

Mobile-izing Health Workers in Rural India

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ABSTRACT

Researchers have long been interested in the potential of ICTs to enable positive change in developing regions communities. In these environments, ICT interventions often fail because political, social and cultural forces work against the changes ICTs entail. We argue that familiar uses of ICTs for information services in these contexts are less potent than their use for *persuasion* and *motivation* in order to facilitate change. We focus on India's rural maternal health system where health workers are employed in villages to persuade pregnant women to utilize health services. Health workers face challenges due to resistance to change in the village, and because of their limited education, training and status. These factors appear to reduce the motivation of health workers and impair their performance. For two months, we deployed short videos on mobile phones designed to persuade village women and motivate health workers. We also asked health workers to record their own videos. While our results are preliminary, they show evidence that the creation and use of videos did help (1) engage village women in dialogue, (2) show positive effects toward health worker motivation and learning, and (3) motivate key community influencers to participate in promoting the health workers.

Author Keywords

ICTD, developing regions, qualitative research, persuasion, motivation, mobile phones, health care

ACM Classification Keywords

H.5.m Information Interfaces and Presentation (e.g., HCI): Miscellaneous

General Terms

Human Factors

INTRODUCTION

There is much recent enthusiasm in the research and design communities around the use of information and communi-

cation technologies (ICTs) for development, i.e. for improving the health, education and economic status of the poorest people on the planet. Yet research examining these interventions through a political lens has found that such interventions succeed or fail often for reasons that have nothing to do with the fitness of the technology in its intended role [15, 16]. ICTs in developing countries are introduced into environments that have highly-stratified power structures, informal economies of exchange, favors and bribes, highly-regimented traditional roles for various groups of people, centuries of traditional practices with relatively little change, and suspicion of outsiders in general, and government in particular. Into these contexts, ICTs bring radically new practices that challenge much of the existing structure and there is considerable resistance to such change.

While many of these interventions often focus on immediate affordances of ICTs, like information or knowledge transfer, we argue that ICTs for development can instead directly address barriers to change. That is, we believe that ICTs can be used to *persuade* targets of an intervention in favor of change, and *motivate* key community members who act as agents of change. In this paper, we explore the role of ICTs in this space.

Specifically in our work, we explore the persuasive/motive role for ICTs in the context of maternal health in rural India. We conducted a needs analysis of the contextual factors affecting maternal health in several sites across India. This analysis showed that the main barriers to change are village and household power dynamics, and compliance with traditional practices. India has a comprehensive approach to maternal health in the village through its National Rural Health Mission [18]. This program mandates that one woman from each village should serve as an *Accredited Social Health Activist* (ASHA) who encourages pregnant women to utilize health services. It provides performance-based compensation for the ASHA and subsidies for poor pregnant women. Pregnant women need to be *persuaded* by the ASHAs to adopt the new health practices and services which the government offers. However, due to the ASHAs' own limited education, training and status within the community, their effectiveness, judged by maternal health indicators, is limited. They are committed to change but need help with *motivation*, measured as self-efficacy, because of significant challenges they face in trying to bring change about.

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CHI 2010, April 10 - 15, 2010, Atlanta, Georgia, USA.

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We deployed both short *persuasive* videos (directed at mothers-to-be) and *testimonial* videos (intended to motivate ASHAs) on mobile phones¹ with seven ASHAs; we also asked them to create their own videos starring people in their community. We conducted a preliminary evaluation of the feasibility of using videos on mobile phones to (1) persuade village women to adopt better health practices and (2) motivate ASHAs to improve their performance. We present several findings which are primarily qualitative at this time, but which support the effectiveness of both kinds of video.

Specifically, we found that: (1) videos served as anchors for health discussions that both scaffolded the ASHA and engaged her clients, a necessary precursor for persuasion, (2) creation of videos was motivating and fun for ASHAs, (3) high-status influencers in the community participated in video creation to a surprising extent (4) statistical tests of effects of video viewing on ASHA self-efficacy (a motivation measure) showed marginally significant gains ($p = 0.06$) and (5) modest learning gains by ASHAs were also manifest after video use.



Figure 1. An ASHA (left) uses a video on a mobile phone to engage her client (right) in discussion.

We begin by giving background on maternal health in India, followed by our needs assessment and lessons from it. This is followed by theoretical background on persuasion and motivation. We then discuss the design and deployment of our prototype informed by these principles. We give the findings from our most recent field trial of the prototype. Next comes related work. We then analyze our findings in light of psychological theories on persuasion and motivation and through our analysis, distill lessons for promising design directions in this space. We end with ideas for future work.

BACKGROUND

Our goal has been to explore the technology design space for supporting maternal health workers in rural India. Maternal mortality is still a serious problem in developing countries, where 99% of all worldwide incidents occur [28]. India has the highest absolute number of maternal deaths worldwide, accounting for more than 20% that occur globally. Nearly all these cases are preventable with proper information and care. For example, anemia, is the cause of nearly a fifth of all maternal deaths in India, but is highly treatable with iron and vitamin supplements [18]. Skilled care at delivery time is

¹We chose mobile phones for their prevalence, portability, relatively low cost, and affordances for privacy and interactivity.

essential in the case of unexpected complications, but is not available in the village where most women deliver. A preliminary study has shown that moving deliveries from home to the hospital can reduce maternal mortality by half [19]. But in India, over 60% of all deliveries are still conducted at home, without a skilled birth attendant [14].

India's rural health system places primary emphasis on maternal and child health in the village. One village woman is employed as an *Accredited Social Health Activist (ASHA)* focused on maternal health, and another as an *Anganwadi Worker (AWW)* focused on infant health. ASHAs receive performance-based compensation, and AWWs, a small monthly salary. The ASHA program has great potential to improve key maternal health indicators, yet ASHA performance is lacking in many dimensions even relative to the modest goals of the program.

NEEDS ASSESSMENT

Methodology

To better understand needs in this space, we conducted two months of field work in 2008. We visited 13 organizations (12 non-government and one state health department) in the states of Tamil Nadu, Andhra Pradesh and Orissa that engage in health worker training. We eventually focused our work on the government health program in Orissa, where needs were most pronounced. Organizations were selected through internet research and personal references; contacts at one organization introduced us to others. All organizations were involved with health worker training. Some gave supplemental training to government health workers, and others employed and trained their own.

We met with trainers at the organizations, two doctors, one midwife, four community health workers and three freelance health worker trainers. We also observed health worker training sessions. With the support of one non-government organization (NGO) in Orissa, we conducted qualitative interviews in nine villages. We interviewed 10 health workers, eight pregnant or postnatal women, four family members of pregnant women, four traditional birth attendants and 11 village leaders and prominent women. In addition, we accompanied three health workers on their visits to clients' homes.

The interviews consisted of one researcher, one research assistant/translator, one NGO staff member and between one and three interviewees. We used snowball sampling for selecting interviewees. In each village we began by selecting a "pivot" to interview (a health worker or pregnant woman) with the NGO staff's help. With health workers we discussed training and current responsibilities. With pregnant women, we asked about their general and prenatal care providers, trusted contacts for discussing pregnancy issues, and plans for the delivery. Through these discussions, we identified and later interviewed other key players who were involved in some aspect of health decision making. The interviews lasted between 15 to 90 minutes and were conducted in the local language, Oriya. We recorded the interviews using an MP3 recorder, and transcribed them into English for analysis.

Performance Problems

During our interviews, we focused on the roles of both the ASHA and AWW. Very early, we were struck by the regularity with which village women chose to ignore advice from health workers, and decline use of free health services. Our results forced us to confront the complex set of issues around health worker performance and village women's decision-making. These, together with some important contextual factors, are listed next.

Village Power Dynamics

From an outsider's perspective, Indian villages are remarkably autonomous communities, self-governing with little interaction with the central government. In theory, each village has a democratically-elected village council which represents all major groups (caste or religious), and makes most day-to-day decisions. In practice the village may still be run by a traditional chief or "headman" with little oversight. A consistent finding in all the villages was that health workers who were backed by the support of the council or chief were more effective and accepted within the community. For example, in one village, the council played an active role in both encouraging people to utilize the AWW's services, as well as keeping her accountable:

"If she doesn't discharge her duties properly we question her. She is actually doing her duties well. She listens to us, and so do we when she faces a problem."

As a result, her acceptance by people in the community was high. In contrast, in another village, a major clash occurred between the council and the AWW, and the council had tried to get her fired from her post. The AWW had taken the case to court and won, but the villagers did not use her services. She complained to us,

"I couldn't eat from anyone else's home, no one would help me with my personal problems... If someone else talked with me, he would be given the same treatment, so everyone was scared to talk to me and continued the boycott."

This underscores well the gap between idealized Indian civil society today, and everyday life in the village which preserves many of the prejudices and inequities of earlier generations. Among these inequities is the very low status of women. Young married women are members of their husbands family, and hold lower status than almost any other family members. In particular, they are expected to follow the will of the mother or mother-in-law in reproductive matters. In our interviews, we found it difficult to have a discussion with a pregnant woman without interjections from other family members. Shy young women got noticeably more silent in the presence of an in-law. ASHAs often remarked on the importance (and difficulties) of convincing mother-in-laws:

"In many places, the mother-in-law refers to her own pregnancies and says that she never used any medicine. Then there are all kinds of problems."

"The mothers often talk with each other and share their experiences, and thus confidence in me increases among the people."

Similarly, as working women in a male-dominated culture, ASHAs and AWWs have low status and credibility. As one AWW described to us,

"If a hospital jeep comes by and advertises [a pulse polio drive] then more people are aware of the issue. If we say the same thing, few people turn up... If I send notice by word of mouth, their reaction is - the jeep hasn't come yet."

As in most poor nations, corruption and bribery are an integral part of the informal economy. ASHAs and AWWs were easy targets for such accusations, whether founded or not. In one village, a father forbade his daughter from travelling to a clinic to deliver, because he knew the ASHA would be compensated for accompanying her. He believed the ASHA told his daughter to go to the hospital for her own benefit, not for his daughter's. In another case, the village council accused the AWW of selling the medication she received from the government, which she is supposed to distribute for free.

Knowledge of Work Responsibilities

All ASHAs are supposed to receive a dedicated *induction training* from the government. According to official government documents, this includes 23 days of training in 5 segments over the course of a year [18]. We found that in practice, the amount of training received by ASHAs varied widely, and was in some cases only 5 days in over one and a half years. In addition, they are required to attend a *monthly meeting* in which they receive a lesson on some health topic. We had a chance to visit one of these meetings where the topic being covered was sunstroke. Only seven of the 23 ASHAs expected showed up on time, and by the end 14 had arrived. We observed throughout the lecture that only one ASHA was taking notes, and only one other looked at all attentive. The information was presented by a man lecturing orally for about forty minutes, with no visual aids. Comprehension was presumably difficult, and it seemed unlikely that much learning occurred. It was clear that ASHAs needed a better method of learning and reviewing information, especially since they are expected to learn new information monthly.

Yet, we learned through discussions with health workers that despite limited training, they still believed they had sufficient knowledge. Their trainers explained that this was because of their limited ability to see the relevance of information that they had not encountered in real situations. It was never sufficient just to provide information. As one trainer said,

"Just making the information available to the health workers by no means motivates them to use it. They need to know why to use it, how to use it, why it's personally relevant, and where to utilize it. Only then will it be of any use to them."

Most trainers agreed that books were great information

sources for themselves but not appropriate for health workers. This is not only because health workers had low-literacy levels, but because they simply did not have the confidence in themselves to find and use information from a book; the concept of searching through a book itself was unfamiliar.

We found that their inability to recognize their shortcomings in knowledge was reflected in their perception of what their roles were in the community. In asking ASHAs what jobs they performed as a part of their duties, we found that they ranged between various subsets of the official job listing. The responses of the ASHAs are shown in Table 1.

	Village 1	Village 2	Village 3
Prenatal Care	✓	✓	✓
Postnatal Care			
Breastfeeding			
Immun. Growth	✓	✓	✓
Counseling		✓	
Inst. Deliveries	✓	✓	✓
Fam. Planning			

Table 1. Roles reported by ASHAs during interviews.

Many intended roles are not carried out, especially those related to counseling and education. They performed roles which directly led to compensation (i.e. institutional deliveries, immunizations and prenatal care appointments), but the rest lacked sufficient motivation.

We accompanied three ASHAs on their house visits. While we made it clear that we wanted to observe a regular visit, to our surprise, when we arrived at the clients’ homes the ASHAs kept asking us what they should say. We realized that “house visits” as we imagined did not generally occur. Whereas ASHAs visited pregnant women when it was time for taking them to appointments or to notify them about village visits from the nurse, they were not regularly visiting the pregnant woman to check for danger signs, monitor medicine intake or provide counseling.

In summary, we found that the power structures of the village and household give pregnant women little control over their own decisions. They pose significant hurdles for health workers who lack status and authority. In addition health workers are limited by their own understanding of their roles. The combination of these factors, and their apparently poor performance suggested to us that motivation might be a problem for the ASHAs. So we decided to focus our subsequent design work on both *motivation* of the ASHAs and *persuasion* of the community women.

THEORETICAL FRAMEWORK

In this section we review the psychology literature on persuasion and motivation to better ground our work.

Persuasion

Persuasion is an area within psychology that focuses on attitude change in an individual, often caused by another’s influence. Cialdini [5] has developed a well-known taxonomy

of persuasive mechanisms, and the three most relevant for our work are:

Social Proof People are strongly influenced by what others, especially friends and peers, are doing.

Authority People will do what they are told by an expert or leader.

Commitment and Consistency People like to do what they said they would do, to appear consistent and rational.

Since people are usually more willing to say they will do something than to actually do it, commitment/consistency can be used in a graduated persuasion strategy to induce a verbal commitment first, and action later.

Motivation

While the words overlap in meaning, persuasion and motivation are quite distinct areas within psychology. While persuasion deals with mechanisms by which people are induced to change their attitudes (often by another actor), motivation deals with the mechanisms through which beliefs and goals lead to action. Since village women do not seem to believe the merits of clinic delivery or prenatal medications a priori, convincing them to do so is a persuasion task. By contrast, we can assume that ASHAs are already convinced they should perform their work, so improving their performance is a motivation task.

A good recent overview of motivation theory is in [13]. Among modern principles within motivation theory, the most relevant to our work seems to be Bandura’s *self-efficacy* theory. Self-efficacy theory revolves around an individual’s perception of his own effectiveness with respect to a task. When perceived self-efficacy is high, individuals tend to perform tasks well, persisting in the face of obstacles. When it is low, performance is weaker, and the person may give up easily in the face of obstacles or acquire avoidance behaviors. Bandura cites the following sources of self-efficacy:

Enactive Mastery When the subject has personal experience where they perform a task well, their perceived self-efficacy for that task will improve.

Vicarious Experience When the subject sees another person have positive outcomes on a task, their perceived self-efficacy will improve.

Verbal Persuasion When an individual hears from another that their performance is good, i.e. a testimonial, self-efficacy will improve.

In discussions with ASHAs and their trainers we identified self-efficacy as a potential problem because the ASHA’s environment has many negatives with respect to these three factors. First of all, inadequate training is likely to lead to situations in which the ASHA is unprepared. As quoted earlier, ASHAs also had a hard time assimilating information about situations they had not encountered. This is a common trait for unschooled or limited-schooling subjects [17]. Vicarious experience is likely to be poor because ASHAs are

quite isolated in their villages. And positive verbal feedback may be rare, while instead the ASHAs receive negative comments since they are regarded as low-status non-experts by many villagers.

PERSUASION AND MOTIVATION FOR HEALTH

From our needs assessment, it was clear that ASHAs were not performing their consultation tasks with village women. Certainly this hampers their ability to persuade the women, since changing attitudes toward long-held practices takes time. Applying the principles of social proof and authority, we determined that persuasive video messages directed at the women should help to persuade them. The use of video allows the marshalling of several influential actors, both higher-status villagers, and also other village women (peers) who may have benefited from the formal health system. A second intended benefit of these videos was to help ASHAs conduct the consultations. And we also hoped that regularly viewing the videos, which contained health information the ASHAs may not know well, would provide a supplementary form of training.

The other main challenge is ASHA motivation. Since we had identified self-efficacy as a strong framework to approach motivation, we sought interventions that can enhance it. The simplest to apply seemed to be verbal persuasion [2]. For this we proposed a second type of video recording, a *testimonial* by an influential village actor. Testimonials by village women who had been helped by the ASHA might also be valuable - since they provide a positive evaluation of the ASHA's performance by the ultimate "expert" - one of the women she is tasked to help.

For both tasks, we felt that mobile camera phones would be ideal, as they are portable, relatively easy to use, and have become relatively inexpensive. India's mobile market has taken off at a phenomenal rate, with nearly 400 million mobile phones in the hands of about 35% of the population [7]. What is more remarkable is the growth rate of nearly 75% each year. Therefore it is predicted that higher end phones will be penetrating rural markets soon. In the current design, we use only the video recording features of the phones - so digital cameras could also have been used. However, all of our future design steps (described at the end of the paper) require other features of the phone: interactivity to improve engagement, and networking to allow exchange of videos and to support a community portal.

DESIGNING AN INTERVENTION

To test our initial design ideas, we returned to the same NGO in Orissa. We decided to focus only on ASHAs (not AWWs) because it was a newer program and therefore exhibited more consistency across villages. Our main goal for this field trip was to iteratively design prototypes with a small group of ASHAs and conduct preliminary evaluations.

Prototype Design

Narrowing in on the idea of creating a prototype to motivate village women and scaffold ASHAs in counseling



Figure 2. Summary of our design and deployment.

them, we created a four-minute *persuasive video* with pictures and voice that described the dangers of anemia and actions for prevention. The pictures used were hand-drawn images sketched by the resident artist at our partner NGO, which we later colored using Adobe Photoshop. The background voices were recorded by staff members at the NGO using an MP3 player. We strung the pieces together into a short video with panning and zooming using a combination of Windows Movie Maker and Photo Story. The video was then converted to 3gp format so that it played on the Nokia 3110c Classic (100 USD).

For our final deployment, we created seven short persuasive videos, each less than a minute long. These videos focused on danger signs that could occur during pregnancy and immediate actions to take. This time, we created a J2ME application which launched the videos and logged the start and end times of each viewing. Each video was launched from a separate J2ME application, so participants still browsed for the persuasive videos using standard phone menus.

We also made a short *video testimonial* by a village president who had prior experience with an anemia prevention program. We recorded him delivering an eloquent, impromptu speech about anemia and the role of ASHAs in prevention.

Methodology

Our team of a researcher and assistant researcher/translator spent three months in the field interspersing village visits and prototyping. With the assistance of an NGO staff worker, we recruited seven ASHAs of average age 35. Five of the seven ASHAs already owned mobile phones, though none of them were camera phones. All ASHAs continued to participate in our study for three months, with no attrition.

We conducted one focus group session with the ASHAs, and observed a total of six house visits during which ASHAs used both the anemia video and testimonial prototypes (see Figure 2.) ASHAs were asked to record their own videos starring anyone in the village they felt would be influential. We shared their videos as a group and voted on a favorite. Later, we translated the videos into English and used the transcripts for analysis.

We deployed our second set of seven persuasive videos for a total of eight weeks in two phases (Phase One lasted from Weeks 1-3, and Phase Two was from Weeks 4-8). At the beginning of each phase we had a group meeting where we conducted two pre and post tests respectively, one on knowledge of pregnancy danger signs, and one which measured self-efficacy. For both tests, the questions were asked orally, but responses were written by the participants. One participant could not read or write, so her responses were verbally stated and transcribed by an NGO staff in a neighboring room. The self-efficacy instrument was derived from a Hindi translation of the *General Self-Efficacy Scale* [23], which we then translated into the local language, Oriya. We adapted the scale to include more questions specifically about ASHA activities as suggested in [2]. Each of the 13 questions received a score between 1-100. We used images of cups with increasing amounts of liquid to illustrate the scale. In Week 8, the NGO staff worker returned to the seven ASHAs' homes and collected the phones.

The results from the pre-test and post-test were translated into English for analysis and scored. We also compiled the logs of the seven persuasive videos, and counted all incidents where at least two-thirds of the video had played. In addition, we collected all photos, videos and music which were on the phone, and compiled the sequence of phone usage incidents over the 8-week deployment.

Findings

Despite government guidelines that all ASHAs should have completed the eighth grade, our participants' education levels varied quite a bit, with five having studied only until 5th or 6th grade, and the others through 9th and 12th.

Although it was necessary for us to do some training for the specific tasks we designed, the phones were used extensively for other tasks. They took on average 35 photos and 23 videos each, and in total downloaded 148 MP3s and 74 video clips. Even while various capabilities of the phone were clearly familiar, there was still a lot of excitement surrounding its use. ASHAs were not the only users of the phones; in fact, when we went to collect the phones from two different ASHAs, the phone was out with their children.

Teaching the Use of the Tool

We initially tested whether teaching with persuasive videos would come more naturally to ASHAs than with materials they currently received. When we deployed the videos in Week 1, we only trained the ASHAs in how to access the videos and gave them instructions to show them to their clients. We were curious to see to what extent they would embrace the idea with minimal instruction.

When we collected the phones after the initial deployment phase in early Week 4, we found that the video logs were sparse. One ASHA never watched a single video, and only three had watched all seven videos at least one time each. We also discovered that, possibly due to non-use of the videos, only two of the seven ASHAs (the youngest and most educated two) could access the videos with no assistance from

us. In fact, one ASHA told us that she kept forgetting how to play the videos, so her son accompanied her on house visits to help.²

During the Week 4 meeting, we individually trained the ASHAs on how to access the videos until we were sure that each could perform the task by herself. In addition, we spent about 45 minutes training the ASHAs to use the videos when they went on house visits. We watched each video as a group on a laptop and asked questions about the video. We replayed the videos until we were sure they understood the points. We explained that they should not just show the videos to their clients, but facilitate a discussion with the client, using the video as an aid. The graph in Figure 3 shows the increase in the number of times the videos were watched after this training session. We do see a drop off towards the later weeks, which makes sense: they only had a limited number of videos, and they might have simply felt they had "completed" their task.

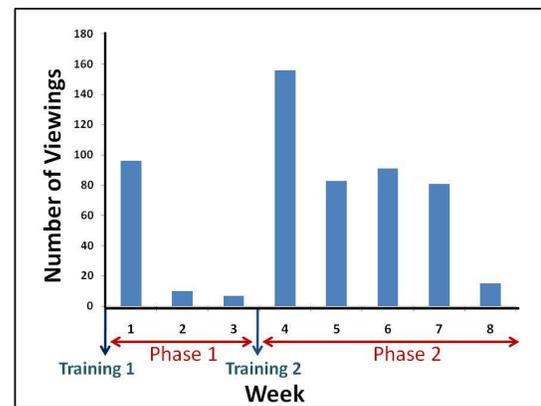


Figure 3. This graph shows the total number of times ASHAs watched the seven short persuasive videos over the 8 week deployment.

Motivating Discussion and Enhancing Persuasion

As described earlier, when we first observed ASHAs on their house visits, they had no idea what to say or do. We asked the same ASHAs to show the anemia video to their clients and observed this interaction in six homes. At first, the ASHAs would simply watch the videos along with their clients. But as we coached them on pausing, asking questions and ensuring that their clients had understood, the interaction began to improve. For example, in one situation, the mother-in-law of a pregnant woman stood at a distance watching the ASHA and client talk, but did not engage in the discussion, even when she was invited. When the ASHA started the video, the mother-in-law came closer and began watching over her shoulder and commenting. Meanwhile, the pregnant woman's husband joined the discussion. By now the ASHA was pausing and repeating the points shown in the video. When the topic of iron pills came up, the husband got up to bring the bag of medicines which his wife was taking, and got the ASHA's opinion on them.

²We recognize that general use of the phone by other family members could have confounded these results; however, in the long run, we believe the dissemination of the messages to *anyone* in the community has value.



Figure 4. Left: ASHA’s son helps her use the video camera. Right: ASHA engages pregnant woman, her husband and mother-in-law.

Many ASHAs also took photos and videos that documented their work activities. Among these, one video showed a long discussion between an ASHA and her client about danger signs, and from the timestamp on this video, we could see that this discussion took place after the ASHA had shown the persuasive videos to her client.

Measuring Learning

After our observations of the ineffective training sessions at monthly meetings, we hoped that ASHAs would learn more information as a result of using the videos when talking to clients. We analyzed the results from the pre and post tests on knowledge of danger signs conducted during Weeks 1 and 4. We saw that all ASHAs appeared to have learned an average of 3.3 new points (SD = 1.7): we measured this by counting the number of points covered by the videos that appeared in the post-test answers but not the pre-test.

Measuring Self-Efficacy

We hoped to show a direct effect of video use on self-efficacy. We administered a self-efficacy survey before and after the first phase of the phone deployment (i.e., during Week 1 and Week 4). We do not have pre-test results for one ASHA, as she was absent when we administered it. Another ASHA was illiterate and her answers were transcribed: we observed that the transcriber during the pre-test was prompting her greatly. We believe that this was responsible for an improbably high initial score. A different transcriber processed the post-test for this ASHA, and that score is likely to be more realistic. This ASHA’s data is probably best ignored. For the remaining ASHAs (n=5), a one-sided t-test results in (p=0.06). While this is indicative of some effect of the videos on self-efficacy (and indeed a strong effect to manifest with such a small sample), a larger study is needed to establish and quantify the effect with confidence.

Our qualitative observations hint some improvement in self-efficacy, as we found that ASHAs became more active in their discussions with clients once they started the videos. The video testimonials also seemed to improve self-efficacy. One ASHA stated that watching the testimonial by the village president made her feel proud about her role. We also observed the ASHAs’ enthusiasm for showing their own videos to each other and us during the meetings. Some even got a bit competitive when the favorite video was selected.

Count	Influencer	Count	Content
3	Pregnant Client	6	Roles of ASHA
4	Streetplay	6	ASHAs make a difference
1	TB Patient	2	Threats to health
3	Village Leader	3	Personal request to comply
2	Youth Leader	4	Personal experience
1	Nurse Midwife	1	Instructional
2	Women’s Leader	1	Reasons for non-compliance

Table 2. Influencers Starring in Testimonials (left) and Testimonial Content (right)

Involving Influencers

The creativity and enthusiasm put into the creation of video was astounding. When we convened for a meeting two days after assigning the video recording task, we had a total of ten videos; only one ASHA had not created a video, and that was because she was with her sick daughter in the hospital. By the end of Phase 1, every ASHA had created at least one video, and by the end of Phase 2 we had 16 videos.

The participants were very imaginative. Most of the videos would be categorized as testimonials on the ASHAs, but some were persuasively targeted towards pregnant women. One ASHA staged and recorded a teaching session between the local nurse and three pregnant women. Two ASHAs recorded a traveling street play which came to their villages spreading awareness about the ASHA program. A complete breakdown of the “influencers” portrayed in the videos are shown in Figure 2. “Youth leaders” were elected officers of village youth groups, and “Women’s Group Leaders” were officers of women’s self-help groups. Both of these groups were organized by our partner NGO.

The content also varied. While videos of pregnant clients talked about personal experiences with ASHAs, videos of leaders touched more on fundamental problems in the village, the reasons and excuses people use for not listening to ASHAs, the threats of pregnancy complications, and how the situation can be improved. A breakdown of the content types is seen in Table 2. The tone also varied in the videos. While pregnant clients related their experiences, the leaders and nurse took on a more persuasive role, framing the message as a personal request to the audience. The following excerpts exhibit this difference:

“I was pregnant for the first time two years ago. Because they did not check me properly at the hospital, I had some complications ... Now there are ASHAs and we get all kinds of help. Now there are no difficulties.”

“Anemia has a bad effect on women and also on their babies during delivery. Some of them die ... Because of this, throughout Orissa, ASHAs are doing great work in every village and their role is very important ... If women don’t eat iron tablets, they can get anemia ... That’s why I implore every pregnant woman in our village to take iron tablets ... Our ASHAs are always there to help.”

During our limited observations of ASHAs using our video

testimonial prototype with their clients, we saw that though it was longer than the persuasive videos, the testimonial held clients' attention longer. The clients commented that they liked the video of the village president because he talked about his personal experiences with his wife's pregnancy.

RELATED WORK

Technology for Rural Health Workers

Many research projects have looked at the use of ICT to support health workers in developing regions. An overview of many uses of mobile phones for healthcare workers is found in [4]. Healthline is a landline phone system for health workers in Pakistan to get information in their native language using automated speech recognition [24]. In the 1990's a large PDA-based system was developed to support Auxiliary Nurse Midwives (ANM) in India organize and schedule house-visits [12]. Another project in Tanzania called e-IMCI looks at the use of a PDA for guiding health workers through protocols [8]. Results show that using the system, health workers adhere to the protocols more strictly and prefer to use the device rather than flip through paper references in front of patients. These projects in general target health workers with higher training³ - not limited-schooling health workers among whom issues in training and status are far more acute, and motivation comes to the fore.

Persuasion, Motivation and ICTs

Recently, a specific area of ICT research called "Persuasive Technology" has been created by B.J. Fogg and others [9]. A good review of work on both persuasive and motive IT is found in [26]. Persuasive IT is used in many domains, i.e. environmental responsibility [29]. Examples of motive IT include tools to help improve physical activity, i.e. [6]. There is work that examines persuasive interface design, i.e. [21], and persuasive games [3]. There is also work that looks at persuasive affordances of mobile platforms [10].

Persuasive IT has also been used in the developing world [11, 20]. The latter is a custom personal health information system to change behaviors of rural Indian women regarding reproductive health [20]. We tackle the same problem but by using technology to strengthen the existing system of health workers, accounting for conflicts with the current structure and practices of the community. Exploring motivation from another angle, the qualitative findings in [25] suggest that women employed as rural computer kiosk operators rise in confidence and status in the community.

DISCUSSION AND IMPLICATIONS FOR DESIGN

In the following, we discuss our key findings and distill lessons for future designers.

Primary Role of Persuasive and Motive ICTs

We argued that especially for innovations that target the rural poor, a major challenge for ICTs is their conflict with traditional practices and power structures. We argued further that

³The exception is Healthline, which initially targeted poorly-schooled community health workers. However, healthline has not yet studied user-initiated use of the system in field settings, only laboratory settings in which use is required.

it is essential to design *persuasive and motive ICTs* which confront these challenges and help to facilitate the adoption process. Our specific example was the rural maternal health care system in India, where a specialized worker, the ASHA, acts as a change agent toward village women.

We believe this a good example of a more general pattern: an innovative practice is introduced (modern medication, clinic deliveries) which conflicts with tradition, and it is mediated by change agents (ASHAs). This is also the canonical pattern in the initial diffusion of innovations [22]. The resistance to change affects both the target audience (village women) and the change agents (ASHAs). The most effective strategies to overcome this resistance will be those that act on both the targets of the innovation (through persuasion) and the change agents (through motivation). **ICTs can be very effective vessels for the creation and consumption of persuasive and motive content.** Many videos made use of social proof and authorities by depicting peers (pregnant women) and influencers (leaders). The testimonials by influencers motivated ASHAs through the mechanism of verbal persuasion. In addition, the persuasive videos enabled improved ASHA-client discussions, and video creation encouraged the participation of other key community players. While the videos were specific to the ASHA's task, we believe the approach is quite generic.

Engaging Influential Actors

One of the most surprising and encouraging results of the field work was the ease with which we and then the ASHAs were able to recruit subjects for the persuasive and testimonial videos. While the willingness to participate as subjects in videos echoes findings from the Digital Green project [11], we were surprised at the large fraction (nearly half, much higher than their presence in the village population) of high-status influencers in the group. Part of this surprise stems from the fact that these are high-status individuals while the ASHAs' status is quite low, but the ASHAs were nevertheless able to recruit them to do a significant favor for them by making a video. Also, the degree of support for the ASHAs manifest by these individuals in the videos seemed much higher than what the ASHAs normally received in the village. We do not yet know the reasons for their high degree of willingness to participate - perhaps the camera is itself a strong intrinsic motivator. More likely, *this particular group* i.e. high-status influencers, are highly-motivated to express their views on camera. For this group, the videos provide a new means for them to influence others and this may already be a strong intrinsic motivator for them.

If this is actually true, then it creates a powerful channel for persuasion *of the influencers*. The videos provide an opportunity for them to express their views and influence others, but only if they express views that are favorable to the ASHAs (or the videos will not be used).

Furthermore, we know that through the commitment and consistency mechanism from persuasion theory, actors who express certain views verbally are more likely to enact them in future. The videos are very strong commitments because (i) the actors in them give detailed reasons for their views (ii)

they may be shown to many viewers (iii) they may be long-lived and (iv) the actors know that they are long-lived and seen by many others. Consistency is particularly important for influencers, since inconsistent behavior hurts their credibility and weakens their status as influencers. Thus they are strongly motivated to support the ASHAs in the future.

If this can be verified, it is a wonderful design implication: first of all, influential actors in the village (who initially may be ambivalent about the ASHAs work) are intrinsically motivated to express positive views about them in the videos that ASHAs make. Secondly, having done so, they will be strongly motivated to follow through. With very little effort, the ASHAs may be able to recruit an array of powerful allies which we have seen is important for their mission in the village. Furthermore, this mechanism seems again very general. **By gathering testimonials from influencers, the change agents for an innovation may be able to recruit them to their cause.**

Motivation and Training

While we found that ASHAs were not regularly visiting their clients for counseling sessions, the persuasive videos enabled them to grasp the practice and perform it, engaging not just their clients, but also family members (the health decision-makers). This pattern of use: video viewing with mediation and discussion, follows the pattern used in several successful ICTD projects, namely Digital Study Hall [1] and Digital Green [11].

We saw an apparent increase in ASHAs' knowledge of health practices due to use of the persuasive videos. By contrast, the monthly training updates which had a didactic (and non-motivating) format appeared to be doing little (we did not attempt to quantify this however). The lesson here is that **for limited-schooling users, motivation and training/learning are closely related** - much more so than for a schooled learner who has the meta-cognitive skills to self-motivate and contextualize new knowledge. The use of persuasive and motive technologies such as videos provides an exceptional opportunity to integrate ongoing training, without even requiring any new practices.

End-User Authoring and Play

Our results showed a sharp contrast between the slow initial use of videos produced by us, and the very fast (in just two days) creation of videos by the ASHAs. The ASHAs clearly enjoyed the latter process, and it stimulated a round of exchange and rating of videos which they also seemed to enjoy very much. ASHAs also used the phones for some non-work-related videos, and even shared them with family members. Their productivity on the video production task strongly suggested that it was motivating them. The lesson here is to **encourage participation and play. This taps two important intrinsic motivators - sense of agency or control, and fun.**

NEXT STEPS

We conclude by describing our next steps for improving upon and extending this work.

Enhancing Interactivity

To address the usability issues we discovered, we are iteratively designing a J2ME tool that encompasses all the functionality we are targeting, and that eliminates the need for navigating through heavily text-based menus. However, the biggest caveat from the current work was the need for a great deal of hand-holding and in-context instruction before the ASHAs started to use the videos as intended (pausing and discussing them). This makes the approach nearly impossible to scale. But more interactivity could be built-in to the seed videos that are given to the ASHAs. Instead of a simple linear video, a scripted (e.g. Javascript) application would play the video as a series of clips. It would monitor user activity, checking for pause events. If it is not being paused regularly, it would halt itself and pose a question using audio, and possibly prompt for a multiple-choice answer. Each time, it would remind the ASHAs to pause themselves and ask their own questions.

Video Exchange

We found that viewing and rating each other's videos was a pleasant and motivating activity for the ASHAs. It also seemed to enhance their sense of community. For our next round of field work, we plan to create a service to archive the videos from ASHAs to support this practice. This will be part of a more general portal described next.

A Community of Practice Portal

A sense of belonging to a community has positive impacts on many aspects of a person's life [27]. This is certainly true in village life, and most people are very closely tied to their clan and to their craft, which will be shared by several others in the village. ASHAs on the other hand, are the sole actors in the village who perform their craft. Furthermore, while other actors are in contact with the peers in their community of practice for decades, ASHAs have an induction lasting a few weeks at best and then they are on the job alone. The monthly training provides some ongoing support, but less than half the ASHAs attended the meetings we observed. A community of practice typically provides strong enhancers of self-efficacy: verbal persuasion, vicarious experience, timely advice to help improve direct experiences, and help coping with negative experiences. For us, enhancing a CofP is a major goal in our next and subsequent rounds of field work. The exchange of videos described earlier provides an ideal seed practice for the portal. Other features would be a newsletter (possibly in audio format) from their nurse, a list of upcoming events, a "FAQ" from ASHAs to the nurse, and a general discussion list.

ACKNOWLEDGEMENTS

This material is based upon work supported by the National Science Foundation under Grant No. 0915705. We thank Kentaro Toyama of Microsoft Research India for his valuable guidance and feedback on this work. We thank Paul Aoki of Intel Research Berkeley for his excellent suggestions on this paper. We thank our anonymous reviewers and numerous colleagues for their feedback. We thank all the staff members at Gram Vikas for their time and dedication

to this project. And last but not least, we thank the ASHAs and their clients who made this work possible.

REFERENCES

1. The digital study hall. Technical report, Department of Computer Science and Eng., Univ. of Washington, 2007.
2. A. Bandura. Guide for constructing self-efficacy scales. In F. Pajares and T. Urdan, editors, *Self-efficacy beliefs of adolescents*, volume 5, pages 307–337, Greenwich, CT, 2006. Information Age Publishing.
3. I. Bogost. *Persuasive Games: The expressive power of video games*. MIT Press, 2007.
4. A. Chib. The aceh besar midwives with mobile phones program: Design and evaluation perspectives using the information and communication technologies for healthcare model. In *Mobile2.0: Beyond Voice? ICA Pre-conference*, 2009.
5. R. B. Cialdini. *Influence: The psychology of persuasion*. Harper Collins, 2007.
6. S. Consolvo, P. Klasnja, D. W. McDonald, and J. A. Landay. Goal-setting considerations for persuasive technologies that encourage physical activity. In *Proc. 4th International Conference on Persuasive Technology*, New York, NY, USA, 2009. ACM.
7. Department of Telecommunications, Government of India, New Delhi. *Annual Report 2008-2009*, 2009.
8. B. DeRenzi, N. Lesh, T. Parikh, C. Sims, M. Mitchell, W. Maokola, M. Chemba, Y. Hamisi, D. Schellenberg, and G. Borriello. e-imci: Improving pediatric health care in low-income countries. In *Proc. CHI 2008*. ACM Press, 2008.
9. B. Fogg. *Persuasive Technology: Using computers to change what we think and do*. Morgan Kaufmann, 2003.
10. B. Fogg and D. Eckles, editors. *Mobile Persuasion: 20 Perspectives on the Future of Behavior Change*. Stanford Captology Media, Palo Alto, CA, 2007.
11. R. Gandhi, R. Veeraraghavan, K. Toyama, and V. Ramprasad. Digital green: Participatory video for agricultural extension. In *Proc. Information and Communication Technology and Development*, 2007.
12. S. Grisedale, M. Graves, and A. Grunsteidl. Designing a graphical user interface for healthcare workers in rural india. In *Proc. CHI 1997*. ACM Press, 1997.
13. E. T. Higgins and R. M. S. (Eds.). *The Handbook of Motivation and Cognition, Vol 2: Foundations of Social Behavior*. The Guilford Press, 1990.
14. International Institute for Population Sciences (IIPS) and Macro International., Mumbai. *National Family Health Survey (NFHS-3), 2005-06: India: Volume I*, 2007.
15. B. E. Kolko. International it implementation projects: Policy and cultural considerations. In *Annual IEEE IPCC Conference*, pages 352–359, 2002.
16. R. Kuriyan, K. Toyama, and I. Ray. Integrating social development and financial sustainability: The challenges of rural computer kiosks in kerala. In *Proc. Information and Communication Technologies for Development*, 2006.
17. A. Luria. *Cognitive Development, Its Cultural and Social Foundations*. Harvard U. Press, 1976.
18. Ministry of Health and Family Welfare (MoHFW), Government of India, New Delhi. *National Commission for Macroeconomics and Health Annual Report 2006-2007*, 2007.
19. Office of the Prime Minister, Norway. *Increased number of births in clinics: Dramatic reduction in maternal mortality rates*, June 2008.
20. V. Parmar, D. Keyson, and C. deBont. Persuasive technology for shaping social beliefs of rural women in india: An approach based on the theory of planned behavior. In H. O.-K. et al., editor, *PERSUASIVE 2008, LNCS 5033*, pages 104–115, 2008.
21. D. Ramachandran and J. Canny. The persuasive power of human-machine dialogue. In H. O.-K. et al., editor, *PERSUASIVE 2008, LNCS 5033*, pages 189–200, 2008.
22. E. Rogers. *The Diffusion of Innovations*. The Free Press, 4th edition, 1995.
23. R. Schwarzer and M. Jerusalem. *The General Self-Efficacy Scale.*, 1981.
24. J. Sherwani, N. Ali, S. Mirza, A. Fatma, Y. Memon, M. Karim, R. Tongia, and R. Rosenfeld. Healthline: Speech-based access to health information by low-literate users. In *Proc. Information and Communication Technology and Development*, 2007.
25. J. Srinivasan. The effects of e-governance implementation on women: a study of the sustainable access in rural india (sari) project, madurai. Master's thesis, Indian Institute of Information Technology, Bangalore, 2004.
26. K. Torning and H. Oinas-Kukkonen. Persuasive system design: state of the art and future directions. In *Proc. 4th International Conference on Persuasive Technology*, New York, NY, USA, 2009. ACM.
27. E. Wenger. *Communities of Practice: Learning, Meaning and Identity*. Cambridge University Press, 1998.
28. World Health Organization, Geneva. *World Health Report: Make every mother and child count.*, 2005.
29. J. L. Zapico, M. Turpeinen, and N. Brandt. Climate persuasive services: changing behavior towards low-carbon lifestyles. In *Proc. 4th International Conference on Persuasive Technology*, New York, NY, USA, 2009. ACM.