


# End Users' Initial Perceptions of mHealth in Nigeria: An Investigation of Primary Healthcare Workers' Attitudes to the IMPACT App

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## ABSTRACT

Mobile health (mHealth) is perceived as a “silver bullet” solution to many of the existing healthcare delivery issues in developing regions. However, the design, development, piloting, implementation, and maintenance activities associated with mHealth are significant. Fundamental to the success of mHealth is stakeholder support within the healthcare system. A qualitative exploratory approach using interviews, presentations, and focus groups was pursued to investigate primary healthcare (PHC) workers' initial perceptions of the proposed IMPACT app to support the assessment of sick young children in the community in Nsukka, Enugu State, Nigeria. PHC workers welcomed the prospect of using the IMPACT app. However, they were keen to highlight local infrastructural challenges and lack of access to training as barriers to the wider rollout of the IMPACT app. Through investigating PHC workers' initial perceptions, mHealth projects may be better designed to positively influence end users' commitment and motivation to use mHealth as part of their roles in the future.

## KEYWORDS

Developing Countries, End Users, mHealth, Mobile Health, Primary Healthcare (PHC) Workers

## 1. INTRODUCTION

The use of mobile Health or ‘mHealth’ continues to grow exponentially in both developed and developing regions of the world. Software applications (apps) for smartphones are available for a variety of health-related tasks including symptom assessment, psychoeducation, resource location, and tracking of treatment progress (Luxton, et al., 2011). Since the establishment of the Millennium

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Development Goals (MDG) in 2000 and the Sustainability Development Goals (SDG) in 2016 the healthcare sector in developing countries has experienced the introduction of mHealth technologies (Franz-Vasdeki, et al., 2015; Lee, et al., 2016). There has been significant investment in resourcing mHealth to support expectant mothers (Kazi et al., 2017), to promote health education (Lupton, 2013), and to support the health assessment of communicable diseases such as HIV (Catalani, et al., 2013), Ebola (Akaninyene, Bassey, Okey, & Egbe, 2016), and malaria (Mangam et al., 2016).

Despite the increased investment from Non-Government Organisations (NGOs), governments, and other funding bodies, in conjunction with and the reported benefits associated with mHealth (Leon, Schneider, & Daviaud, 2012), the number of mHealth solutions operating in developing countries remains extremely low (Källander et al., 2013). There are many possible reasons for the low levels of mHealth including resistance among end users and stakeholders and failure to adequately communicate the aims and benefits of mHealth solutions (Klöcker, Bernnat, & Veit, 2015). It is argued that there exists a limited body of empirical mHealth research in the context of developing countries (Franzen et al., 2017; Hossain, Goyder, Rigby, & El Nahas, 2009).

It is therefore imperative that we capture end users' impressions when initially introduced to mHealth projects. This is important to explore, as research suggests that early impressions formulated by various end users impact their attitude towards technology (O'Connor, Eze, & Heavin, 2016). That is, through these early impressions end users formulate their perceptions about the project (ibid), and this directly influences their attitudes towards the project. Subsequently, the objective of this research is to investigate end users' initial perceptions of the proposed mHealth artefact. This paper seeks to explore the first impressions perceived by Primary healthcare (PHCs) workers when initially introduced to an mHealth app, namely the IMPACT app, in Enugu State, Nigeria. Following a qualitative analysis approach, it was evident that PHC workers were positively predisposed to considering the adoption of mHealth as part of their roles in the delivery of healthcare services in the rural community. Broadly speaking, the proposed introduction of mHealth was deemed a welcome initiative that has the potential to create new opportunities for healthcare delivery in this jurisdiction. However, PHC workers were keen to elucidate the challenges associated with the potential implementation of mHealth. These included resourcing and infrastructural challenges, as well as the significant training needs of healthcare workers in the use of mHealth. By better understanding end users' initial impressions, our aim is to develop new interventions, i.e. training and ongoing support, to positively influence end users in their adoption and use of the proposed mHealth app.

The paper is structured as follows – the next section considers the existing body of mHealth literature. Section 3 presents the conceptual model of end users' attitudes toward mHealth adoption proposing four hypotheses for further exploration. Following this, section 4 outlines the research approach undertaken. The findings from our field study are considered in section 5. The results are discussed in section 6 and the conclusions from the study are presented in section 7. Finally, opportunities for further research are outlined.

## 2. LITERATURE REVIEW

In today's digital age, the first impression or the first point of contact a primary healthcare worker may have with electronic health is likely to be via a mobile device. The rationale behind this statement is that diffusion of mobile technology in developing countries has grown exponentially over the past ten years (Haenssgen & Ariana, 2017). Furthermore, it is argued that the use of desktop computers is very scarce in these regions, and where desktops are minimally used they are increasingly becoming more costly to support and maintain (Achargui & Zaouia, 2016). The move from traditional desktop-based computer technologies towards mobile computing environments has resulted in the use of mobile technologies to support various services in developing countries, including the delivery of healthcare services (Kahn, Yang, & Kahn, 2010).

mHealth is defined as the utilization of wireless technologies to access, store and process health data content and services through mobile devices such as phones, PDAs, laptops and tablets (Kay, Santos, & Takane, 2011). The evolution of Information Technology (IT) to mobile computing environments have received immense attention in order to explore their promising opportunities, apparent limitations, and experienced implications for both theory and practice (Kahn, et al., 2010). User acceptance and diffusion studies of mHealth in developing countries are well documented in literature (Alghamdi, Gashgari, & Househ, 2015), primarily examined at a pilot stage of implementation (O'Connor, et al., 2016). Research conducted at this stage of implementation (i.e. pilot) tends to emphasise the exploration and evaluation of new technologies, whereby user experiences, knowledge and familiarity with the new technology and the problems it can potentially solve are examined (McFarlan & McKenney, 1982). It is at this stage that many end-users of mHealth initiatives in developing countries are first introduced to a product and/or service and form initial impressions of the technological artefact.

First impressions are considered to be extremely important (Lindgaard, Fernandes, Dudek, & Brown, 2006), independent of the context in which technological tools are embraced. First impressions are reported as strong predictors for overall attitudes towards utilization (see Table 1 for a sample overview of the research).

**Table 1. Snippet of First Impressions Research**

Authors	First Impression Constructs	Dependent Variable
(Thielsch & Hirschfeld, 2018)	Aesthetic	Use of Website
(Douneva, Jaron, & Thielsch, 2016)	Aesthetic	Memory Performance & Use of Website
(Jiang, Wang, Tan, & Yu, 2016)	Aesthetic	Use of Website
(Tractinsky, Cokhavi, Kirschenbaum, & Sharfi, 2006)	Aesthetic	Use of Website
(Lindgaard, et al., 2006)	Aesthetic	Use of Website

As highlighted in Table 1, research on first impressions has predominantly been conducted focusing on the impacts of first impressions surrounding the visual design/aesthetics of the technological artefact (i.e. websites) and the subsequent usage. Noteworthy, other research has focused on different ways in which first impressions can have an impact, e.g. intentions to participate in IT research (O'Connor, Heavin, & O'Donoghue, 2016b), trusting online financial advice (Agnew et al., 2016), text-messaging in lecture settings (Jones & Marsden, 2004), and online consumer decision support (Jiang, Wang, & Benbasat, 2005). This research offers insights into both the academic and practitioner communities. However, while the authors acknowledge that pleasing visual cues are important because they create first impression that result in an individual's desire to explore further technological artefacts (Visinescu, Sidorova, Jones, & Prybutok, 2015), we argue that more research on first impressions in a developing world context is required. O'Connor, Heavin, & O'Donoghue (2016a, p.186) propose that individuals associated with mHealth projects in developing countries could *"be more concerned with the mHealth initiative solving society-wide critical issues"*. They call for more research to be conducted in this space.

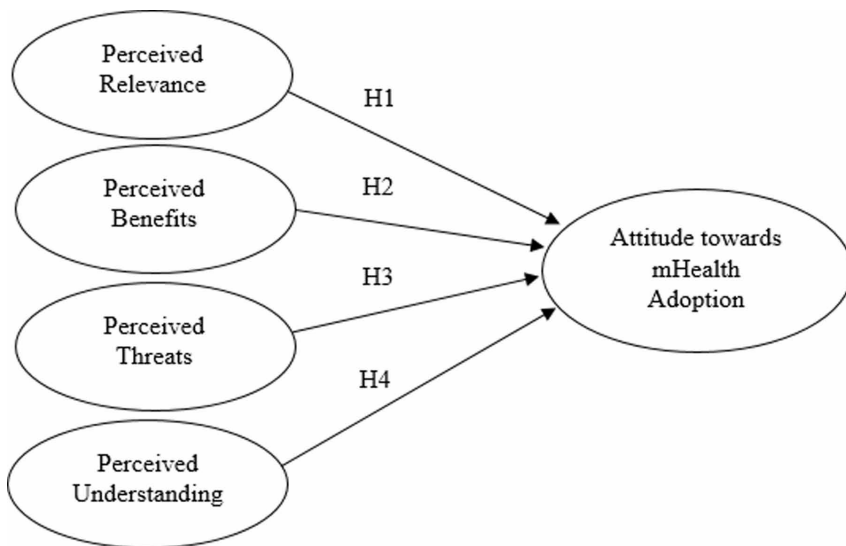
Currently, there is a dearth of research which focuses on how first impressions of a technological artefact which could address (or not) societal issues has an impact on attitudes of adoption from an end-user perspective. To address this gap in literature, a conceptual model is proposed in the next section.

### 3. CONCEPTUAL MODEL AND HYPOTHESES

Leveraging existing literature, we have identified a set of factors that help us to better understand end users' attitude towards mHealth adoption. Figure 1 illustrates factors that characterize PHC workers' attitude when they are initially presented with an mHealth application. These factors include: 1) Perceived Relevance, 2) Perceived Benefits, 3) Perceived Threats, and 4) Perceived Understanding. This model is provided as a lens for viewing or explaining the phenomenon under review (Gregor, 2006). As a result, formal testing of such a framework is not envisaged (Walsham, 1995).

Our aim is to understand the factors that impact end users' attitude towards mHealth adoption. The following subsections consider each of the four factors illustrated in Figure 1.

Figure 1. Conceptual model of attitudes toward adoption



#### 3.1. Initial Perceived Relevance

Perceived relevance, as depicted in Figure 1, is a concept that can be subdivided into two categories (Katsma, Spil, Ligt, & Wassenaar, 2007). The relevance of an ICT development within a healthcare context can be viewed from a macro and micro perspective (Katsma, et al., 2007). The former refers to the extent in which users of Information Technology (IT) (in this case, a mobile health application) will solve problems or help users realise their actual goals. A micro relevance perspective reflects the extent to which IT assists with solving the 'here-and-now' problems of the users in their daily work routines (Spil, Schuring, & Michel-Verkerke, 2004). For this paper, the definition of perceived relevance builds on the work of Katsma et al. (2007) whereby the concept refers to the end users' perception of the apparent value that mHealth based projects hold for them. More specifically, it represents the importance end users' attribute to the new mHealth project. Empirical associations between perceived relevance and attitudes towards new systems have been found, i.e. higher perceived relevance has a positive impact on attitudes toward new systems, albeit not in an mHealth context (Enterprise Systems)(Koperberg, 2010). End user adoption behaviour for mHealth depends on the end users' preference to replace the old system (Shareef, Kumar, & Kumar, 2014). Therefore, the higher the perceived relevance of the mHealth project from an end user perspective, there is an increased positive attitude towards adoption. Thus, it is hypothesised:

**H1:** Initial Perceived Relevance has an impact on end users' attitude towards adoption of mobile health.

### **3.2. Initial Perceived Benefits**

Research argues that anticipated benefits are a significant predictor of individual behaviours (Petter & McLean, 2009). Benefits for healthcare practitioners (i.e. end users) include improvements in information and time management, enhanced communications and consulting, reference and information gathering source to promote medical education and training, improved clinical decision-making, and better patient monitoring (Ventola, 2014). If the initial perceived benefits associated with the mHealth project are high, end users are more likely to possess positive attitudes towards adopting mHealth. Conversely, if end users perceive few benefits associated with the mHealth project then these individuals will acquire negative attitudes towards adopting mHealth. As a result, it is hypothesised:

**H2:** Initial Perceived Benefits has an impact on end users' attitude towards adoption of mobile health.

### **3.3. Initial Perceived Threats**

Research conducted on the perceptions of the effects of mobile devices on medical data security and privacy and healthcare quality found that mHealth may be subject to unintended consequences such as increased threats to data privacy and security (Richardson & Ancker, 2015). Eight years previously, it was found that end users perceive data security as one of the central tenets associated with the implementation of an electronic health application (Sequist et al., 2007). Therefore, higher perceptions of threats, in terms of perceived privacy and security breaches, may negatively impact attitudes towards adoption of mHealth. Several other threats have been associated with health technology implementations in developing countries. For example, it was noted that end users of a health information exchange system in Rwanda highlighted issues associated with system use such as network access and reduction in time spent with patients (Sahay, 2016). This system provides an example of health system implementation without reaching scalability. There are often other factors driving end-users' attitudes and actual use of new solutions such as network problems, and time constraints (Vedanthan et al., 2015). Therefore, it is hypothesised:

**H3:** Initial Perceived Threats have a negative impact on end users' attitude towards adoption of mobile health.

### **3.4. Initial Understanding**

It was purported that the absence of knowledge about a target system and limited direct behavioural experience with the system can negatively impact individuals' attitudes towards the adoption of technology (Venkatesh, 2000). A study on individual differences and conceptual models in training novice users reveals that users' knowledge or understanding of the system will impact their motivation to use it (Sein & Bostrom, 1989). Building from existing research, it is hypothesised:

**H4:** Initial understanding of the system has an impact on end users' attitude towards adoption of mobile health.

## **4. METHODOLOGY**

The IMPACT (usIng Mobile Phones for Assessing, Classifying and Treating sick children) project explores the feasibility of introducing an mHealth application for use among PHC workers. The IMPACT app is targeted at the assessment of sick young children in rural communities in Enugu State, Nigeria. The IMPACT app was developed in conjunction with collaborators in the College

of Medicine at Enugu State University of Science and Technology (ESUT). The IMPACT app is a functional prototype android-based mobile application designed and developed to support PHC workers assess young children in rural communities. 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 project consisted of two phases of data collection, the first of which is briefly discussed in this paper. During a week-long visit to Enugu State, Nigeria in September 2016, the project team conducted a qualitative exploratory study engaging with PHC workers (i.e. end users) via interviews, presentations, and focus groups. As part of the visit, the project team presented the IMPACT app at Nsukka Health centre and at Parklane Teaching Hospital. The presentation outlined the objective of the study and presented the IMPACT app outlining its design and key features. Participants were allocated time to access and interact with the IMPACT app via smartphone technology made available to them during the presentation and focus groups. We conducted three focus groups with 20 prospective end users, i.e. PHC workers, of the IMPACT app. Data collection amounted to over eight hours of taped interviews/focus groups and over 30 pages of typed field notes. It is important to note that these groups of PHC workers were relatively well-educated. A number of these workers had bachelor's degrees and at least two years training in the role of PHC worker.

Ethical approval to conduct this study was granted by the Social Research Ethics Committee at University College Cork and by Parklane Teaching Hospital, Enugu State, Nigeria. All interviews and focus groups were transcribed verbatim and hand-written field notes were typed. Using a qualitative analysis approach, the data was analysed using "seed categories" (Miles & Huberman, 1994) related to the conceptual model in Figure 1.

The seed categories shown in Table 2 relate to the four hypotheses including: initial perceived relevance of the mHealth project, initial perceived benefits, initial perceived threats, initial perceived understanding and initial attitudes towards adoption. Data were reviewed by the research team and attributed to the seed categories through several iterations of review. Table 2 highlights examples illustrating the chain of evidence from the seed categories to the interview data (Beaudry & Pinsonneault, 2005). Next, section 5 presents findings from the interviews and focus group, these were coded by participant by focus group, from focus group 1 to 3.

## 5. FINDINGS

### 5.1. Initial Perceived Relevance

In line with H1, PHC workers' impressions on the relevance of the mHealth application to their daily work activities and processes were explored. In each focus group, all PHC workers expressed positive perceptions regarding the relevance of the mHealth application as a tool for aiding them in the assessment and treatment of young children. PHC workers also believed that the mHealth application could improve the effectiveness and efficiency of assessing patients as it enables PHC workers to adhere to guidelines in a timely manner. PHC workers noted this would improve on their current processes which require them to utilise a large treatment book and sift through different sections to ask questions about different patient ailments. When the question seems irrelevant, PHC workers will skip this question thereby not adhering to recommended guidelines. "If someone comes in with fever, cough, and diarrhoea, you have to go to fever page, the cough page and the diarrhoea page and that makes our work very difficult and stressful" (Focus Group 3, Participant 4). The mHealth application enables the seamless transition of questions regarding one ailment to the next in line with treatment guidelines, thereby facilitating adherence to recommended treatment guidelines.

The link between perceived relevance and attitudes towards the application was also apparent and positive as evidenced in quotes such as "I think it will be useful, as I am seeing it now, I like it, I will use it" (Focus Group 2, Participant 3). Furthermore, the importance of perceived relevance was

**Table 2. Snapshot of Data Analysis**

Seed Category	Sub-categories	Link to Attitude	Illustrative Quote
Perceived Relevance	Aligns with daily tasks. Improve effectiveness of treatment.	High perceptions of relevance were linked to positive attitudes towards adoption and positive intentions to adopt.	<i>“I think it will be useful, as I am seeing it now, I like it, I will use it”</i>
Perceived Benefits	For PHC workers: Uniform assessment of patients, creating reliable records, reducing stress. For guardians: Reducing costs of treatment, Improving guardian confidence.	High perceptions of benefits were linked to positive attitudes and intentions to adopt.	<i>“Yes, we would like to use it, we like it, it will help patients, it will motivate the workers”.</i>
Perceived Threats	Technical: connectivity, battery life, electricity. Community: gaining buy in from the wider community.	Participants expressed concern about several threats. If threats were not addressed, participants’ willingness to use the application was negatively impacted.	<i>Need to organise a “workshop telling them this mHealth app is efficient. Otherwise, it may not be as efficient as we hope.”</i>
Perceived Understanding	All respondents had a clear understanding of aim of the app. Participants understood the function of application.	Perceived Understanding of the Application was linked to positive attitudes but intentions to adopt were dependent on the availability of training.	Understanding: <i>“Yes we will use the application if we are taught how to do so”.</i>

also evident in our focus groups with PHC workers noting that some workers will not use existing information systems if they do not deem them relevant. This is captured in the following quote: “Some people will say it will waste their time and won’t like to use it” (Focus Group 3, Participant 5). This strengthens our arguments on the importance of first impressions and incorporating end-users early in the implementation process.

## 5.2. Initial Perceived Benefits

H2 posited that initial perceptions of the benefits associated with the mHealth application would influence PHC workers’ attitudes towards the application. All PHC workers expressed positive views regarding the potential benefits of the application. These benefits included enabling the uniform assessment of all patients, creating reliable records, reducing costs of treatment, improving guardian confidence in treatments, and reducing stress on PHC workers. These perceived benefits also fostered positive attitudes towards the incorporation of the mHealth application into their work processes. This is evidenced in the following quotes. One participant expressed her belief that the application would

increase the number of patients visiting the clinics due to the efficiencies it would bring “I think that once we start using this phone, it will make many people come because it will be very easy to test everybody in the clinic” (Focus Group 2, Participant 3). In addition, several participants in Focus Group 2 expressed positive attitudes towards use of the application due to the benefits it could bring noting; “Yes, we would like to use it, we like it, it will help patients, it will motivate the workers”. These quotes demonstrate the positive link between perceived benefits and attitudes towards the application and illustrate the need to communicate the benefits to all end users and indeed patients and other stakeholders prior to implementation.

### 5.3. Initial Perceived Threats

H3 explored PHC workers’ perceptions on the threats facing the mHealth application by asking workers about the challenges which may hinder the success of the mHealth application. The initial threats discussed by PHC workers mirror many of the challenges noted in previous studies conducted in developing countries. Many challenges were technical in nature with PHC workers expressing concerns over ensuring network access, software reliability and ensuring devices were adequately charged for uninterrupted use throughout the day. The following quote represents an example of the many current challenges PHC workers face in ensuring mobile devices are charged. “We charge phones with house electricity and when there is no electricity we charge it with generator, but the problem is that sometimes we don’t have access to that generator, or the generator has a fault, what can we do about it?” (Focus Group 1, Participant 3). In contrast to our hypothesis, end users did not view privacy or security as a threat associated with the application. This is illustrated in the following quote; “we do not show anybody people’s health information” (Focus Group 3, Participant 1). Due to the low perceived threat represented by privacy and security, privacy has no influence on attitudes towards the mHealth application. The link between these perceived threats and attitude was demonstrated in PHC workers’ questions on possible solutions as a means of reassurance that the mHealth application would work. This desire for reassurance was evident in statements such as “I need it to diagnose people, how long will the battery last?” (Focus Group 1, Participant 2). Without communicating the backup measures in place to enable charging, PHC workers may believe that the application is unreliable and therefore may express negative attitudes. By exploring these threats, the mHealth team can develop mitigation strategies and communication plans to ensure all end users are aware of these measures.

Another perceived threat discussed in the focus groups related to community engagement and support. PHC workers highlighted the importance of educating community members on the reliability of the application to achieve their acceptance. They noted that without such engagement, community members may express negative views towards the application. This is evidenced in the following quote: “Rural dwellers do not have confidence about the result generated in the health centres in the rural areas. If you come up with a programme where the community leaders engage the rural dwellers in a workshop telling them this mHealth app is efficient, that it the same result, and it is better than what you have in the traditional means of diagnosis. Otherwise, it may not be as efficient as we hope” (Focus Group 1, Participant 5). This finding illustrates the importance of engaging with PHC workers on the ground to identify any potential barriers and develop informed mitigation strategies.

### 5.4. Initial Understanding

In line with the final hypothesis, participants’ initial understanding of the functionality and limits of the mHealth application was investigated. Upon viewing the mHealth application, PHC workers demonstrated a cognizant understanding of the basic aim of the application to assess and treat young children and its functions including data entry, classification, and data storage. The link between understanding and attitudes was also prominent. All PHC workers expressed a willingness to use the application, provided training was received with several participants in Focus group 2 stating “Yes we will use the application if we are taught how to do so”. The level of training varied with PHC workers



who had previous experience using Android devices noting the application “will not be difficult for us to use” (Focus Group 1, Participant 1). It is imperative to investigate initial understanding as this understanding was linked to the other first impressions as it enabled PHC workers to identify the relevance of this application to their jobs, the benefits and any threats or barriers to their use.

## 6. DISCUSSION

The introduction of new mHealth solutions is often met with resistance from stakeholders including end users (Klöcker, et al., 2015). As this resistance may negatively impact acceptance of mHealth solutions, it is imperative to explore end users’ initial perceptions and develop an implementation strategy which (1) highlights the relevance of the solution, (2) outlines the benefits of the solution, (3) describes strategies to mitigate threats and barriers, and (4) communicates the aims and functionality of the solution. This section briefly discusses the insights gained from focus groups with end users in Enugu State, Nigeria.

Following the presentation briefing on the new mHealth application, end users’ expressed their positive perceptions regarding the relevance of the mHealth solution. They articulated the belief that this application would provide an improvement on existing paper-based data collection and assessment processes. At present, PHC workers often fail to adhere to treatment guidelines due to the length of time required to assess patients. The new mHealth application enables the efficient, uniform treatment of patients in accordance with treatment guidelines. The perceived relevance and improvements realised by the new mHealth solution fostered a positive attitude towards the new solution among PHC workers. Previous research indicates that perceived relevance can drive actual adoption behavior upon implementation of the new system (Shareef, et al., 2014). It can thus be argued that PHC workers’ positive first impressions towards the application will pave the way towards acceptance and adoption of the application upon its introduction.

PHC workers expressed the view that the new mHealth application could generate many benefits including data generation and the uniform assessment and treatment of children. In addition, they opined that the new app could improve the ease by which patients could be treated. This adds further empirical support for the benefits of health technologies highlighted by previous researchers (Ventola, 2014). Furthermore, these perceived benefits also manifested in positive attitudes towards adoption of the application. Several threats facing the application were discussed by PHC workers. These included technical threats such as availability of Internet access and electricity issues as well as resourcing issues such as time limits to conduct patient assessments and lack of staff resources at the community clinics. These constraints echo the findings of previous studies in developing countries including network problems, and time constraints (Sahay, 2016; Vedanthan, et al., 2015). These prior studies noted that these threats hindered the success of health technologies and led to the eventual failure of the system. However, as this study highlights perceived barriers prior to implementation, mitigation strategies can be devised to address these threats and communication strategies developed to educate end users, thereby decreasing perceptions of threats and increasing the likelihood of adoption upon implementation. Privacy and security did not represent a threat according to end users, thus refuting assertions made that privacy and security represent barriers to mHealth in developing countries (Al Dahdah, Du Loû, & Méadel, 2015). PHC workers developed an initial understanding of the mHealth application, its functions and aims. This understanding fostered positive perceptions towards the relevance of the application to their work processes and tasks, the benefits attainable from use of the application and positive attitudes towards the adoption of the application.

As scalability remains an issue plaguing the success of mobile health in developing countries, the need to engage end users throughout the project to achieve positive attitudes, adoption, and eventual scalability has been highlighted (Källander, et al., 2013). This paper seeks to engage end users at the pre-implementation stage via informative presentations and focus groups. The findings highlight the influence of end users’ first impressions in the formulation of their attitudes towards

a new mHealth application. The paper extends existing knowledge by elucidating the influence of first impressions on attitudes towards adoption. While many existing studies explore the attitudes of end users or stakeholders after implementation, this paper illustrates that many perceptions are formulated upon the initial introduction of the application via presentations. By engaging end users prior to implementation, many of the barriers which often hinder implementation and scalability (Sahay, 2016) could be adequately addressed thereby improving the likelihood of success. Positive first impressions can be capitalised upon by developing an informed communication strategy which strengthens these positive attitudes and perceptions on the relevance, understanding and benefits of the application and educates workers on the measures in place to reduce threats. It is believed that such a communication strategy can improve the likelihood of success for new mHealth applications. In a practical sense, this paper highlights the issues which persistently influence the use of mHealth solutions such as Internet and electricity availability and resourcing issues which hinder adherence to treatment guidelines. These issues must be addressed to facilitate not only the success of future mHealth implementations but effective and efficient delivery of healthcare services in developing countries.

## 7. CONCLUSION

This research extends understanding and knowledge of participatory behaviour by examining the intention to participate in a mHealth project as opposed to the decision to adopt ICT, for which the latter has underpinned IS research to date. For the most part, end users were positive about the relevance and benefits associated with mHealth. They focused on how this new technology could support them to become more efficient and effective in their roles. PHC workers envisaged that mHealth could positively impact the wider community's perception about the quality of healthcare services delivered at the community health centre. Further, it seems that the introduction of mHealth could also improve PHC workers motivation in their roles. PHC workers in this study identified challenges associated with the availability of electricity, internet and technical resources as potential threats to mHealth adoption. In addition, the rural community health clinics are challenged by existing negative reputational perceptions amongst the local people. PHC workers advocated the need for community wide mHealth education and training to eradicate any negative perceptions or misgivings about the potential use of mHealth as part of a patient's assessment. In general, PHC workers were confident about their ability to use the mHealth application once they are provided with the adequate training and support to do so.

While the approach used in this study provides rich insights into the perceptions of PHC workers on the ground in Enugu, this qualitative exploratory study among a small sample does not allow us to understand the extent to which each of the four hypotheses impacts end users' attitude toward adoption. It is important to acknowledge that Nsukka is a university town, many of the PHC workers involved in the study had a bachelor's degree, indeed many of them are qualified nurses. We believe that end user education may also play a role in developing positive perceptions around the possibility of adopting new technology as part of their roles. The sole focus of this research was to understand end users' motivation to engage with a mHealth pilot study. As mHealth designers, developers and implementers, this improved understanding will provide us with an evidence base to better support end users when the mHealth application is rolled out. This research does not claim to analyse any impact on user motivation to participate in subsequent larger scale implementations. Indeed, this study provides participants with a high level view of the mHealth solution and does not endeavour to investigate the usability of the app itself.

## 8. FUTURE RESEARCH

This research project promises important translational impacts by equipping PHC workers with the knowledge and skills necessary to effectively undertake to utilise the IMPACT application in the

future, thereby improving the delivery of healthcare services to young children in Nigeria. These initial findings prompt us to ask four further research questions: 1) to what extent does each of the hypotheses impact end users', i.e. PHC workers', attitude toward adoption, 2) pursuing a community-up approach, how do PHC workers influence the outcome of an mHealth project and subsequent wide scale rollout of the mHealth solution?, 3) in order to further understand the surprising finding that privacy and security were not deemed barriers to mHealth, how do PHC workers perceive privacy and security factors relating to patient health data and mHealth?, and 4) as IS researchers, how can we actively promote the successful scalability and long-term embeddedness of mHealth in developing countries.

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