Mobile video for patient education: The midwives' perspective

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ABSTRACT
The study presented in this paper demonstrates how nurse midwives used video on mobile phones to support patient education in a maternal and child health project in rural India. The main goals of the study were to understand how the technology impacted the workflow of the nurses and to assess the acceptability of the use of video during patient encounters. The study was based on interviews of the midwives, observation of patient visits, and an analysis of logs from the mobile devices. The overall results were positive; the midwives accepted use of mobile video as part of the workflow for postnatal care examinations. Using video changed the process of patient education, in some cases making it a more focused activity. The use of video also led to midwife multitasking, which was enabled by the technology. The study suggests that the midwives felt that their authority was enhanced by the use of video.

Categories and Subject Descriptors
K.3.1 [**Computing Milieux**]: Computer Uses in Education-*distance learning*.

General Terms
Human Factors.

Keywords
mHealth, video, smartphone, usability, health education, postpartum visits, Open Data Kit

1. INTRODUCTION
There is tremendous excitement surrounding the introduction of mobile devices for enhancement of the capabilities of peripheral health workers. Projects have supplied health care workers with mobile devices in order to collect data on patients, send reminders, submit reports, guide the worker through protocols, take readings with medical devices, educate patients, and participate in remote consultations. Although many projects are still at the pilot stage, large-scale deployments are beginning. For example, the Indian state of Punjab has deployed mobile phones to 5,000 auxiliary nurse midwives [19] and planning is under way for deploying mobile phones to all 43,000 health extension workers in Ethiopia.

The big question is, "Can the wide-scale deployment of mobile devices enhance health worker and health system performance?" This will take many years to answer as the technologies are refined and introduced into health systems and as sustainable deployment models are developed and key performance metrics identified. There are requirements for the sustainability of mobile devices to support health care; we consider the following five to be necessary:

1) Technical feasibility: the device must work reliably in the field.
2) Usability: the target users must be able to operate the device.
3) Acceptability: the users must be willing to use the device in the course of their work.
4) Maintainability: it must be possible to keep the devices running at low cost.
5) Affordability: the total cost of the system must be low enough that the health system can pay for it and sees commensurate value.

Much of the current work on mobile devices for health care addresses technical feasibility and usability. Through iteration, technology development, and field deployments, significant progress has been made on these. Less attention has been paid to the latter three. Very little published work has looked at how these technologies fit into health workers regular workflow. Some of the issues of maintainability come up in pilots, but it is rare for projects to run long enough to need to address the issues of repair and replacement. Similarly, an evaluation of the affordability of projects requires moving beyond externally funded pilots.

In this paper we focus on acceptability by studying how the use of a mobile device fits into the workflow of a nurse midwife (NM) who is conducting postnatal care (PNC) visits. The reason for examining how a technology fits into the workflow is that technologies are often disruptive to existing systems and generally fail if they do not meet the needs of the user of the technology. It is recognized that there may be a mismatch between those who benefit from the introduction of a technology and those who have the burden of extra work from a technology [12, 13]. A common example in the field of mHealth is when electronic data entry improves the overall collection time for the benefit of managers but is more difficult for the field workers than the paper-based methods that were replaced.

Here, we examine how midwives use mobile videos to support patient education in one-on-one settings. There is currently a lot of interest in this question as multiple groups are developing health videos for patient education, and the wide availability of

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consumer video technology has led to creative ways of integrating video into community programs [10]. There are many arguments as to why video might be useful for health education including conveying information through visual demonstrations, repeatable and accurate messaging from an authority, and the ability to address sensitive topics. We consider the case for video strong enough that it should be investigated under a wide range of deployment models. There are different philosophies on how video materials can be created, as either centralized, expert-created videos or lower-cost videos created for local consumption. Although we relied on locally created content, we do not focus on this distinction in this paper.

Our study is based on the deployment of Android SmartPhones that were used by NMs[1] to support PNC examinations. The phones were used to step through a visit protocol and record data on the patients. There were three videos that could be shown during the visit. We chose to study the use of video in this project in order to inform future work on mobile video.

The main question that we investigated was how the NMs used the video during their visits and their reactions to changing the method for patient education. Our primary data source was a series of interviews with the nurses which were transcribed and then coded and analyzed. We were able to triangulate this information with observation notes from some PNC examinations and the timings of the video showings collected from device logs.

1.1 Contributions

The question driving this paper was, "How does the use of mobile video impact the workflow of midwives in conducting PNC visits?" Most of our evidence was gathered directly from the midwives, either through interviews or visit observations. The technology was introduced into an established PNC program and was used for six months when the interviews took place, so it is based on long-term use.

There is very little published work that looks at the impact of mobile health technologies in low-resource settings from the point of view of the health care worker, therefore, one of our main contributions is an analysis of how acceptable the technology is for this stakeholder. Overall, the results we present on use of video for patient education were positive. The videos were used throughout the project, and the midwives reported that the videos were their favorite component of the mobile devices. Midwives identified multiple advantages to using video for patient education.

We report our results in three main themes: feasibility, work environment, and authority. We argue that mobile video is feasible to use in these settings, both in terms of the technology and in acceptability to the participants. This is consistent with other reports [25]. We found that the PNC visit process is a very complex work environment, consisting of many different behaviors in how videos are used. This is important to note as the use of the technology differed from what was envisioned by the designers; this has ramifications toward the impact of the video. Finally, we consider how the use of video relates to the authority of the health care worker. Issues of authority of the speaker on a video relative to the presenter of the video have been significant in other projects [23]. The evidence from this project shows that the midwives found that the videos reinforce their authority and enhanced their ability to do patient education in the context of a PNC visit.

[1] The clinic has both general nurse midwives and auxiliary nurse midwives (ANMs) so we use the abbreviation NM throughout instead of the more common ANM.

2. RELATED WORK

The work that is most closely related to this project was conducted by Ramachandran [25, 26]. Ramachandran examined health workers' use of mobile phone videos for persuasion in rural India. In the first paper the feasibility of accredited social health activists (ASHAs) using mobile phones for health messaging is examined. In the second paper a deeper look at the design of messaging shows that videos which require responses (referred to as "dialogic" videos) promote greater engagement of patients. A second theme of this paper is the complexity of introducing and measuring a technology that is introduced into this type of environment.

Our results are consistent and complementary to Ramachandran's. We concur with their findings of feasibility and engagement with video for health education. There are some differences in settings between our work and Ramachandran's, for example we consider NMs who have a higher level of training than ASHAs. Perhaps the biggest difference is that we focus on how technology is used in an existing workflow, while Ramachandran was investigating how video could be used to most effectively convey messages.

Treatman [29] describes the inclusion of multimedia into Commcare, a mobile phone tool used by community health workers, stressing the advantages of improving performance and handling sensitive topics. Another system using multimedia on mobile phones [7] is GuideView, which provides video aids for supporting health workers. Other projects that incorporate mobile videos include eMocha, Medic Mobile, and ClickDiagnostics.

An alternative approach to using video for community messaging is the use of group showings with a television set or a projector. The Digital Green model [10] shows community-created video content to groups with a facilitator present to encourage discussion. Digital Green is growing rapidly in India and is primarily focused on teaching farmers improved agricultural practices, although a number of projects are starting that apply the ideas to health. The literature on facilitated video instruction has primarily been on issues that arise when a video is substituted for a live instructor, which can either be perceived positively or negatively by the live instructor. For example in some situations the video has enhanced the material presented by the instructor, while in other cases instructors have felt that they were being replaced and losing an important aspect of their jobs [1, 11, 23].

Behavior change communication literature is also relevant to this work. There are many different theories, but it is generally agreed that successful behavior change requires more than just communicating a message. Rather, behavior change emerges through dynamic socio-technical networks that many models aim to account for and anticipate [8]. For example, Kumar [17] developed an influence network model for behavior change for maternal health practices. This is not to diminish the potential for the use of video messaging but just to acknowledge that a successful program must fit into a broader context. B.J. Fogg and others working in the area of "persuasive technology" have argued that the affordances of mobile devices make them particularly good vehicles for behavior change [9]. This work motivates a close examination of the use of educational mobile video, not solely focused on target audience but also on how these tools may reshape work practices and communication in the larger socio-technical context.

3. OUR STUDY

This study took place in an established program that provides maternal health care in rural Rajasthan. Mobile phones were introduced to support the midwives' data collection for their PNC visits. In addition to the application for data collection, the phones had educational videos on some basic maternal and child health topics. While a more comprehensive study on the use of mobile phones to support the PNC visits was conducted [14], this paper focuses solely on the use of video for patient education.

3.1 Postnatal Care Examinations

The organization running the maternal health program has been working in rural Rajasthan since 1997. They have two main clinics which provide both in-patient care and deliveries as well as outreach care in a population of 64,000. Between the two clinics, they have approximately eight NMs.[2] At these clinics, NMs are responsible for providing a range of reproductive and child health services including 24*7 delivery and obstetric emergency services. Each clinic is staffed by a doctor two days a week, and there is a much higher demand for services on doctor days.

In addition to seeing women in the clinics, the midwives also conduct household visits for PNC within the first week of birth. The goal of the organization is to visit all women who gave birth in their area, independent of whether they delivered in the clinics [16]. The household visits are done by a nurse and a motorcycle driver. In most cases the houses are accessible by motorcycle, although in a few cases, the nurse needed to walk for at least a kilometer.

The PNC examinations cover both the mother and the baby. The clinic has a nine-page form filled out by the nurse during the examination. The standard of care is that each mother receives two PNC visits, the first (PNC1) within 72 hours of giving birth, and the second (PNC2) within seven days of giving birth. In the case of a clinic delivery, the PNC1 is conducted in the clinic.

3.2 Mobile Midwife Platform

The Mobile Midwife Platform (MMP) was an Open Data Kit application [15] running on Android phones that was developed for this project. The application consisted of a sequence of linked forms that covered all of the steps of the PNC visit and mirrored the paper form. Skip logic ensured that certain items were skipped if they were unnecessary. When the PNC form was submitted, the visit data was sent to a database on a server. The plan was for this application to eventually replace the paper forms used for PNC.

In this project, midwives were provided seven Android phones.[3] We selected a low-cost Android phone, believing that this will be an accessible device for health workers. The phones were owned by the clinic and used solely for the MMP application. Data was synchronized using cellular data plans purchased from a local carrier. Both clinics had access to EDGE data networks.

3.3 Video in the Mobile Midwife Platform

Certain educational topics were specified in the PNC visits. The form advised on counseling on specific topics. Health program leaders identified maternal nutrition, neonatal thermal care, and breastfeeding as key topics to include as videos. The MMP application was extended to allow videos to be played. The videos were triggered by specific questions. This gave the videos fixed places in the PNC visits, and they were played only if they were relevant. When a video was reached, the standard Android video player was used, which allowed the NM to stop the video for discussion.

Initially, we considered getting videos from an external source, but we were unable to identify appropriate videos. Instead, the clinic produced its own videos, following the methodology from Digital Green [6]. These videos featured senior nurses and women from the community. In the videos, the nurse described a topic to the mother, and in the case of the thermal care video, demonstrated the appropriate method for wrapping a baby. Since breastfeeding is a sensitive subject, stock photographs were used for illustration. The language spoken in the videos was Mewari, which is the local dialect of Hindi.

Three videos were created:

- Maternal nutrition [Length 2:28], topics: iron tablets, maternal diet, protein-rich foods.
- Breastfeeding [Length 1:42], topics: importance of breastfeeding, positioning, burping, attachment.
- Thermal care [Length 2:24], topics: keeping the baby warm, wrapping the baby.

3.4 Use of Video

We had planned to use the MMP application to support all of the PNC sessions. However, during the introduction period, there was some inconsistency in the use of the device. For example, we discovered that some midwives continued to use paper and enter the data on the device after the fact, so videos were not shown in all sessions.

The MMP application logged the time spent on each form, which gave a record of when videos were played with the MMP application. It also enabled us to record of the number of times the video was played and how long each video was shown. Table 1 summarizes the length of time each video was played. We considered a video to be played in its entirety when the recorded viewing length was the same as the video length, videos were considered partially played when the viewing time was at least ten seconds, terminated video view times were under ten seconds, and extended view times were longer than the video length (indicated stopping and restarting).

Table 1. Length of time videos were played by topic.

	Nutrition	Breast-feeding	Thermal care	Total
Video played in its entirety	554 (77.1 %)	497 (77.7 %)	288 (62.5 %)	1339 (73.4 %)
Video partially played	46 (6.4 %)	52 (8.1 %)	26 (5.6 %)	124 (6.8 %)
Video terminated	110 (15.3 %)	89 (13.9 %)	146 (32.7 %)	345 (19.0 %)
Video play time extended	9 (1.2 %)	2 (0.3 %)	1 (0.2 %)	12 (0.7 %)

[2] With turnover, there was some fluctuation in the number of NMs.

[3] We were unable to find these phones in India when the project started, so used phones were purchased in the United States for US$139.99 each.

In instances where the video was terminated, a decision was made not to show the video—one possible scenario for this situation is that when the video was reached, the patient indicated that they had seen it on a previous visit. The higher percentage of the terminated videos for thermal care is likely due to confusion over when this video should be shown. The partially played videos have a fairly uniform distribution of play time with no indication that there were fixed stopping points that NMs used to end a video early. Since under 1 % of the times that videos ran longer than the video length, it was very rare for a video to be stopped for discussion. There were only two occasions where the same video was replayed at its full length during a session.

4. METHODOLOGY

In this study, based on a one-year deployment, we sought to understand the impact of mobile-based educational video on midwife work practices within a previously established PNC program. We employed a multi-method research design that included ethnographic observations of NMs using the mobile video during PNC visits, semi-structured interviews with NMs about the impact of the video on their work, and analysis of data logs from the mobile phones. Fieldwork was conducted over a month-long period from January 2012 to February 2012. One of the authors and a local translator observed 22 PNC visits, out of which 16 were PNC1 visits where the mobile videos were shown. At least one PNC visit was observed with each NM, except for one senior NM, who no longer conducted PNC visits. Observations of PNC visits consisted of shadowing the NM throughout the day as she carried out her work. Almost one quarter of these visits were conducted in the clinics, while the rest consisted of visiting remote village homes. Particular attention was paid to observing the ways in which the NM used the mobile video, how it affected her workflow, the challenges and opportunities different uses appeared to present, the interaction of the patient and midwife around the mobile video, and the practices and talk around the use of the mobile video. This fieldwork also included conducting semi-structured interviews with each of the eight midwives about the acceptability and feasibility of using mobile-based video for counseling patients, the perceived effects of integrating video into their workflow, and the implications for their work practices and the education of the patient. Field notes were recorded during all observations and interviews or at the observer's earliest convenience in order to maintain the richness of data. Interviews were audio recorded and then transcribed into Hindi and translated into English.

This research design generated multiple sources of data to allow for cross validation and the triangulation of findings. This strengthened the validity of our findings and expanded our ability to contextualize and make sense of partial or conflicting data. The mobile log data collected indicated video use patterns across midwives on a macro scale and was used to validate and generalize use patterns observed in the field. The qualitative methods enabled a more focused, micro-scale view of the potential variables and relationships in context and the impact of the use of videos for the work of midwives. Empirical ethnographic research has proven to be an effective way of mapping out complex negotiations within communities experiencing technological change [2, 3, 21, 28]. Adopting a practice-based approach, practice becomes not simply a description of what people do, but rather the activities that make meaning, form identity, and produce order [20]. It enables a complex view of practice as representative and constitutive of larger socio-technical systems. The relationships between individual practices with technology and their context of use are what we seek to unpack and understand. Qualitative methods are an optimal way to understand the meanings and purposes the midwives attach to these videos and the impact on their work processes and practices because qualitative data retain a local groundedness and contextual richness. These data generate understanding and insight around questions of how and why, giving meaning and texture to the macro-level use patterns [24, p.242].

4.1 Data Analysis

As this is a very broad area, multiple levels of analysis are necessary based on studies of deployments and experiments. Our analysis is based on three types of empirical data: observation field notes, interview transcripts, and video use statistics.

We developed an iterative coding scheme using Atlas.ti qualitative coding software. We began with descriptive codes (e.g., "language") which led us to inferential coding (e.g., "video bridges language gap") [18]. From the inferential codes, we identified recurrent themes that we then used as a reference for our thematic coding. We used the network view in Atlas.ti to specify and map code-to-code relationships, labeling each code as a node. Through an iterative analysis process, constantly comparing coded data across midwives, across observations and interviews, and with findings in the current literature, thematic patterns emerged. The findings generated in this qualitative analysis were then triangulated with the macro-level video use statistics in order to strengthen validity.

5. RESULTS

Three key themes or findings emerged from this study. The first concerns the general feasibility of midwives using mobile video in care delivery. The second highlights the complexity of practices and experiences around the midwives' use of the mobile video as centrally important for understanding and anticipating its impact. The third highlights how the use of mobile video has implications for patient trust and midwife authority.

5.1 General Feasibility

Presented here are our findings concerning the general feasibility of using mobile video in this setting. Our analysis examined feasibility in terms of the technology and in terms of the acceptability to the participants.

Based on our multiple sources of data, there was general acceptance of the mobile video among NMs and a generally positive reaction to its use. Our video use statistics showed that midwives played a video during PNC1—the visit when the midwives were supposed to show the videos—71% of the time and 27.2% during PNC2. Nearly three-quarters of the time the videos were shown in full duration. The videos were played in both clinic and home visit settings. This data suggests that the mobile video was in use consistently throughout the study including the time when there was not an observer present.

The observation and interview data support this broader pattern of accepted use. All NMs reacted positively to the mobile video citing its role in helping patients understand the counseling information better. As one midwife explains:

"The video that we show is very good—it becomes very easy for the people to understand. There is a big difference between telling something and showing it. On watching the video people understand that yes, this is how it is to be done. [For instance,] they didn't know the reason for vomiting, so it tells about the

burping method [and] through the video they learn easily how it is to be done [more than] if we just tell about it" (m3).[4]

In general, the NMs accepted the video as a helpful tool for use during PNC. They felt the video provided complete, accurate information and was generally well received by their patients.

On the technical side, there were minimal logistical problems that prevented midwives from showing the videos. Unreliable electricity and constraints on charging mobiles were cited as potential complications as was the coordination among midwives of who needed to have the mobile to do PNC. The three counseling videos are shown at two different time points during the PNC visit. The first two videos are shown in succession, usually about halfway through the visit, while the third video is shown at the end. The videos are embedded within a mobile software platform that has digitized their PNC paper form and now collects PNC visit data on the mobile-based form. The NMs played the videos in home visits and in the clinic with no apparent issues. In fact, one NM independently discovered a different way to access and play the videos outside of the mobile forms. There was a period of time in the beginning of the project when due to technical difficulties with the mobile-based data collection forms this NM was unable to use the mobile-based PNC form to input patient data, and, therefore, was not able to access and play the videos embedded in the mobile form. Yet, she assured [the observer] that she could still show the videos to the patient. When the observer questioned how she was able to do this, the NM responded promptly, "the gallery!" The NM proceeded to turn on the phone, quickly navigate to the video gallery, and show the observer the simplicity of accessing the videos through the gallery! While this is a single anecdote, the evidence across midwife interviews and observations supports the claim that midwives find the mobile video easy and acceptable to use and have a general positive reaction to the use of video in supporting their work.

5.2 Complexity of Experiences

The second theme that emerged from the data is the complexity of the PNC work process and environment within which mobile video is embedded. The diverse and complex set of behaviors observed around how mobile video is used highlights the variety of practices and experiences with video use.

Health care work happens in a complex socio-technical network, co-constituted through interdependent interactions and relationships among people, tools, information infrastructures, and organizational routines. Educational videos, like all other media, are embedded in complex work practices that shape how individuals and communities interpret, use, and evaluate them. Understanding this complexity is centrally important for interpreting and anticipating the impact of these interventions. Practice-based research on work and organizations has demonstrated that prescribed representations of work differ greatly from work in practice. As particular work procedures are reflected and inscribed in organizational processes and tools, it is important to view them not as prescriptions for work, but rather as resources for action [27, 30]. As resources for action educational mobile videos can be enrolled in a variety of contingent practices. Thus, we need to consider not only how the mobile video format impacts NM work practices, but also the complex social and organizational arrangements within which the video is inextricably embedded.

5.2.1 Workflow

One of the key questions for introducing a new tool into a pre-existing work practice is whether and how the tool fits into a user's workflow. In this analysis of mobile video use in the PNC workflow, we developed an understanding of the variance and complexity of the workflow itself and the adaptive strategies NMs employed when integrating the video into their workflow.

We examined the perceived impact on workflow in terms of time and workload. What we found was that while a structured protocol existed in the mobile forms to guide the midwives through conducting all components of PNC examinations, including the showing of the videos at the appropriate times, each NM had a slightly different way of working through a PNC examination and using the video. NMs used the examination protocol and the videos as resources for action rather than as prescriptions for their work.

Multitasking surfaced across the interviews and observations as an important part of how NMs perform PNC examinations. Most of the NMs consistently used the time while the mothers viewed the videos to conduct other parts of the PNC visit. Many of the NMs expressed that a good thing about the video "is that the video explains how to feed the baby [and] gives advice, so we don't have to talk much. So while they watch the video, we can continue with our work" (m8). For example, during one PNC home visit we observed after the NM had worked through the PNC questions and exams for the mother, she paused to ask the mother to have her mother-in-law take the baby. While the mother-in-law got situated with the baby, the NM cleaned her hands and the thermometer and gave the mother the mobile video to watch. At that point, three other women who had been sitting outside of the mother's home came inside to watch the video. While the women were intently watching the video, the NM took the baby's temperature while in the mother-in-law's arms and laid him on the scale to his weight. The NM handed the baby back to the mother-in-law to count his breaths and waited for the video to end so she could enter the values for the baby's temperature, weight, and breath count into the mobile form. Using the time during video viewing to examine the baby was a common occurrence throughout our observations. NMs found other creative ways to multitask around showing the video, such as going through the current medications that the mother and her family are asked to produce at the beginning of the visit or completing the Sahli test for hemoglobin level, in which the blood and HCl solution has to sit for a few minutes before it can provide an accurate reading. One NM we observed did not like to give over the mobile to the patient for video viewing and expressed that she did not want to be doing other things while the video was being shown so that she could be available if the patient had questions. Many of the NMs explained that previously they would verbally counsel patients at different points throughout the visit, often while they were conducting tests and filling out forms. Thus, multitasking is an adaptive strategy that NMs employed across different contexts.

Multitasking while showing the videos differed when NMs conducted the PNC in the clinic. In the clinic, there were usually other patients around that the NM tried to attend to, and there was also a lot of record keeping and paperwork that could be done while videos were shown. In one instance, the NM put the mobile on the counter face up for the mother to watch, which meant that

[4] We identified midwives by number to indicate the source of quotations.

she was unable see it properly. While the video was playing the NM was loudly talking to other patients and NMs which made it very hard to hear the video. During the video, the NM said to the mother, "I will give you the medicine. You need to take it properly and do what she says in the video." This is an interesting shift of authority, rather than instructing her directly, the NM told the patient to do what the woman in the video told her to do. While the woman watched the video the NM made records and filled out paperwork for another patient. Another woman who worked to maintain the clinic walked by and helped the mother see the video by holding up the mobile for her. After the NM completed a Sahli test for another patient, she returned and placed the mobile in the mother's hands to hold and ushered her to go sit on the bench. The NM busied herself with other patients again until she noticed the confused woman sitting there still holding the mobile after the video had stopped. She then told the mother that she could leave. In the clinic, on days when the doctor was present and seeing patients, a high level of multitasking was required of NMs, which can detract from the viewing experience. It is no surprise then that shortage of time or emergencies are the most common reasons that an NM might not show the videos during certain PNC1s conducted in the clinic. As one NM explained, "we don't show the video on the days when there are too many PNCs here in the hospital. Monday is the day when many patients come [and] that day we are not able to show the video, [but] on all other days we show it." If a video is not shown during PNC1, "we definitely show it during the second PNC [for] those to whom we couldn't show it during the first PNC" (m2).

The majority of NMs perceive the mobile video as decreasing their workload by reducing the amount they have to speak and put effort into verbally counseling the patient during the PNC visit. One NM described the impact of mobile video on counseling work: "we don't have to speak [because] we now show things that we earlier had to talk about and they [the patients] understand it" (m4). NMs differed in how much they perceived the video relieved them of the work of making the patient understand. As one NM explained, "I feel mobile is the best for counseling. I just see patient [and] it involves no talking. [The patients] just see the mobile and the patients understand on their own" (m1). Other NMs described the process of showing of the video as involving varying degrees of verbal explanation along with the video. Our analysis suggests that NMs have different ways of integrating video counseling into their communication with the patient. Those NMs that described having to do additional work by explaining why the video was being shown or answer questions from the individual or even sometimes a group noted that this took time but that they were most concerned about the patient understanding.

5.2.2 Interactivity

Interactivity around video use is a pedagogical model that is often aspired to in educational interventions. Video is being promoted as a tool for focused education on an issue or topic. As such, we expected to observe dialogue and interactive exchanges around the video during PNC visits. Instead, while many of the patients appeared very engaged in the video, we observed very little interactivity, much less dialogue around the video.

When showing the video, most NMs handed the mobile to either the patient or mother-in-law to hold and watch, though a couple times the NM held it for the patient to watch. Most patients became immediately transfixed by the video, appearing engaged and focused on what is being shown. The audience for the videos during the PNC home visits typically included the patient and her mother-in-law, however, during some of the visits observed there were other women and children that gathered around to watch the videos. On one home visit six women and several children were gathered around the mobile video, all engaged and excited to watch. During the videos the experienced mothers in the group affirmed pieces of information delivered in the video. "Yes, hold the baby up" they reinforced while the video showed the burping method in the proper feeding video. Group viewing happened on occasion for the NMs, especially during the home visits.

"When we do PNC before, only the patient and I are present… now I am showing the video, now others too come on hearing the sound from the video (like the mother-in-law and other family), so they too remember that yes, we have to do this, so more people come inside, we tell the patient, and everyone hears" (m1).

While most midwives described the positive effect of the mobile video increasing possibilities for exposure and engagement of surrounding family in the counseling material, two of the midwives mentioned the drawback of the process of managing comments and questions from the group taking more time, especially from those for whom the messaging was not specifically intended.

In the interviews, three of the NMs said that answering questions regarding the video's contents and ensuring patient understanding was part of their work in showing the video. However, the patients we observed, while appearing engaged most of the time, tended to act in a very passive manner. Patients did not ask questions and the NMs did not once stop the video at a midpoint for clarification or explanation. One NM explained that "there is less communication than earlier because the video tells them everything that we used to, how to feed, the burping method etc." and "if we talk while showing the video, it would be distracting to them" (m3). There was only one home visit that we observed in which a mother asked a question during the video. The NM responded, "I will tell you after the video," but did not go back and address the question later in the visit. Most NMs asked at the end of the video "Did you understand?" to which the patient always responded "yes." The NM described what she typically says and does around the video:

"Of course I ask if they have understood everything or not. I say you have seen the video, so what have you understood. And if they ask something, then I tell them" (m3).

Several times we observed the NM commanding the patient to "do what it says in the video!" On several occasions the patient and NM shared laughter in response to a particular part in the video.

We observed two of the NMs reinforce particular bits of information in the video by repeating it to the patient at different points during the visit. One of the NMs we observed practicing the reinforcing technique explained that she did it out of habit.

"The video tells everything, but we are used to telling them things, so we also tell them. We do the PNC on the mobile [and] the video comes later. While we are doing the PNC, we ask the questions and also tell them everything, like you saw just now I was telling her the better way of feeding the baby, meaning I tell them everything, and then the video, too, tells them." (m8)

The NM's explanation suggests that throughout the PNC visit while the NM examines and collects information from the mother about her health and care practices opportune moments for counseling about particular issues that arise. This indicates that verbal counseling is often adaptive, dynamic, and locally contextualized within the interaction between the patient and NM.

The above described set of behaviors accounts for the range of interactivity observed around the video use. Our findings suggest that the patient in this context will most often act passively, therefore diminishing the role that interactivity can have in these education interventions. As we discussed earlier in the context of multitasking, at times the video served as a distraction for the patient while the NM multitasks. This supports the view that video use may not be ideally suited for interactive counseling in these settings as some may have predicted. However, it is also possible that if the videos are designed differently and the NMs are specifically trained on how to create an interactive and educational experience around the video, we might observe a different set of behaviors that would have different outcomes.

Overall, the NMs' adaptive, variable uses of mobile video and the complexity of the viewing experience of mobile video did not match the pedagogical model of focused education around the video that was predicted.

5.3 Nurse Midwife Authority and Patient Trust

The third set of findings to emerge through our data concerns the implications of the use of mobile video for issues of authority and patient trust. Here we analyze how mobile video use impacts the production and distribution of authority in the PNC context. With the introduction of mobile video, as with any new tool, new configurations of people and technologies emerge, which reshape how information flows and how information is processed and valued. These shifts have been shown to influence where authority and credibility are located and how they are relationally produced [3, 4].

In previous projects it was observed that the presenter of the video could experience the video as preemptive, thus competing with their authority. On this project our evidence did not reveal this as a dynamic. Mobile videos were shown in place of the verbal counseling that NMs deliver to patients, yet none of the NMs expressed any concern about the video infringing on their authority. Instead, our findings revealed that the NMs felt comfortable with the use of the video and experienced a number of positive impacts and enhancements to their authority. While we cannot directly compare the perceptions of NMs across different educational video projects, we can present evidence from this project that demonstrates that NMs perceived the videos as positively reinforcing their authority and enhancing their ability to do patient education in the context of a PNC examination.

5.3.1 Establishing and extending nurse midwife authority

Our analysis suggests that mobile videos can extend or establish authority in a number of different ways. First, NMs perceive the video as offering more complete and detailed information than they could have provided through counseling. One NM explained the difference the video made as providing more detailed explanations to patients.

"The video makes a difference…I would explain in detail [before the video], but do this, do that, not everything in detail. [I'm] not able to explain everything. No one explains in as much detail as the video does" (m6).

The NMs expressed that a positive contribution of the video was that it could provide complete, detailed explanations to patients. The NMs never mentioned anything pertaining to their ability to counsel better than the video. Instead, they consistently affirmed that the video not only "explains everything very well," but "also explains things that we can't" (m5). In this sense, NMs experienced the video not as undermining their authority as the counselor but improving the quality of the counseling they could provide, thus complementing their authority.

We found that NMs perceived the mobile video as generating complementary authority in the context of doing the PNC. One NM described how the video possessed an authority that patients respond to and believe is credible, to a greater degree than her verbal counseling.

"So when they [patients] see this [video], they say this is right, it should be done like this. The baby should be held in this manner while being fed. Earlier when we used to tell them, it was like all right. Now on seeing this they are convinced that this is right, it should be done in this way. It is much better for the baby" (m1).

Another NM framed the authority generated through the video differently. She viewed the speakers in the video as no different from her and took ownership of the information presented in the video and the authority it generated.

"We explained that this too is showing how to feed the baby, the things that you should eat, is it necessary for you to have the tablets or not. We are telling you through the mobile. It is just like the nurse used to tell you. You should take it the same way. We show the video and they feel it is right" (m8).

Many of the NMs expressed that upon seeing the video, the patients were more convinced that the information was "right," suggesting some inherent authority in the video itself. Since movies have such a strong influence on Indian culture [22], it is not surprising that the NMs considered this a source of additional authority.

Another finding is that NMs experienced the mobile video as extending their authority in the context of doing PNC. For example, the use of mobile videos served to extend the authority of the younger or less experienced NMs. One of the older NMs explained the difficulty that some of the younger NMs faced when trying to counsel mothers in the village.

"I look old enough. I wear a saree, so I look like a nurse, but… there are younger nurses, like X, if she gives advice, the villagers would think she is so young and is giving us advice… They will say you don't have children, what do you know about what should or shouldn't be eaten?"

The older NM continued and explained how the video helped to extend the authority of the younger NM in this context.

"But in the video, a nurse about my age is speaking, so they will feel a doctor or a nurse is giving advice. So the video is helping a lot. People think they should follow the advice given in the video as it would help them" (m7).

This explanation suggests that younger or less-experienced NMs can better counsel and educate patients through the use of the video, in part due to the authority generated by the video speakers that they are not able to produce on their own.

5.3.2 Bridging language gaps

Another way that we found mobile video could extend the credibility and authority of NMs was through extending their ability to communicate to their patients outside their native language. It can be difficult for some NMs who come from other parts of the country to communicate as effectively in the local language of their patients. The video, created with local native speakers, can provide a bridge for communication for those NMs whose local language skills are not as good.

One NM who was not from the village explained that she had to "repeat everything and ask them if they have understood the things that I have explained. So they tell me… they don't know where I come from. Some people say, Behenji (respectful term for sister) speaks Hindi so they don't understand, as their language is Mewari" (m1).

A different NM described that when she first started the NM job, the language barrier made it very difficult to communicate, so much so that she "would ask the driver to explain a little." The driver, who spoke the local dialect, helped her to bridge the communication gap. Now, using the video this NM tells her patients, "When we speak, sometimes you don't understand, so we are showing you the video. So you have to do things the same way you are seeing in the video. So they understand…because it is all explained in the video" (m6).

This NM expressed that the patients now seemed to trust her more because they could understand what was being explained through the video (m6). In summary, NMs in the context of this project perceived that the use of mobile video enhanced their work and at times extended their ability to influence and communicate to patients. These observations also suggest that the nature of video content can contribute to the relationships of authority and trust in these contexts.

5.3.3 Locally created content

Our analysis suggests that locally created video content can support patient trust in video information. As mentioned previously, the age, language, and appearance of the woman in the video mattered when establishing credibility among mothers who are not as likely to listen to younger women who appear to be inexperienced. A variety of contextual, visual, and verbal cues that are meaningful in the local community can help to establish the symbolic credibility of the video actor. The NMs consistently expressed that patients found the video content credible, that it was "right." Part of the reason a few of the NMs thought patients trusted the content was that the patient was able to identify with the relationships among actors in the video as well as the context. One NM elaborated on this idea:

"What will the mother think? She thinks the video is correct. A movie has been made, so it is right because there is a lady in it, a patient and a nurse, so she understands. She understands that she, too, has to do this way. She understands on seeing the patient. If there had been only two nurses, she wouldn't have understood" (m6).

In this quote the NM explained how the configuration and relationship of the patient and nurse displayed in the video was important for gaining the patient's trust and understanding of the video content.

Mobile video creates a different counseling experience; it centers around "showing" rather than telling. Many of the NMs expressed that the video showing patients—rather than telling—them increased their level of engagement. An NM, quoted earlier, noted that "there is a big difference between telling something and showing it" because "they will understand on seeing, [but] when we talk, it would be difficult to do it" (m3). The videos show the patient how to take care in a practical way that can make the information easier to consume. In addition to the NM's perception that better patient understanding results from information consumed through mobile video, the NMs also noted repeatedly that the videos captured their attention in ways that verbal counseling did not.

"Showing the video helps. It has more effect on the people as compared to just speaking about it because they consider it a movie and there is greater effect. When we just speak, their mind wanders" (m2).

This NM explained that by showing the video the patient's attention was more focused on the information than the patient's focus was during verbal counseling. For the most part, we observed that the video did create a focused time for viewing, whereas the verbal counseling was often done while they were conducting other parts of the PNC examination.

Overall, patients appeared engaged and focused on the video as it was being shown. However, there were a few patients we observed that appeared disengaged and confused by the video. The NMs explained that some patients did not understand why the video was being shown. This suggests that it is not immediately evident for some viewers why they are being shown a video, and for these patients, it is then difficult to comprehend the content. Videos may require supplementary communication and further explanation in order to engage viewers.

Our data suggests that there may be some authority coming from the video format itself in this context. Repeatedly, NMs explained that patients consider the mobile video as a "movie," which is part of why they become transfixed by it and how a certain level of credibility is imparted on the video. The professional nature of the videos also helped establish the mobile phone as a professional device. Often the reactions of patients to the use of the mobile device for collecting data from the PNC was that the NM used it for entertainment. "When we fill [the forms] on the phone, they feel we are playing. When we show the video, they think we are doing some work" (m2). The NMs recalled many times where patients were confused about what the mobile was being used for and did not understand until they viewed the videos on the phone, which clearly indicated the professional use of the phone.

6. DISCUSSION AND FUTURE WORK

This study looked at a component of a mobile health intervention, the use of mobile phone videos by nurse midwives while they were conducting PNC examinations. Our goal was to understand how the users of the technology felt about it and assess whether they felt it enhanced their jobs and brought them benefits. One of the keys to making mobile health initiatives sustainable is to make sure that they bring recognized benefits to the users, as opposed to just looking at the system-wide benefits. The primary data source for the study was extensive interviews with the midwives which were then translated and coded. The interview information was supplemented by observations of PNC examinations. A potential limitation in this work includes the reliance on an interpreter to bridge language differences between the NMs, who speak Hindi, Mewari, and limited English and the interviewer, who is English-speaking. The interviewer worked very closely with the interpreter throughout the month of interviews and observations and routinely checked her understanding with respondents in order to mitigate the risk of misinterpretation in this situation. Another concern in this work, discussed by Dell [5], is the potential for participant response bias in situations where social distance exists between the interviewer and participant. Efforts to reduce the potential for this response bias included a month-long period of participant-observation, in which participants developed a level of trust and relationship with the interviewer and the iterative triangulation of other sources of data in addition to participants' interview responses. We believe that there is a need for much more work surrounding the assessment of the

acceptability of mobile health technologies that are being introduced

There are many open questions about the use of video to support health education and behavior change communication. We saw positive results with respect to acceptability and the willingness to use videos in PNC. We also found that NMs employed diverse strategies for adopting the videos into routine work practices and for drawing on them as resources in their work. Future work might further unpack both NM perceptions and patient engagement over time in order to reveal and characterize the influence of any novelty effects associated with the intervention. In this study, we did not assess the actual impact of the video—we do not know if the videos helped increase the uptake of the specific practices discussed in the video. There are many different permutations on how multimedia and video can be used in this domain, such as using centrally created content or locally created content. Studying the impact of different approaches is an important area of future work.

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