuate it	Government funding & manpower training
Community ownership of RI	Poor	Fair	Good with aid of TBAs & VDCs
Government policies to aid RI mHealth	None at present but interest is growing	Not aware of any	Not aware. Only ICT training for LIOs

Scores: 1–, 2–, 3–, depict mild moderate and severe disadvantage; 1+, 2+, 3+ depict mild, moderate and major advantage to RI. RI, routine immunization; DPT, Diphteria Pertussis, Tetanus; BCG, Bacille Calmette Guerin; LGA, Local Government Area; HW, health worker; AEFI, adverse events following immunization; SIAs, supplemental immunization activity; IMNCH, Integrated Maternal Newborn and Child Health; UNICEF, United Nations Children Fund; GAVI, Global Alliance for Vaccines & Immunization; TBAs, traditional Birth Attendants; VDCs, Village Development Committees; ICT, Information Communication Technology; LIO, Local Immunization Officer.

“Our people are poor; the government should just accept provision of Routine Immunization as its responsibility to its people—whatever it takes.” She also commented on the reasons for ineffectiveness of the erstwhile approved practice of home-visits for defaulter tracking in these words: *“The government doesn’t provide money for transport for home visits and you don’t expect health workers to spend their meagre salaries visiting children.”*

Pertaining to where such an initiative should be piloted, the experts were unequivocal about the teaching hospital. One of them said: *“The tertiary hospital is responsible for immunizing over a third of the target population of this LGA,”* while another said: *“It is that tertiary hospital that is saving our face in this LGA, children are taken to that hospital for immunization from all over Benin, and even from outside Benin.”*

To further buttress the need to use government owned facilities to pilot this SMS text message-based mHealth initiative, one of the RI experts made an indicting statement concerning private health facilities. She said: *“The private facilities are more interested in profit making than in providing service; they don’t even employ qualified hands.”*

Summary

The three experts interviewed all opined that the state of RI coverage in Edo State was relatively satisfactory with coverage at about 70%. The reasons proffered for better RI coverage in Edo state than in the rest of the country were: minimal level of non-compliance all over the state due to good team work between state, agencies and communities; training and high level competence of health workers. The volume of clients receiving immunization at the tertiary hospital was also a reason for the relatively high immunization rate. They all decried the DPT vaccine stock-out situation but one of them also reported BCG stock-out which had not yet manifested significantly at the facility level.

As for factors impeding RI performance, stock-out of antigens and payment for service were the most recurrent reasons tendered by these experts interviewed. Use of unqualified health workers, shortage (mal-distribution) of health workers, continuous migration of clients, and poor supportive supervision were the next most recurring issues. Distance to health facility, SIAs and occurrence of AEFIs seemed not to have been deemed factors as important as the aforementioned in impeding immunization performance.

As touching strategies for improving RI, every one of those interviewed felt having outreach sessions, qualitative

supportive supervision, and training and retraining of health workers would be of great benefit. Two of the experts felt that holding more sessions and having home visits would improve on RI performance.

When the concept of SMS tracking system was explained to each of them, they each felt that if implemented it would be very helpful in improving RI coverage, reduce dropouts, reduce the mean uptake time for all antigens, and improve on data quality. But some also felt that government might not want to commit to funding it, and that it might be bedevilled by lack of will for continuity—especially since there is currently no local policy backing the use of such a system. Manpower training was pointed out as one requirement that must be fulfilled for a smooth running of this system if it were to be adopted.

All experts felt that there was poor community participation in RI delivery. One expert opined that RI should mostly be the government’s social responsibility to its citizenry.

Discussion

Client reminder and defaulter tracking is a recommendation for RI services and other periodic medical services all over the world (17). It is no surprise therefore that the in-depth interviews produced nearly consistent views from all three experts interviewed on the issue of adoption of mHealth into RI service delivery. It was obvious that the control of vaccine stock-outs was not within the purview of any of these experts as they all just reported the situation and not the solutions. If this is not tackled, the perennial problems with missed opportunities cannot be brought under control even if the other components of RI service delivery are intact. mHealth holds the potential to solving this problem if adopted.

The issue of fee-for-service in public hospitals also did not sound much within control but the government must regulate this matter by some form of enforcement as part of creating the right policy environment for the mHealth initiative, else there would continue to be clients who would be unable or unwilling to pay these sums and would take their wards away resulting in missed opportunities to the detriment of all.

The reported RI coverage of about 70% could be a far cry from the truth judging by the records of the National Demographic and Health Survey, 2008 which records fully immunized children as 19% (18). It may also be an expression of the heterogeneity of health indices in the Nigerian space previously spoken of (5) and could have

resulted from the presence of the teaching hospital and other Large and well patronized hospitals within the state which attract clientele from far and near. This distribution and use of health facilities is not the case in many other parts of Nigeria. Results from other independent cluster surveys may also give information on the true state of RI in this circumstance. The database component of this proposed mHealth system would go a long way in solving these problems of disparity in coverage figures.

Supportive supervision and community participation ought to also be taken seriously even when mHealth has been adopted as they would go a long way in making RI an established neo-culture in all of our locales.

From their wealth of knowledge and insight, all experts interviewed identified the diverse advantages of using an SMS reminder-recall system; it should therefore be given very great attention as an appropriate strategy to achieving better RI outputs and outcomes in Nigeria.

In our environment, the store and forward technique for handling health information appears to be the more appropriate option to adopt as inconsistent and epileptic electric power, mobile telecom services, and internet services are all still far from being consistent enough for continuous cloud computing to be adopted.

Conclusions

Although RI performance appears fairly satisfactory in the study setting, adoption of mHealth is highly encouraged to sustain the gains. User-friendliness, interoperability and adaptations to fit peculiar financial models must be kept in view while customizing software solutions for this setting. Also, the store and forward system for handling health information appears more appropriate in this setting to maximize the effectiveness of mHealth.

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Footnote

Conflicts of Interest: Only the results section of this work has been published previously as part of the full dissertation

with the title “mHealth: New Paradigms for Improving Routine Immunization Performance—Rethinking traditional defaulter tracking methods in developing countries.” Lambert Academic Publishers, Germany; Jan. 2013. ISBN No. 978-3-659-16012-7. The agreement is that part of the whole book could be published as a separate paper. No royalties are being collected for the book and no financial support was received for this project from individuals or other corporate entities.

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