

A post-development perspective on mHealth – an implementation initiative in Malawi

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Abstract

While the sheer number of mHealth implementations around the world have been increasing dramatically, authoritative voices on global health have tried to put the focus on quantifiable evaluations and comparisons of these projects (e.g. health outcomes, cost savings, efficiency) in order to channel donor funds and investments into proven and scalable solutions. Drawing on empirical data from an mHealth implementation in Malawi we argue that quantitative evaluation of health interventions often assumes a top-down and limited view on the developmental impact of mHealth. Through our action-research involvement with facility-based reporting of routine health data through mobile phones, we conclude that developmental impacts of mHealth are local and each locale experience a different developmental impact depending on the context of use and available resources. The paper contrasts global concerns for quantifiable development with local priorities with respect to mHealth projects and information system (IS) interventions in health more broadly.

1. Introduction

mHealth or Mobile-based Health Information System projects have shown the promise in changing health outcomes in developing countries [1]. Although the number of mHealth initiatives is staggering, recent reviews have shown that most initiatives have failed to scale and sustain beyond pilots [2]. Other researches [3] have suggested that to see the benefits of “ICT for development” (ICT4D) interventions in primary healthcare, these need to be scaled to a level, where they can inform decision making and resource allocation for whole administrative regions. At the global or national-level, there is a push towards interpreting the impacts of mHealth initiatives through the concept of *scale* in

breadth (number of users) or depth (across organizational hierarchy). There is also a number of mHealth initiatives that primarily target impacting health care directly [4][5][6] or indicators [7]. Recent review of mHealth projects shows that while mHealth initiatives have focused on treatment compliance, data collection & disease surveillance, point-of-care support for health workers, disease prevention, health promotion, emergency response [8], very few projects have tried to study the organizational impact of mHealth. Through our adoption of a post-development perspective [9], we would argue that developmental impacts of mHealth need first to be analyzed in terms of the local organizational adjustments. Unless local organizational work practices and arrangements are fully understood and appreciated, quantifiable impact on measurable indicators may dwindle as soon as external funding or expert involvement is withdrawn from the projects. The paper also delves on how decision making power and influence over local change [10] is taken away from the local health workers (and their patients), who are the immediate users of mHealth applications and transferred to managers and administrators at the higher levels within the health system. Often real decision making power over what practices are inscribed into an mHealth solution lies not with the ministry of health, but with the foreign agencies and intervention researchers who are funding and implementing the solutions.

The paper is organized as follows. In section 2, we put forth the concepts from post-development theory that guides our analysis. In section 3, we describe our research approach of Critical Action Research. In section 4, we describe our empirical case and detail the development and implementation of the mHealth project. In section 5, we provide analysis and discuss the impacts of mHealth projects at the grassroots level. We conclude the paper by providing a comparison between global development and local priorities with respect to mHealth and

information system (IS) interventions in health more broadly.

2. Post-development theory

Post-development theory puts forth the idea that the notion of development has constructed a hierarchy of developed countries and under-developed countries [11]. This hierarchy suggests that under-developed countries are dependent on help from developed countries to reach the level of development and the lifestyle associated with the developed countries. Information and Communication Technology for Development (ICT4D) initiatives are exemplary of this rhetoric, as technology bears promise to bridge the gap and bring development into contexts where technological knowledge and resources are inadequate. The existing development ideology suggests that external agencies from developed countries provide the technology expertise and help solve social challenges in the under-developed countries through the use of technology. Instead of this indicator-determinist world-view, post-development school of thought is concerned with the study of local culture and knowledge, critical stance towards established scientific discourse and promotion of local, pluralistic grassroots movements [12].

Among the concepts of Post-development theory, we draw on the following:

1. Cultural relativism as an opposition to Ethnocentrism
2. Grassroots movements
3. Non-universalism

Ethnocentrism is behavior of an individual or groups of individuals to judge another culture solely on the values of one's own culture [13]. This bias is also termed as egotistic because of the pride that one experiences and views other cultures as lacking in something. This behavior leads to the condition where culture from the so-called "South" or "under-developed" cultures are considered to be backward and need support. In the case of mHealth/eHealth, this means that support for technology change in health systems in under-developed countries needs to come from developed countries. Thus due to ethnocentrism, use of technology is considered self-evident as an improvement to health care systems independent of how the culture is accustomed in its forms of communication within its existing cultural practices and norms. In contrast, post-developmental perspectives recognize cultural relativism. Researchers, or in our case mHealth interventionist

researchers acknowledge the inherent value of existing practices and customs where the system needs to be implemented. Cultural relativism does not mean that one's own inclinations towards a certain culture, based on life long experience and indoctrination is incorrect, but it does mean that claiming one's view as self-evidently better is inappropriate [14]. Thus, dismissing the notion of technology benefits because it was useful in the so-called "developed" world is incorrect, but questioning the principles of technologists, along with the view of the culture where the technology is to be implemented is highlighted by the concept of Cultural relativism.

Post-development theory uses the concept of grassroots movement to highlight the fact that change that is done from outside the system is generally resisted to by individuals on whom the change is being thrust upon [12]. The concept of grassroots movement highlights the fact that change is often most appropriate when coming from within the system and helps improve the system in a more sustainable way. This has been highlighted by other researchers [2] reviewing different mHealth projects and encourage the fact that there should be "South-to-South" collaborations to enhance mHealth. There is a dearth of research studying grassroots effect or movement as an impact of mHealth implementations. Evaluation of mHealth projects also lack any form of studying the grassroots movements that have occurred due to the interventions made by technology. Using post-development lens, one needs to look at grassroots movement as a contributing factor to need for change.

Non-universalism is the concept in post-development theory which suggests that there is no common process of development that can be followed in all contexts. Technology or any change that is supposed to result in development cannot be the same across different contexts. Non-universalism suggests that approaches to development are context-specific. This is to say that change needs to be evaluated through the eyes of the local.

3. Research Approach

The three authors of this paper are part of an international research network named Health Information Systems Programme (HISP). The main activities of the HISP network consist of developing free and open-source software systems (FOSS) and implementing them in collaboration with local partners. The HISP network draws on action-research methods by involving local agencies like health

ministries, NGOs and mobile operators, and has implemented the District Health Information System (DHIS2) in more than 15 countries in Africa and Asia. The mHealth project (DHIS-Mobile) draws on and extends the global DHIS2 project and aims to share learning between the different nodes of the network.

The authors are involved in the implementation of mHealth applications in partnership with the Ministry of Health, Malawi and are currently piloting the mHealth solution in two health areas in Lilongwe, Malawi. The research is conducted as Critical Action Research as developed by Kemmis [15] and Carr and Kemmis [16]. We follow the steps of problem-solving cycle of action research [17] and the incremental process improvement wheel [18]. These steps include planning, data collection, analysis and reflection. We see that deliberate reflection and critical analysis of any interpretations as necessary for effective learning and research in action research. Since, we are also linked to the larger network of action researchers [19]; there is often discussion with a panel of fellow researchers or a 'self-reflective community of researchers' [17] enhances the rigor of research. Such reflection is valuable for interpretive research in general. A formal stage of reflection, involving deliberate and critical thought, is performed after the data are analyzed [20].

Key informants for our study include medical personnel, health surveillance assistants, and statistical clerks, from all 17 health facilities that are part of the pilots. Training sessions we conducted for would-be users on the solutions under pilot involving three stages. There were multiple segments to the trainings. Firstly, we conducted focus group discussions, with participants, covering topics such as existing paper-based routine health data collection and reporting practices, challenges related to monthly aggregate data reporting, data use at health facility level. We also discussed what sort of feedback health facilities get from the District Health Office, if any, on reports they submit. The second part involved hands-on training on the DHIS Mobile solutions under pilot. This was then followed by a feedback session on all matters covered during the training. This was done through another round of discussions and completion of pre-designed feedback forms. Additional data for this paper comes from close involvement with different partners who are involved in the project and its implementation. We've conducted focused group discussions and interviews with 22 community health workers, two health facility managers and two district-level health department officials. Every iteration of the mHealth application involves feedback and critical analysis of

the data collected through the interviews and changes are made to the application based on the feedback.

For the purpose of understanding the context, we've collaborated with researchers working in other health information-related projects in Malawi, local master students from the Chancellor College of the University of Malawi, for example. One of the authors of the paper has also been involved in review of mHealth projects in Malawi and understands the local culture, context and language (Chichewa).

4. Facility-based Reporting through mHealth Application

The global Health Information Systems Programme network has been involved in the design, development and implementation of a suite of tools that can allow reporting health information from health facilities to district health offices. The applications that we are implementing in Malawi are an evolution of a previous application that has been implemented starting in India [21] and then to other places in Tanzania, Gambia, Zambia and other countries. Based on the experiences and lessons learnt from other nodes in the network [22], we build on the existing mHealth solution and work towards matching it to the context of Malawi.

We are piloting two types of applications through which community health workers and health facility administrators can report data to the ministry of health. One is a mobile web-browser based system that allows the user to open a website, fill forms and submit data. The other application is a Java ME application that can store information on the mobile device and based on the user's input will send the information. Both these applications contain the same forms and data from both solutions are stored in the same central database with the ministry of health. We chose to implement only two routine forms for the pilot study, but a functional widening to include all relevant paper forms from the facilities is being planned. At the time of writing, we are working with two monthly reporting forms, the Integrated Disease Surveillance and Response (IDSR) form and the HMIS-15. The IDSR form is used for tracking incidences of communicable diseases and diseases targeted for eradication, such as Cholera and Measles, The HMIS-15, on the other hand, is a summary form comprising select data elements across health programmes. At least two people from total of 17 health facilities distributed across two health areas (Kabudula and Area 25) have been trained to use the application and have been reporting data to the ministry of health.

Ground work on our pilots started the second half of 2011, through discussions with the Ministry of Health's Central Monitoring and Evaluation Division (CMED) and the Lilongwe District Health Office, on goals and scope of the project. Through the discussions, it was agreed that we run a pilot of the mobile phone-based reporting solutions in all health facilities under Lilongwe DHO. Lilongwe was chosen as a pilot district because it was the only district ready to utilize DHIS2, a server-based solution. Other districts in Malawi were still utilizing standalone desktop solutions for data storage and processing, and paper forms are entered into these systems by data clerks. Although Lilongwe DHO had started shifting to DHIS2, these efforts were put on hold and the office has gone back to using the standalone solution, due to technical support related issues. Nevertheless, the DHIS-Mobile pilots are being run partly to revive the efforts and ensure that Lilongwe DHO uses DHIS2, as a national best practice district. At various points, we have also provided technical advice to the Ministry of Health on how to manage migration from distributed standalone instances to a server based DHIS2 national setup.

For the mHealth pilot we initially acquired 20 Nokia C2-00 handsets from India. We opted to get the phones from India, where they cost \$50 compared to around \$85 in Malawi. The phones that we got from India, as we learnt during the testing in Malawi were not adapted to the mobile network configuration in Malawi. The Nokia C2-00 handsets have dual-SIM and internet settings such as APN (Access Point Name) cannot be configured manually. The mobile phone operators in Malawi had not configured their networks to automatically send internet settings to this model of the phone, since they were not in-use in Malawi. We spent a lot of time communicating with the mobile operator including communicating to the operator's operations division in India, but we could not get the configurations done on the phones in Malawi in-time. Because we were losing a lot of time, we shipped these 20 phones back to India and instead bought a model of phone that was available and worked in Malawi (Nokia C1-01). This was an important lesson at the start of the project that universalism needs to be taken with a pinch of salt. Technology that worked fine in one context, although expected to work in another context does not always work as expected. In our case, we see that understanding and applying the concept of non-universalism would have saved us a lot of time and improved our implementation from the very beginning. We did align much better to the mobile operator and the available network later, but doing

that from the start is an important lesson that we've learnt.

To enable all health facilities to send in monthly reports, we provide them with a monthly credit of MWK 1500 (~\$9 at the time of implementation). Thus far, we have not capped monthly Internet traffic to allow health facilities submit reports even when they have exhausted the allocated MWK 1500 on voice calls.

4.1. Mobile Services & Internet Connectivity

Over time, we have also had problems relating to mobile service delivery. For example, it has taken about five months for our mobile service provider to cap voice calls (at MWK 1500) for all the post-paid numbers we issued to health facilities, despite this being the agreement before we rolled out our solutions. Data reporting by health facilities has also, at times, been affected by intermittent GPRS/EDGE services. For example, at some point, we advised one health facility under Kabudula Health area to use a different service provider, from the one we had an agreement with.

At the start of our pilots, the Health Management Information Systems (HMIS) and Integrated Disease Surveillance and Response (IDSR) officers at Lilongwe DHO had no internet access. This meant that they could not access the data that health facilities had submitted. The two health area offices taking part also had no dedicated Internet access. After noting these problems, we provided the HMIS and IDSR officers at Lilongwe DHO with Internet dongles, to enable them access the online DHIS2 server. We also provided Kabudula Health Area Office with an Internet dongle and oriented staff on how to monitor monthly data reporting, by health facilities under their jurisdiction. We were unable to get Area 25 Health Area Office connected, because their computers had been taken to the district health office for repairs, when we visited the office.

Getting the health area offices connected to the Internet and able to access the DHIS2 server, to which health facilities are submitting reports, is an attempt at creating an opportunity for the health areas to have access to tools for automated data analysis. This way, health area offices can be encouraged to utilize data in decision making. Furthermore, they can also provide much needed guidance and feedback to health facilities, on various health service performance indicators

4.2. Multi-stakeholder Involvement and Systems Development Support

This pilot cuts across multiple organizations and geographical boundaries. Conversely, there are also various challenges in trying to align the interests of multiple stakeholders. Some key stakeholders in this effort include the Ministry of Health in Malawi, the University of Oslo, and Chancellor College (through the Mathematical Sciences Department), and the Malawi College of Medicine, which hosts and maintains the national DHIS2 server in Malawi. The pilot is also part of rapidly changing mHealth landscape in Malawi, where there is an ever increasing number of players and solutions being piloted and scaled. Realizing this, we are actively taking part in shaping discourse on mHealth in Malawi, through the mHealth-Malawi, a grouping of organizations implementing mHealth solutions in Malawi. The grouping is working towards harmonizing efforts on mHealth in the country. Further to this, the group is working towards the development of guidelines to inform mHealth implementations in Malawi. .

4.3. The grassroots movement of using mHealth

Our empirical findings have suggested some important advantages that make mobile phone-based submission of reports useful for the health workers and health facilities. Staff from health facilities indicated that when they have to physically travel to the district health office to deliver reports their travel costs are neither refunded nor subsidized. This results in the problem that they do not prioritize report submissions, but only submit reports when they are going to town to get their salaries. This is supported by the quote below:

“For the reports to be delivered well, we sacrifice ourselves...going to district office...using our own cash...so it’s a big challenge” (an officer from one of the health facilities taking part in our pilots)

In our case, we observed that health officers needed to spend approx. MWK 1500 for a monthly trip to the district office. There are also additional problems of stationery that the health facilities or officers have to bear out of their own pockets. At times, the ministry of health has not been able to provide enough forms to the facilities for reporting. When asked what they do if they have no money. Some officers mentioned that they don’t submit the reports or send the reports through some colleagues who might be going to town.

In addition, personnel from most health facilities also indicated that they are unavailable for service delivery to clients, at their health facilities, for a complete day, when they have to submit reports at

the district health office. Most of the roads in rural areas are muddy during the rainy season and commuting to the district health office is extremely difficult. Since we also travelled to some health facilities during the rainy season, we experienced that without a 4x4 vehicle, it was practically impossible to reach the health facilities from the town center.

In addition, it is a known fact that health facilities in Malawi, especially those in rural areas are understaffed. Thus, we were requested by the health officers and district health office personnel to have solutions in place that allow medical personnel to submit reports on time, without adversely affecting their service delivery to clients. The use of mobile phones for data reporting is a promising route to take. Now after the pilot has been running for eight months in one area, we have evidence to show that mobile phone-based reporting can help address some of these challenges, as is indicated in the quote below:

“Previously we had problems with transport and stationery...now [reporting] has been simplified with the phones” (an officer from one of the health facilities taking part in our pilots)

Participants in the pilots also seem to find the mobile reporting tools easy to use. For example, one person had this to say during a review meeting:

“Generally it is something that everyone can use with ease...it was made simple” (an officer from one health area office taking part in our pilots)

This statement was supported by other participant during the review meeting.

When using paper forms, health facilities sometimes send reports to the district, using ambulance drivers. Both personnel from health facilities and the district health office agreed that this option is riddled with problems. Often, the ambulance drivers do not deliver the reports at the district health office. For example, an officer from Lilongwe district health office shared a story regarding the discovery of reports for three months, in an ambulance that was involved in an accident. In addition to this, health facilities hardly get any feedback on the successful delivery of their reports.

The quotes below substantiate these claims:

“It is just unfortunate that this [the ambulance] is probably the best means of sending reports to the district, but we send [through] people who do not know the importance of the reports...I remember last time when one of the drivers had an accident people discovered that he had a pile of reports from various health facilities, not being delivered to the DHO (district health office) for months.” (IDSR officer, Lilongwe District Health Office).

We have held meetings at health facilities, district health office, and the ministry all indicating that

meetings and local analysis and evolutions of health data are seldom conducted at the health facility level. Previously, such meetings were common at health facility level, with support from a World Bank programme. The meetings died out when the program folded, as is indicated in the quote below:

“Since this was a project, the money was there, but when the project came to an end...they [health facilities and district health offices] had a problem to sustain it” (official, Ministry of Health)

5. Discussion and Analysis

From our conversations and feedback with field-level health workers, we have seen that mobile-based health information systems are useful on the ground. There are different factors on why the solution has proved useful for health workers in our pilot areas in Malawi. The challenges that we discovered as part of our research gives us enough evidence to justify that projects need to prioritize the problems they attempt to solve based on the requirements of the locale.

As mentioned in the beginning of the paper, that evaluation of mHealth projects is a global focus. We see through our action-research experience that current view of evaluation is simplistic. For example in evaluating Text4baby case study, researchers study the change in behavior of the patients through Randomized Clinical Trials (RCT) [23]. Here they associate patient behavior purely to the mHealth intervention, whereas there may be other socio-technical aspects that are reasons outside the Medical Center that cause such behavioral change. Fairly similar is the approach from researchers in New Zealand evaluating based on RCT [24]. Although we've just shown these evaluation examples, there are many more mHealth projects that are evaluated as RCT. Kaplan & Maxwell [25] suggest qualitative methods to evaluate Computer-based medical systems and critique the limited approach to evaluation such as RCTs and experimental designs. We support the idea of qualitative methods to evaluate, but would like to go a step further. Without considering the nuances of the locale and without local needs being a priority, even qualitative evaluation methods may prove inadequate. We also find that some mHealth evaluations [26] where researchers have customized population surveillance applications to context and learnt lessons through implementations. But when looking at cost benefit of comparing to other devices, the researchers do not highlight the lack of power, maintenance of devices, use beyond data collection, changes in social structure due to devices etc. Using their approach of

basing the evaluation on survey might be to only evaluate their application, but it does not evaluate the mHealth system holistically.

5.1. Information Delivery Efficiency

Transportation is a huge problem in our pilot health areas. Earlier when paper reports had to be delivered to the district health office using vehicles; there were a number of problems. The cost of transportation, risk of travel in bad weather and bad road infrastructure, misplacement of reports when sent through ambulance drivers are serious issues that decrease the sense of satisfaction of the health officers. Although the officers realize the importance of delivering reports to the district office and care about information and management done through information, their problems of submitting of reports through physical travel to the district health office is a bigger hindrance than their weighing of data reporting as priority. A Developmental change in the context of health officers is being able to improve their lives by making things simpler and decreasing the hassle in delivering reports. Thus, we discovered that the improvement of health interventions or disease surveillance was much less important to the health officer community than we had initially planned before starting out on the project. As researchers we realized that the cultural relativism of the context demanded that we understand these problems and cater our mHealth solution to these. In post-modernization of health systems, just as we had seen during modernization in enterprises, that technology enhanced efficiency of the system. Thus, not all mHealth projects need to focus on improving healthcare interventions. Some projects can also just focus on improving organizational efficiency and still achieve useful developmental impact to health systems.

5.2. Cost benefits

Introduction of technology (mobile handsets and mobile data services in this case) is an expensive affair. There needs to be careful analysis if the local context is able to sustain the cost of running an mHealth system. Considering that in our case, health officers needed to spend approximately MWK 1500, of their own money, for a monthly trip to the district office and that they, at times, have to buy own stationery, due to resource constraints in the Ministry of Health, we wonder if the ministry of health will be able to provide handsets or at least subsidize handsets or internet costs on handsets for the health workers.

Thankfully, we see that the locale of Malawi and the people already own mobile phones. Unlike any other communication technology, mobile phones are available with all health officers where we piloted the project and hence if we can use the mobile phones of the health workers, we make an important developmental impact to the health system, by reducing the cost of reporting health data from facilities to district or national level.

5.3. Data Analysis and Feedback

Beyond transportation there were other problems that were identified in our conversations. This was related to not getting adequate feedback for the reports that were submitted to the district health office. The district health offices complained to us that the reports were not delivered on time and hence they were not able to give feedback. They also suggested lack of training or resources to analyze the data that was received at the district health office. We have realized that visibility and power struggles are in place in the context and even if individuals at higher levels of health systems hierarchy were not able to analyze what was being sent, the lower level health workers still needed to submit the reports. In the post-development literature we see that this challenge of visibility of work is not just between so-called “developed” cultures and so-called “under-developed” cultures, but also between individuals because of the perspective of some people being more developed than others. Although we haven’t piloted a solution for the same, we’ve realized that simple automated delivery notification that can be sent from the servers will help build confidence within the health workers at the lower levels and will help motivate them to send reports more regularly.

5.4. Simplicity and Ease of Use

We have seen that health workers are burdened by the amount of work that is needed for reporting data. It is important that the mHealth application should be simple and easy to use. From the design and development of the application, we have tried to approach simplicity through two different solutions. We assumed that the browser based solution would be harder to use compared to a custom Java ME application and hence wanted to compare the usability of the two applications. After our research, we realize that the health workers in Malawi were able to use the browser forms as easily as the Java ME application. The health officers highlighted the fact that they liked the simplicity of the mHealth

applications because they replicate their existing expertise of paper forms. Both the application, as well as the browser form is similar to the paper forms that the health officers were used to from earlier. The fact that they asked for simplicity as a priority for mHealth application is not highlighted in the reviews of mHealth application that we’ve mentioned at the start of this paper. Thus, we see that although from a global development level, simplicity of mHealth is not a priority, at the grassroots level, it is important for mHealth to be simple if it has to make developmental impacts.

5.5. Peer-to-Peer Communication

In some of our communication with health workers, we have seen that they would like mHealth applications to allow improved peer-to-peer communication. This is interesting to note in the light of how social networks because of the use of technology have skyrocketed in terms of use. The grassroots health workers want to communicate more between their peers to be able to discuss and solve issues in the health system on their own. This highlights a difference in perspective from the global development level where improvements in health systems are primarily derived from communication between top-down and bottom-up levels of hierarchy. Here we observed that horizontal communication in the health system is a priority as much as vertical communication. If mHealth solutions have to make developmental impact, we suggest that solutions should prioritize horizontal communication in the health system and not just focus on vertical communication.

5.6. Comparing Global Development Priorities to Local Priorities in mHealth

We see that local priorities are focused on information delivery efficiency, cost benefits, data analysis and feedback, simplicity of use and peer-to-peer communication. Although the global development priorities also intersect with the data analysis and feedback through a policy level focus, the other priorities are far different from the local priorities. These are only local priorities of our case and thus might be different from local priorities in other locales. Global development focus seems to be on standard metrics for comparison between countries or in-country health facilities, Health impact measurable through indicators, interoperability between different mHealth solutions and identifying policy gaps. These global development

priorities highlight focus on top-down design of mHealth systems. We have interpreted the global development focus from articles referenced in the introduction section. Although in [8], the researchers make similar recommendations and considerations about community engagement for mHealth projects as we have discovered in our implementation initiative.

6. Conclusion

We conclude our paper by urging mHealth solutions implementers to adhere to the locale and prioritize solutions based on the needs of the grassroots. We also suggest to aid agencies and global health organizations to evaluate projects not just through the lens of global structures, but to consider the effects on the locale and changes that happen in the locale due to mHealth implementation. Thus, even if our project evaluation does not take into consideration how the health information helps take informed decision at the district or national level, we realize the problem of the locale has been solved through mobile communication that now makes the lives of grassroots health officers easier. This in their own and our opinion is appropriate development.

7. References

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