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BRIDGING THE KNOWLEDGE GAP: TOWARDS A COMPREHENSIVE MHEALTH TRAINING FRAMEWORK

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BRIDGING THE KNOWLEDGE GAP: TOWARDS A COMPREHENSIVE MHEALTH TRAINING FRAMEWORK

Research in Progress

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Abstract

Mobile health (mHealth) solutions can improve the efficiency and effectiveness of healthcare services delivered by Primary Healthcare (PHC) workers in rural communities in developing countries. However, a host of barriers can hinder the success of new mHealth implementations including low tech-nology literacy levels and failure to communicate the benefits of the solution for all stakeholders. This paper argues that effective training of end users and all stakeholders can remove the barriers which stem from these issues, thereby improving the likelihood of successful implementation and enabling the eventual improvement of healthcare delivery. During a visit to Nigeria, the perceptions of key stakeholders regarding IMPACT, a new mHealth solution, were explored to ascertain the training needs of all stakeholders in the healthcare ecosystem. The paper leverages data from this visit and presents IMPACTeD, a comprehensive mHealth training framework which aims to develop a collec-tive understanding of the solution among all stakeholders, while also improving the technical ability and confidence of PHC workers. The framework will be implemented and evaluated during a second visit to Nigeria. This paper contributes to the scant literature in developing countries by providing a framework which can guide the implementation of further mHealth solutions in developing nations.

Keywords: mobile health, mHealth, developing countries, training framework.

1 Introduction

Mobile Health (mHealth) or the provision of health services and information via mobile technologies such as mobile phones and Personal Digital Assistants (PDAs) (Källander et al., 2013) can lead to vast improvements in healthcare delivery especially in developing countries, where these technologies could possibly have transformative impacts (Varshney, 2014). These interventions offer many poten-tial benefits including greatly improving the quality and efficiency of healthcare services delivered by Primary Healthcare (PHC) workers in rural areas in developing countries such as Nigeria. However, the implementation of mHealth solutions can be fraught with challenges ranging from data security and privacy issues (Al Dahdah et al., 2015), infrastructural barriers and cultural barriers (Varshney, 2014), to low levels of technology literacy (Alwan et al., 2015), and failure to communicate the bene-fits of mHealth and the aims of the technology (Ezenwa and Brooks, 2013). These challenges are dif-ficult to overcome and can lead to resistance among end users, thereby hindering the success of these solutions (Klöcker et al., 2014; Cohen et al., 2015). Despite the indisputable importance of under-standing and addressing the barriers facing mHealth solutions and the likelihood that developing countries present unique challenges, there exists a paucity of studies

which explore the impact of mHealth and the challenges facing these solutions in the developing world context (Al Dahdah et al., 2015; Amoakoh-Coleman et al. 2016). The importance of addressing this gap in our knowledge through in-creased mHealth research in developing countries has been recently highlighted (Hossain, 2016).

Of the many challenges facing mHealth implementation, this paper focuses on the challenges related to technology literacy levels and communication of the benefits and aims of the solution. We argue that these challenges can be addressed through the development of an adequate training programme to train primary healthcare (PHC) workers and other stakeholders (e.g. healthcare supervisors and gov-ernment officials) in the health ecosystem for two reasons. Firstly, the importance of training end users and involving them in pilot testing has recently been highlighted as a means of motivating users to adopt the solution (Thondoo et al., 2015). Indeed, the need to train PHC workers has been previously noted by mHealth researchers (e.g. Kahn et al., 2010), with some describing training as a critical com-ponent of mHealth implementation (Källander et al., 2013). Secondly, it has been asserted that training which covers both the new technology and general technology concepts can improve the success of mHealth implementation (Alwan et al., 2015). It is thus imperative to provide training which targets end users' confidence in using the new solution and improves their broader understanding of technol-ogy. We also propose that a comprehensive training framework can tackle not only low technology literacy levels (Alwan et al., 2015), but can also ensure all stakeholders have a comprehensive under-standing of the technology in question (e.g. operationalising mobile devices – turning on/off the de-vice, charging the device, installing applications, etc.) while also combating the other challenges fac-ing mHealth solutions. Furthermore, we argue that the need for training extends beyond the end users of an mHealth solution to the various stakeholders engaged in healthcare delivery. The importance of understanding the views of all stakeholders in the health ecosystem when introducing a new mHealth intervention has repeatedly been highlighted (Currie, 2012; Klöcker et al., 2015; O'Connor et al., 2016). Therefore, the aim of this paper is to develop and present an mHealth training framework for training end users and healthcare stakeholders to ensure end users are capable of adopting, motivated to adopt, and to address the other challenges facing mHealth implementation such as confusion sur-rounding the benefits of the solution (Ezenwa and Brooks, 2013).

The paper proceeds by introducing the context of the study and the mHealth application in question. The existing literature is outlined, prior to describing the methodology followed to collect data. The findings from the visit to Enugu, Nigeria are briefly outlined. These findings are harnessed to develop the training framework. The methodology to test and evaluate the training framework is detailed. The paper concludes with a brief overview of the potential contributions of this research.

2 Context of the Study

This paper is based on an ongoing two-stage study which explores the feasibility of implementing an mHealth solution in Nigeria. There are a number of issues currently facing the Nigerian health system including inadequate facilities, low literacy levels, issues regarding remuneration of healthcare work-ers, poor supervision of health workers, and low motivation levels among primary healthcare workers (Obsana, 2013). In addition, in Nigeria the 2015 mortality rate for children under 5 was 109 per 1,000 children (World Bank, 2016), which is above the global average and fails to meet Millennium Devel-opment Goals (MDG4) of 64 per 1,000 (Fed. Republic of Nigeria, 2014; UN, 2015). This high mortal-ity rate could largely be attributable to service delivery gaps which hinder access to health services in rural areas where many vulnerable children reside (Federal Ministry of Health, 2013). To address this issue, Nigeria has adopted the WHO and UNICEF recommended Integrated Community Case Man-agement (iCCM) guidelines aimed at providing life-saving curative interventions in rural areas where access could be challenging, thereby promoting equity in healthcare delivery (Federal Ministry of Health, 2013). Children under the age of five are treated at the community level by PHC workers.

To aid PHC workers in adhering to iCCM guidelines, the research team developed the IMPACT (us-**I**ng **M**obile **P**hones for **A**ssessing, **C**lassifying and **T**reating sick children) application, an integrated electronic iCCM based mobile application. This application offers a low cost mHealth solution, using robust secure cloud-based data storage in a rural community, where the reliability of technical infrastructure is a challenge. The aim of this research is to explore the feasibility of introducing the IMPACT solution to improve healthcare delivery in rural communities in Nsukka, Enugu State, Nigeria. Nsukka is one of seventeen Local Government Authorities (LGAs) in Enugu State, Nigeria. An LGA is currently allocated two laptops. In the past, this technology was funded through external sources such as the UK Department for International Development (DFID). Each LGA is assigned clusters of healthcare facilities located in the rural communities. Communities are arranged into wards for population reasons, some communities are merged together to make up for the shortfall in the population count. The 'IMPACT app' will be used to support PHC workers in five wards in Nsukka LGA. However, while these PHC workers are often educated, recent resourcing limitations has meant that training in new technical innovations for assisting with patient assessment, classification, and treatment (i.e. mHealth), has not been widely available to this cadre of healthcare worker. Thus, they may have low levels of technology literacy. To ensure the successful adoption, continued use, and eventual diffusion of mHealth interventions, it is imperative to adequately train PHC workers in the use of new mobile technologies. The aim of this paper is to develop and present a framework for training PHC workers and other stakeholders prior to the implementation of the IMPACT solution.

3 Literature Review

As noted above, there is a limited body of existing literature which investigates mHealth implementation in developing countries. Furthermore, our review of the mHealth literature failed to identify any studies which have focused on training as a means of improving motivation to use these solutions and addressing the other challenges facing implementation. The existing literature often highlights the importance of training, asserting that in order to successfully implement mHealth, 'training will be necessary' (Kahn et al., 2010 p.259). The literature also notes that without adequate training, healthcare workers may resist adopting new mHealth solutions (Källander et al., 2013), thereby further illustrating the importance of training. Furthermore, one study noted that when end user training was not provided, health professionals felt poorly equipped to adopt new technologies (Chikotie et al., 2011). Research also shows that community healthcare workers often have low technology literacy levels (Alwan et al., 2015), thus indicating the *need* to train these workers to ensure they have the skills necessary to adopt mHealth solutions. While the existing literature highlights the importance of training when introducing a new mHealth solution, no studies focus on developing a framework as a means of ensuring adequate training is provided. This paper addresses this gap and aims to develop an mHealth training framework to (1) help PHC workers develop the technical skills needed to use the solution, and (2) ensure all stakeholders in the healthcare ecosystem have a shared understanding of the aims and benefits of the application. The first stage of the study explores the 'As-Is' situation in Enugu, Nigeria to develop a customised training programme based on PHC workers' and stakeholders' current knowledge levels and attitudes towards the IMPACT application.

4 Methodology

The IMPACT project consists of two phases of data collection, the first of which is discussed in this paper. The aim of visit one was to introduce the IMPACT application and determine the training needs of all stakeholders. During a week-long visit to Enugu State, Nigeria in September 2016, the IMPACT project team conducted focus groups with PHC workers from Edem, Ibagwa, Alor-uno, Okpuje, and Okutu (near Nsukka - 58km from Enugu City). The intention of focus groups was twofold: (1) to explore PHC workers' current understanding of the potential of an mHealth application based on their

current knowledge levels, and (2) to ultimately develop a comprehensive training needs framework to bridge PHC workers' knowledge deficit. Interviews were also conducted with key stakeholders in the healthcare delivery ecosystem. Table 1 provides an overview of the data collection effort.

Data Collection	**Roles**	**Type**
Interviews (6 interviews)	Commissioner for Health, Enugu State	Health Leadership
	Head of Department of Community Medicine (University in Nigeria)	Academic
	Provost – College of Medicine (University in Nigeria)	Academic
	Permanent Secretary to the Governor, Enugu State	Administrative
	District Health Information Systems Expert, Enugu State	Health IT
	Clinical Academic, Dept. Community Medicine with experience managing development projects (University in Nigeria)	Academic
Presentations followed by Focus Groups	Paediatricians and Medical Students (University in Nigeria) (51 attendees)	Health professional
	PHC Workers, Officers in Charge (OIC of rural health facilities) and Community Chiefs, Nsukka, Enugu State (41 attendees)	Health professional
Field notes	NA	NA

Table 1. Phase 1 Sept '16: Data Collection Overview

This qualitative exploratory study involved engaging with key stakeholders or "numerous highly knowledgeable informants who view the focal phenomena from diverse perspectives" (Eisenhardt and Graebner, 2007, p.28) in healthcare delivery via interviews, presentations, and focus groups. Ethical approval to conduct this study was granted by both the Social Research Ethics Committee (SREC), at a university in Europe and the Ethical Committee at a university in Enugu State, Nigeria. All interviews and focus groups were transcribed verbatim and hand-written field notes were typed. Using a qualitative analysis approach (Ägerfalk and Fitzgerald, 2008), the data was analysed using "seed categories" (Miles and Huberman, 1994) related to the training needs of PHC workers and potential barriers facing mHealth implementation in Enugu.

5 Findings: Visit One

The findings from visit one are briefly outlined in this section to provide the basis for the training framework presented in the subsequent section. The data was analysed with two aims: (1) to develop an understanding of the training needs of PHC workers, and (2) to ascertain the training needs and perceptions of other stakeholders. Firstly, the importance of training was echoed across all stakeholders, supporting the assertions in existing mHealth literature. For health system stakeholders, training was viewed as a vital component in the successful implementation of the IMPACT application. For instance, when asked about the determinants of success, training was frequently mentioned. One interviewee from the Ministry of Health highlighted the importance of skills acquisition via *'training, training, training'.* Another interviewee, a high ranking civil servant, illustrated the importance of training in the following statement: *'There is a need for training, you can't introduce a new idea and not back it up with training'.* These quotes further affirm the importance of offering adequate training.

As the IMPACT application follows iCCM guidelines, it was important to explore PHC workers' current understanding of the guidelines and adherence to these guidelines. The majority of healthcare stakeholders lacked any awareness of iCCM guidelines. This is unsurprising as iCCM guidelines are yet to be introduced in Enugu State despite implementation in two other States in Nigeria. In addition, PHC workers discussed their difficulties in adhering to current paper guidelines noting that these

guidelines were too lengthy and time constraints and staff shortages hindered their ability to adhere to guidelines, thus illustrating the importance of highlighting the timesaving aspects of using the IMPACT application and following the iCCM guidelines to assess and treat young children. Other stakeholders including those from the Ministry of Health also lacked awareness of iCCM. However, one academic with expertise in the area of 'Community Health' was familiar with the guidelines and expressed a positive view on their introduction; describing iCCM guidelines as an improvement on the current guidelines which would improve the efficiency at which PHC workers could assess children. This lack of awareness points to the need to include a comprehensive review of iCCM guidelines when training PHC workers, as well as a brief overview of the aims of the new guidelines when training key stakeholders to ensure a base level of understanding is shared by end users and stakeholders.

In terms of the technical proficiency of PHC workers, participants in the focus groups noted that many workers would require training on basic technical concepts as well as training in the use of the mobile device. This view was shared by other stakeholders such as academic interviewees who noted that training should encompass these basic technical skills prior to providing training on the application. This finding coincides with assertions made by other researchers such as Alwan et al. (2015) who asserted that training programmes which address technology in general as well as the specific solution to be implemented can decrease healthcare workers' anxiety towards using technology. These findings resonate with those of research carried out in the English National Health Service identifying the need for training that goes beyond an introduction to a new software application, to cover the entire workflow and different stakeholders' data needs (Klecun et al., 2014). The planned training programme will therefore include an introduction to mobile technology in general as well as training on the IMPACT application in a bid to improve PHC workers' confidence in using the IMPACT app. We also sought stakeholders' opinions on *how* to adequately train PHC workers in the use of the application. Again, a variety of recommendations were made ranging from one or two information sessions to seven-day training courses. Two important ideas were shared among the majority of stakeholders. First, PHC workers and other stakeholders called for training which went beyond an introduction to the application and created a deep understanding of the application and the technology. Stakeholders believed that this form of sustained, comprehensive training would build 'institutional capacity' which could be harnessed to train new workers in the future. Second, in order to enable end-users to test the application and use it, scenario based training was highly recommended. The training programme will aim to develop this deep level understanding among PHC workers.

The second aim of the data analysis was to ascertain the training needs of all stakeholders based on the current challenges facing mHealth implementation and conflicting views among stakeholders. Motivation of PHC workers emerged as an important challenge facing the delivery of healthcare services in Enugu at present. This issue was addressed by both health stakeholders and PHC workers. Stakeholders including academics and health leaders noted that PHC workers currently lack motivation in the workplace, they often fail to adhere to existing paper based guidelines, and they do not provide complete data in existing health information systems. While PHC workers attributed this lack of motivation to lack of training, lack of resources and staff; other stakeholders focused on the negative impacts of this lack of motivation for the broader health system such as the prevalence of incomplete data and lack of data due to failure to utilise health information systems. As a result, some stakeholders believed that greater supervision of PHC workers could be realised via mHealth applications such as IMPACT, which could provide a real-time transparent mechanism of overseeing PHC-patient assessments and thus ensure that workers are being productive. For PHC workers, the solution was to improve resourcing, staffing and training. These findings provide evidence that the various stakeholders in the health ecosystem including PHC workers fail to understand the views and issues facing other groups and lack an understanding of how their actions impact the broader health system. There is an evident need to educate all stakeholder groups on the challenges facing other groups as well as how IMPACT relates to each group.

The disparity in views was also evident when discussing other challenges facing implementation. For example, many PHC workers expressed fear of technology failure and the lack of back-up plans in

place should this occur, when in contrast, a health information systems developer was confident in the plans currently in place to tackle lack of network and Internet availability and power outages. This highlights the need to ensure all stakeholders understand the technical measures in place to secure and protect data. In addition, there were differences among stakeholders in their understanding of the aims, proposed benefits, and functionality of the IMPACT app. We argue that these disparate views can be addressed via training and educational resources aimed at end users and stakeholders. It is imperative to incorporate the views of all groups in training to develop a harmonic, accurate understanding of how the IMPACT app can help all parties engaged in delivering healthcare services in Enugu. These findings are summarised in Table 2 below, which depicts each challenge facing implementation, the 'As-Is' situation based on these findings, how each challenge relates to the IMPACT app and the aim to address each challenge via training.

Challenge	**'As-Is' Situation**	**IMPACT Application**	**Training Aim**	
			PHC Workers	**Stakeholders**
Adherence to iCCM guidelines	Low awareness of iCCM guidelines among all stake-holders as not yet implemented.	Follows iCCM guidelines to assess, classify and treat sick children.	Ensure PHC Workers have a comprehensive understanding of iCCM guidelines.	Introduce the premise of iCCM guidelines.
Technology Literacy	Some PHC Workers lack experience and confidence using mobile devices.	Requires confidence using mobile devices.	Provide workshop on using mobile devices.	Introduce mobile technology on a broad level.
MHealth Application Literacy	All stakeholders have received a brief presentation on the IMPACT application.	Requires confidence using the application to enter data, follow treatments and synchronise records.	Application walkthrough. Hands on scenario based training. Evaluation.	Provide a walkthrough of the application.
Understanding the application aims	Conflicting views on the aims of the application and the benefits to all stakeholders.	Aims to aid PHC workers in treating sick children and benefits stakeholders via the creation of com-plete accurate patient data.	Presentation on the aims, functionality and limits of the application.	Presentation on the aims, functionality and limits of the application.
Motivation of PHC Workers	PHC workers feel overwhelmed and stakeholders believe workers are insub-ordinate.	Application will improve efficiency but workers must be motivated to adopt.	Presentation on the importance of IMPACT to all stakeholders. Ex-plore motivation via interviews.	Presentation on the importance of IMPACT to all stakeholders.

Table 2. Summary of Research Findings.

6 Training Framework: IMPACTeD

The framework harnesses the findings from Visit One and Table 2 above. The training framework consists of four levels which vary in comprehensiveness. The training framework will be supplement-ed with training resources called "IMPACTeD". These resources cover all levels of the framework in great detail and include various sources of media such as text, image, and video, as well as references to further reading material. The training framework will be supplemented with training resources called "IMPACTeD". These resources cover all levels of the framework in great detail and include various sources of media such as text, image, and video, as well as references to further reading mate-rial. The training framework is visually depicted below in Figure 1.

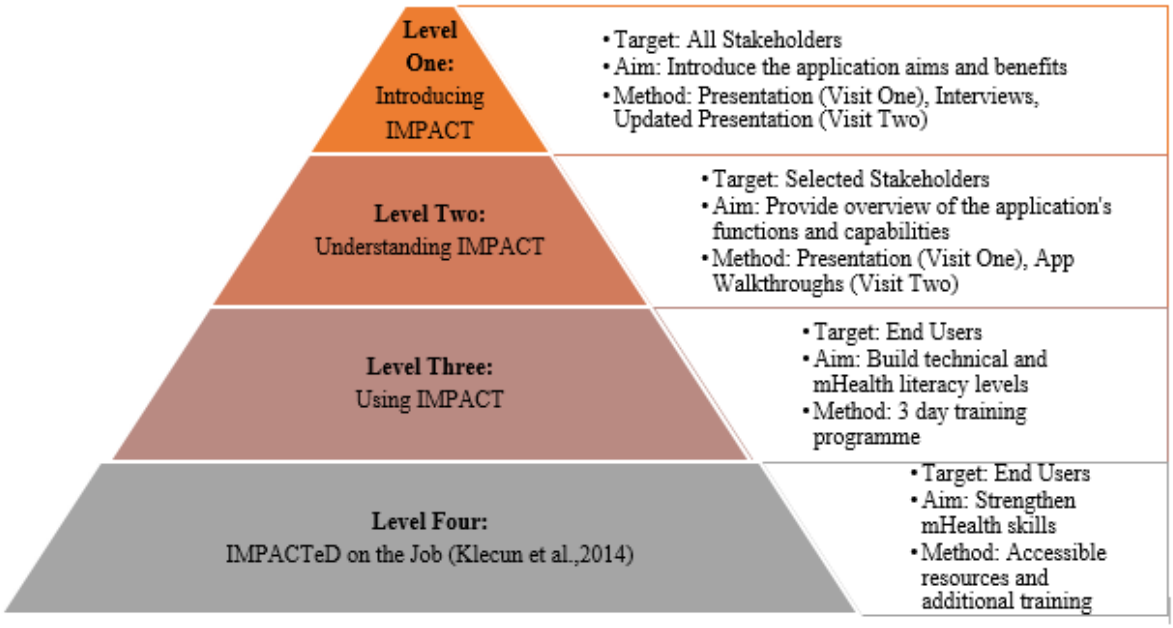

Figure 1. IMPACTeD Training Framework

Level One is entitled 'Introducing IMPACT'. This level targets all stakeholders including academics, administrative staff, health information system developers, as well as PHC workers; the end users of the application. The aim of this level is to ensure all stakeholders have a shared and comprehensive understanding of the IMPACT application, its aims, and how it benefits other stakeholders as well as the background of the application by briefly introducing mobile health technology and the iCCM guidelines. Level One will be implemented via presentations with key stakeholders. During Visit One, an introductory presentation was delivered to the various groups of stakeholders. However, based on the interview and focus group findings, it is apparent that these various groups hold conflicting views on IMPACT and generic mHealth technologies. These presentations will be redesigned to encompass the aspects of IMPACT which relate to all stakeholders, as well as a brief introduction to mobile technology on a general level and how it can benefit all stakeholders and as a result healthcare delivery. Level Two is entitled 'Understanding IMPACT'. This level focuses on the technical functionality of IMPACT including the functions of the application, storage capabilities, security and privacy, and backup plans in place to protect data and aid PHC workers in their roles. This level targets PHC workers, health information system developers, and health officials and aims to create a shared understanding of how the application functions, and its limitations. Again, the application was briefly introduced to stakeholders during Visit One. This provided feedback on the usability of the application, which has been updated since. On Visit Two, level two will involve a walkthrough of the app with stakeholders.

Level Three is aimed at the end users of the application. This level encompasses the two previous levels and includes an additional three-day workshop with PHC workers. This workshop will include a review of the iCCM guidelines to ensure PHC workers understand the aim of the guidelines and the importance of adherence. Technical literacy will also be addressed. To ensure all PHC workers are equipped to use the application, they will be provided with training on completing various tasks with the mobile phone based on Kaphle et al. (2014). These tasks include turning on the device, charging the device, accessing the Internet, and accessing the IMPACT application. PHC workers will be shown how to complete these tasks, provided with assistance when trying out the tasks, and tested on their ability to complete the tasks without assistance. The third aspect of level three training relates to IMPACT literacy or PHC workers' confidence in using the application. Having received a walkthrough of the application, PHC workers will also be provided with a detailed follow-along presentation on each screen in the application, each button and function, culminating in a comprehensive overview of the application in use. They will then be afforded time to experiment with the appli-

cation and will receive assistance throughout this progress. PHC workers will then participate in scenario based training in the use of the application, and an evaluation to determine their comfort in completing various tasks such as creating a record and synchronising a record.
Level Four focuses on the on-going training workshops and training over time (Klecun et al., 2014). This level aims to build on the skills developed in previous levels to address any issues that arise when using the application in practice via updating educational resources or providing new training workshops for workers. It is believed that this training programme will provide PHC workers with the confidence and motivation needed to adopt the application while also ensuring all stakeholders have a shared understanding of the IMPACT application's aims, benefits, and functionality. Elements of the IMPACTeD resources will also be available on the IMPACT application itself.
The IMPACTeD training programme will be implemented in Enugu State, Nigeria in February 2017. To ensure the training framework achieves its goals, it is important to evaluate its efficacy. This paper follows Kirkpatrick's model of evaluation as adapted by Rouse (2011) and includes four stages:

1. **Assess Expectations:** Visit One explored the current expectations of stakeholders. These views will be addressed in the training framework to develop uniformity among participants with regards to the aims and capabilities of the IMPACT application.
2. **Assess Current Perceptions:** Visit One assessed PHC workers' current technology literacy levels and their perceived ability to use mobile technology and the IMPACT solution. The training framework aims to further develop these perceptions.
3. **Usefulness of Training:** Visit Two will explore stakeholders' views on the effectiveness of training and their post-training perceptions regarding their ability to use the IMPACT app.
4. **Interviews and Focus Groups:** Visit two will investigate stakeholders' views to determine the uniformity of expectations and post training knowledge levels.

7 Conclusion

The importance of training to the success of new mHealth solutions has been previously highlighted by mHealth researchers (Kahn et al., 2010; Källander et al., 2013). In our experience, much lip service is paid to the need for healthcare worker training. Following our visit to Enugu in September 2016, PHC training was cited as a high priority (a close second to the issues around limited availability of necessary resources). This paper explores the current training needs of PHC workers and the perceptions of all stakeholders engaged in healthcare delivery to develop a training programme for effectively training end users in the use of the mHealth application and supporting an understanding that is appropriate for the different stakeholders so that they can fulfil their respective roles, taking into account the existence of different perspectives and needs. The IMPACTeD training programme will be implemented and evaluated during a second visit to Nigeria. In order to further understand the training needs of the various stakeholders, shared mental model (SMM) theory (Cannon-Bowers et al., 1993) will be used during Visit 2 to investigate stakeholders' perceptions of the technology i.e. IMPACT app, existing and new processes in the delivery of healthcare in the community and the team i.e. the key stakeholders involved in delivery of healthcare services. In the health context, team performance may translate into more efficient delivery of healthcare services, adherence to guidelines, utilisation of mHealth interventions, and strengthened relationships between PHC workers and supervisors (Thondoo et al., 2015). Further exploring stakeholder SMM in this context should serve to inform the ongoing training needs of all stakeholders and better "assist individuals and groups in 'working out' what the new system means for them and their work" (Klecun et al., 2014, p847). The IMPACTeD training programme will support capacity building amongst healthcare workers on the ground in Enugu moving away from developing 'once off' training sessions by building ongoing support for mHealth literacy beyond the scope of the IMPACT app. Hopefully, it will serve to motivate PHC workers to engage with mHealth therefore improving their adherence to the medical guidelines that are in place. In addition, it is hoped that this framework can be applied to guide the implementation of other mHealth solutions in developing nations and extended further in future research efforts.

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