Mobile Phones for Maternal Health in Rural India

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ABSTRACT

We present our findings from a mixed methods study of mobile phone practices of rural Indian women. We situate our study in the context of Projecting Health, a public health initiative we deployed in Uttar Pradesh (India) to target the dissemination of health information for mothers and newborns. Adopting the lens of feminist reflexivity, we reconsider our design of Projecting Health by factoring in the mobile media consumption and sharing practices of our target audience. We stress the importance of taking a community-oriented approach and show that although there are strict social conventions and patriarchal norms that constrain various practices of these women, they are able to exercise agency and mobilize help within their communities when needed.

Author Keywords

HCI4D; ICTD; Health; Information; Feminist HCI

ACM Classification Keywords

H.5.1. Information Interfaces and Presentation (e.g. HCI): Multimedia Information Systems

INTRODUCTION

The scope of HCI research has grown rapidly to include studies of technology design, adoption, and use in low-resource environments around the world, frequently categorized as HCI4D research. The 'third wave' of HCI has also brought with it an engagement with issues more social and political. This includes an interest in bringing feminist reflexivity to HCI [2, 27, 38, 21, 6]. Bardzell suggested a framework for design principles and methodologies that took inspiration from feminist theory and social sciences [2], identifying the key qualities that contribute to feminist design as pluralism, reflexivity, participation, ecology, and self-disclosure. We draw on this work as we extend HCI4D research to include an examination of women's mobile practices in rural India that we conducted to iterate on the design of an effective information dissemination model for maternal and newborn health. A Feminist HCI perspective allows us to uniquely reflect on our assumptions regarding both - the patriarchal structures in rural India that influence women's social and technological

interactions and the agency these women exhibit in spite of their social limitations.

The *Projecting Health* (PH) initiative we discuss in this paper was designed in collaboration with PATH (a health NGO) to bring globally approved health-related information to women in rural Uttar Pradesh (UP, India). By providing Accredited Social Health Activists (ASHAs) with locally crafted videos and portable projectors, PH aims to facilitate their teaching of women about ante-natal (before birth) and postpartum (after birth) health care. In this paper, we reconsider our original design using the lens of Feminist HCI. We take Muller's lead [21] to ask the "who" questions in the context of our study, using ethnographic methods to listen to the voices of our users. Although the target audience of the videos includes pregnant and lactating mothers, and target users are the ASHAs, we view the community at large as our user group, where men, women (new mothers, their mothers-in-law, ASHAs), children, project staff are *all* users to varying degrees and in varying capacities. This is in line with Rode's view of users from a "proximate" and "distal" perspective [26]. Next, we highlight in our findings how our users are not only users who can speak for themselves, but also users who can *act* for themselves. Finally, we acknowledge that we are not the "voice from nowhere" that Haraway critiques [10], but willing proponents of emancipatory action research, as Dimond [6] recognizes as a legitimate approach for Feminist HCI researchers to use, even as we attempt to observe and understand our users. Taylor questions [34] what the "better" is that we strive towards and whether we will know it when we see it. We believe we will, as we strive for women to be better informed and able to tend to their children's health to minimize the loss of health (and lives).

After presenting the body of related research within which we situate our findings, we offer background information on PH for context. We then present methodological details of our qualitative study, followed by our findings and a discussion of the prime takeaways of our work. Our goal is to make the following contributions. First, to the best of our knowledge, we offer the first detailed account of women's mobile practices in rural India, seeking also to dispel the pervasive misperception that rural Indian women operating amid severe patriarchal norms and resource constraints are unlikely to be active users of technology. Second, we strongly believe that technology use must be viewed in the context of existing social practices and we document a unique set of sociotechnical configurations that highlight the role *community* plays in aiding and facilitating media consumption, sharing, and dissemination. Third, our work also makes a novel contribution by highlighting the potential impact that existing community

practices could have on development-related outcomes in an area of immense need. We consider it essential for HCI4D research (and HCI research in general) to strive for a good 'ecological fit' and our use of feminist reflexivity - with its focus on pluralism and advocacy - is aimed at demonstrating how this might be attained.

RELATED WORK
The premise for PH lies in the literature on behavior change, drawing particularly on Kumar et al.'s [17] work on behavior change for newborn survival in rural India. In this paper we also extend existing work in the areas of mHealth, mobile media practices, videos and storytelling, and feminist design, all of which are current and relevant topics of consideration for HCI research.

Mobile Health
Prior HCI research that examines the use of technology for maternal health in low-resource regions has tried to capitalize on the wide penetration and usability of mobile technology in these settings. For example, Ramachandran et al. [23] deployed short videos on mobile phones to motivate health workers and persuade village women, their goal being to attract more village women towards utilizing health services provided by the state. A related study also examined phone-based messaging between health workers and village women [24]. Fiore-Silfvast et al. [7] studied the use of mobile videos by midwives for patient education during postnatal care examinations. Molapo and Marsden [20] designed a tool to aid rural health trainers in creating mobile content for training low-literate Community Health Workers in Lesotho. Mathur et al. [19] explored the feasibility of creating and presenting digital content using a camera phone and pico projector in the domains of health care and education in a development context. Other mobile devices are also being designed for maternal health care. For instance, there is the digital PartoPen [37] that was deployed in Nairobi for early detection of maternal and fetal complications during labor. Kolko et al. [13] have discussed the design and deployment of an inexpensive ultrasound system for use by rural midwives in Uganda. We build on this work by presenting an 'in the wild' study of how mobile phones are being used - both by frontline workers and our target audience - for consumption and dissemination of health information in similarly resource-challenged settings.

Mobiles and Media
Mobile media practices in Indian settings have been a subject of study for the past 4-5 years. Smyth et al. [32] found that urban multimedia mobile users were adept at maintaining and transferring media libraries on their phone. Kumar et al. [14] studied the folk music ecology in rural and small town India, highlighting the audience that exists for consuming various forms of music on multimedia mobiles. Building on this work, Kumar and Parikh [15] and Kumar and Rangaswamy [16] discuss the growing adoption of mobile media and the informal economy that has emerged in support. All of this prior work, however, looks predominantly at male audiences. Our findings indicate that women avidly consume and

share mobile media as well, but rely on a different support infrastructure due to the social and patriarchal boundaries they are subjected to. We hope to motivate future work in this area.

Local Videos and Storytelling
The 'facilitated video' approach of PH was adapted from Digital Green [9], an initiative that aims to teach farmers about better agricultural practices using locally crafted films. This approach, in turn, was inspired by Digital Study Hall's [36] work on facilitated video instruction to assist primary school teachers in Lucknow, India. Local language video and storytelling approaches to disseminating information have been adopted widely in HCI4D research. Frohlich et al. [8], Reitmaier et al. [25], and Bidwell et al. [4] have studied the creation of local mobile audio and video content for digital storytelling in rural communities of India, Kenya, and South Africa. Ladeira and Cutrell [18] highlight the instructional value of a digital storytelling approach that combines motivational content with narrative framing. Much of this work is motivated by the desire to reduce text dependence and increase audience engagement in communities where literacy rates are low. For example, Cuendet et al. [5] developed VideoKheti, a mobile interface that uses speech, graphics, and touch to help farmers locate and watch agricultural extension videos in their own dialects. In this paper, we focus additionally on the *community response* to local, storytelling-focused health videos.

Gender and a Feminist HCI Perspective
Sengers et al. [30] introduced the notion of Reflective Design, stressing the importance of reflection on unconscious values embedded in computing. We incorporate feminist reflexivity in our research as we use Bardzell's [2] framework to reflect on aspects of PH thus far, as well as to inform the design of our next iteration. Bardzell and Bardzell [3] also identify ICT4D as a potential application area in their rejection of the notion of a 'universal' design. This fits well with our ideology of situating our design in the context of local cultural practices. Shroff and Kam [31] - studying the context of Indian NGOs working to improve gender equity - have offered an in-depth analysis of the stages that women traverse on their road to empowerment. In our study, we see these stages co-occurring in the context of different women and health workers and provide a richer understanding of women's interactions with technology 'in the wild', outside an institutional context. We also draw inspiration from Dimond's [6] use of Feminist HCI in her research on a social movement organization working to end street harassment.

BACKGROUND
We deployed Projecting Health in 2012 for disseminating information regarding maternal and child health in rural Uttar Pradesh (India) with the goal of addressing local maternal and infant mortality rates that are among the highest in the country. The dissemination takes place via group screenings of locally produced short films. Our partner organizations engage video production staff and train them in storyboarding, filming, and editing. This staff is then responsible for producing films based on inputs received from the Community Advisory

Board (CAB) - a volunteer group set up by our partner organizations, comprised of community members with diverse expertise. Once the CAB approves a video storyboard, it is cast, shot, and screened. ASHAs use low-cost pico projectors to conduct group screenings. The projector acts as a 'job aid', reducing the ASHA's burden of remembering and repeating information to every mother. These films are unique in that they feature local village residents, local dialects, and local music forms.

Disseminations take place a few times a month, at most. The typical venue is a publicly accessible, closed meeting space, where a projector can be used conveniently. At the dissemination, while the women collect and seat themselves in a semi-circle (some with their mothers-in-law, others with their children), the ASHA sets up the 'pico' (as it is popularly called) and tapes a white paper onto the wall if needed (see Fig 1). She begins the meeting with a recap of the video from the last meeting, asking questions to check that the women remember. She then plays the video and - taking her cue from the text in the video - stops it halfway to pose questions to her audience. The goal of these questions is to reinforce the women's learning, but they appear in the video also as an aid for the ASHA. When the screening is over, the ASHA leads a discussion of the video they just saw. The women then sit around singing local folk songs - as we observed - while some play the *dholak* or percussion. After 10-15 minutes, they disperse, returning to their household duties.

Taylor et al. [35] write that for sustained community involvement, it is important to iterate *with* community members on the design of technology interventions targeting them. Balestrini et al. [1] also discuss this in the context of their community-focused intervention in rural Argentina. In this paper, we study the community response to PH, focusing on women's technology practices and the role that mobile phones are playing in disseminating information. We view this as a process of iteration to inform our understanding of how the initiative could be developed further, factoring in ways that women are currently engaging with PH content. We adopt feminist reflexivity to do both - assess current community response and move towards a dissemination model that is receptive to emerging technology practices of women. Our next steps with PH will build on the insights that we glean from this study.

METHODOLOGY
Our IRB-approved study used a mixed methods approach, combining the results of a quantitative survey and qualitative methods such as semi-structured interviews, participant observations, and focus group sessions.

Our partner organization conducted a survey for us that included a set of questions regarding mobile penetration and the consumption of mobile videos. We asked the participants (mothers and ASHAs) if they owned a mobile phone and what they used it for. One of our main goals was to determine whether the participants had PH videos on their personal mobile devices and where they had procured these from. The results of this survey informed our approach to collecting qualitative data. Details that were difficult to capture using sur-

Figure 1. A Projecting Health dissemination in progress.

vey questions, e.g., the role of interrelationships in guiding women's uses of mobiles, were far easier to understand with the help of qualitative methods.

We conducted our qualitative study in the villages of blocks Khiro and Sareni, where the project is currently in progress. Our intention was to interview *at least* five ASHAs, five mothers, five project staff, and five men who were familiar with the films shown by PH. Some of these interviews were held one-on-one, while others quickly turned into focus group sessions as more and more village residents trickled in out of curiosity, raising our participant count to over 30. Every conversation lasted at least 45 minutes, often longer. The participants were identified based on the partner organization's knowledge and understanding of the landscape of mobile use. We also have a rich repository of data from prior visits - interviews and notes on observations - to the PH field sites. This made sure that we conducted our field work with a reasonable understanding of the field sites and their people and practices. We analyzed all our data using an iterative process of coding. This helped us in distilling the themes we discuss in this paper. Our focus in this process was on women (mothers and ASHAs) and their interactions with mobile technology. Using the lens of feminist HCI [3], we noted both the patriarchal structures that women are subjected to, and the ways in which they exhibit agency regardless.

Adopting a self-reflexive stance, we observed that although conversing fluently in Hindi (the native language of the first author) brought us closer to an 'insider' perspective [11, 33], for the participants who contributed to this study we were definitely 'outsiders'. Class and socioeconomic differences were quickly discerned, and we were received as members of an exotic species whose presence was worthy of local news articles for each day that we spent in the field.

FINDINGS
We now present the findings from our survey and qualitative study. We organize this section with the goal of highlighting two things the prevalence of mobile use in our field sites

and the role played by relationships in the transfer of mobile media from one person to another. Our lens of feminist reflexivity brings us to foreground the women's perspective, the limitations they are subject to, and their agency in overcoming these limitations.

Survey

Our survey included 309 women who had seen at least three PH films and came from villages in Khiro and Sareni where PH had been deployed. Of these women, 93 percent were between ages 20 to 39, 32 percent were illiterate (unable to sign their name) and another 46 percent had a middle school education at best, and 90 percent were housewives. Almost all women said they owned a mobile. Though these were primarily used for making calls, 45 percent reported using their mobiles for listening to music and 30 percent for watching videos. Twelve percent women reported having PH videos on their own mobile or on that of a family member. A third of these women had received the videos from the ASHAs and another third from the project staff. Eight percent have watched at least one video on either their or an ASHA's mobile. Among the 32 ASHAs who were part of the survey as well, 11 had PH videos on their mobile and all of them had shown these videos (using their mobile) to other women. A third of these ASHAs said that they found it *"easier to explain using the mobile."*

We consider these survey findings significant given there was no initiative on PH's part to facilitate mobile dissemination of the videos. The percentage of women using their mobiles for consuming media was larger than we had expected, as was the percentage of ASHAs showing videos on their mobiles. This data is what motivated us to conduct our study and examine these trends from a qualitative perspective to develop a deeper understanding of the phenomenon as we proceed with PH.

Qualitative Study

The pregnant and lactating mothers in our field sites are the target audience of PH disseminations and the ASHAs are the prime actors. To understand the sociotechnical configurations that their mobile practices - the focus of our study - are embedded in, we look also at their interactions with the rest of the community. We discuss below the interactions of the women among themselves, with the men, children, and other community members, with the technology, and with the patriarchal social structures influencing their lives.

ASHAs and Mobile Phones

The public health care system instituted the role of the ASHA in 2005. ASHAs are assigned one or more villages (that is, a population of a 1,000 women) and interact regularly with the women in the assigned villages. We observed that they are commonly referred to with terms of endearment and respect as *ASHA bahu* (daughter-in-law) or *ASHA didi* (older sister). Apart from the ASHAs, there are other frontline workers who are responsible for various aspects of maternal and child health. Together, they provide health care to women before and after their pregnancy, and to children up to the age of five. There are monthly Immunization Saturdays and Village Health and Nutrition Days. The ASHAs use the pico projector to conduct back-to-back screenings of PH films for the duration of these events. Thus, PH operates not in parallel but in conjunction with this structure instituted by the state government. The ASHAs who were earlier meeting with the mothers now fulfill their duties and outreach responsibilities at *Mothers Groups* - meetings the mothers (and often, mothers-in-law/children) attend to watch projected PH films.

The state government considers the ASHAs key in promoting the health of rural women and children. The ASHAs' staying in touch with the village women and other ASHAs is evidently a priority for the government, for we learned that all ASHAs in the state of U.P. had recently been distributed Nokia mobile phones and given 100 free minutes every month to call other ASHAs. When we asked about the utility of these new phones, however, we were surprised to hear that none of our interviewees were using them. We were given two reasons. First, the SIM was from a mobile service provider that had poor coverage in the rural areas we visited. Second, these mobiles were 'basic phones' (see Fig 2) and could only be used for making calls, while the ASHAs already owned more expensive and capable multimedia-enabled mobiles. ASHA Kusum Devi[1] shared that she had inserted her new Nokia SIM into her dual-SIM multimedia device. When we asked what she had done with the Nokia, she said:

> *"I don't have any reason to use it, so it sits at home. When my phone battery goes dead and there is no electricity, then I look at it to tell the time."*

Other ASHAs shared that they had given the phone away to relatives because they had no use for a basic phone. It is clear that the state government did give some thought to the phone sets to be distributed. Having a "dust proof keypad" and a "long lasting battery" (see Fig 2) would certainly make the phone more durable in the rural setting where it will be used. It *was* designed to fit the needs of the users (the ASHAs), but from whose perspective? This draws us to the notion of ecology that Bardzell [2] has discussed. Despite the fact that the mobile was selected to suit the material limitations of the environment, we saw how its selection was designed consciously or unconsciously to limit the uses of the ASHAs. They would have liked more versatile devices that they could use in their daily practices, instead of having to carry two phones around all the time. Had these Nokia phones been multimedia-enabled, they would have given us a strong reason to explore the feasibility of mobile disseminations of PH media. However, our finding that the ASHAs are already better equipped than the state government imagined gives us even stronger reason to believe that they would be willing and able to conduct disseminations of mobile media.

Women: The Young and the Old

For a nuanced understanding of the context in which PH operates, it is necessary to understand active social norms and the inherently patriarchal family structure that persists in much of India, particularly rural parts. As Kant discusses [12], mothers-in-law have considerable influence over their daughters-in-law, who form the primary target audience of

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[1]Names have been anonymized.

Figure 2. The ASHAs were given these Nokia phones by the state government. They are dust-proof and have a long battery life but they do not offer multimedia capabilities.

PH. For these young women to adopt new health practices, they must also have the cooperation of their mothers-in-law. Kant [12] describes how this authority is negotiated within households, where the pregnant daughters-in-law (or new mothers) try to resolve potential disparities between what their mothers-in-law believe and what is best from a medical/scientific perspective.

In PH, mothers-in-law are regularly included in the filming process and invited to screenings as well. For example, in one of the shootings we observed, the storyboard involved an ASHA approaching a mother-in-law of a pregnant woman and stressing the importance of institutional deliveries. As more mothers-in-law volunteer to act in these films, the general receptivity towards new health information grows. This also makes them a more engaged mobile video audience. We spoke to a few mothers-in-law who had PH videos on their phone. They showed us the files and shared that they would spend their free time at home watching these with their daughters-in-law:

> *"Once we have cooked and fed lunch to everyone, taken care of all the other household chores, and before the dinner preparations begin, we get some time to ourselves. While we are lying down, not doing anything, we go through the mobile and see what's on it. In this way, we also end up seeing the [PH] videos."*

Being able to watch the films together in this window of convenience is a crucial offering of the mobile phone. Further, when mother-in-law and daughter-in-law watch them together, one of our participants mentioned, there is lesser likelihood of disagreement between them too.

What About the Men?
Men's presence has not been solicited by PH thus far. This is not because we did not consider them to play a critical role towards the better health of their wives and children, but in response to the social conventions that make it challenging or even undesirable for them to attend disseminations. In a room full of women, the presence of men is awkward for both the men and the women, given that the primary target audience is women. As an ASHA asked, *"It is a place for women. What will the men do there?"* We have often observed, however, a few men crowding around and trying to get a peek into disseminations from outside. This is more out of sheer curiosity than a desire to partake of the information being shared. There is a general understanding among the men we interviewed that *"for them (the women) it is good"* and that "they" should watch them. Getting the men on board (if not in the dissemination) is important so that *(a)* they do not oppose their wives or daughters-in-law attending these mysterious viewings, and *(b)* they are willing to go one step further and encourage the women to do so. One of our ASHAs reasoned as follows:

> *"It is important for men also to know what is in the films. They may not be interested thinking this is for women. But when women's health suffers, then men are the ones who have to take time out from their work and go with their wife and/or child to the hospital to get the necessary treatment. The money for this treatment will go from* their *pockets."*

Though the men might 'rationally' agree with this ASHA, there are social barriers that exist between them and the information being disseminated in group screenings. Mobile media sharing practices open up new possibilities by being more inclusive of these men. Physical boundaries are relaxed and our participants claimed that it was much easier to share the media with their spouses in the confined spaces of their households. In addition to getting access to the content, it is important that they are able to watch these films in the company of their family members - wives and mothers.

Children and Youth as Helpful Intermediaries
In one of our early interviews, as we spoke to an ASHA about her engagement with her mobile phone, we found that she had multiple PH videos on it. When we asked if she had shared them with anyone, she said she had done so with several other women. However, when we asked if she knew how to transfer media from one mobile to another, she confessed that she had no knowledge of conducting mobile transfers, *"but the children will do it."* These children of varying ages who do not have their own mobile phones are adept at using them nevertheless. For them, these phones owned by their family members are among few 'toys' that they have access to, and must take apart to understand their every functionality. They make up for the ASHAs' lack of mobile expertise.

We did not initially have children on our agenda for interviews. However, as our study progressed, we found that it became increasingly relevant to consider their perspectives as well. Not only did they play a role (boys and girls both) in conducting mobile media transfers, they were also the ones to scan these mobile phones at home for content and play the media they could find. Although power dynamics could make it more complex for women to use their husbands' mobiles freely, the children appeared to have easier, freer access.

When we made visits to girls' schools, we learned that several students knew about PH. This speaks of the publicity PH has received outside of its target audience, although the schoolchildren may not be a representative group, given that we had been invited by one of their schoolteachers who was also on the Community Advisory Board and had written newspaper articles about PH. Regardless, our conversations with the girls revealed their strong desire to be of help to the women in their households - mothers, aunts, older sisters-in-law, and others. One girl stood up and said:

> "If you want, you can give me the files, and I can make sure that every house in my village has them in a week."

She was not the only one. Several other girls volunteered to help with disseminating these videos, willing to take on the responsibility of passing on health information to the women in their network. They claimed:

> "If this is something that would be useful to the women in our villages, that would be good for their health, why will we not help?"

Why indeed! Though we do not claim that these promises will all convert to action, recognizing the desire of these girls to participate aligns with our emancipatory action research agenda. Their keenness to help women in their families and villages to access information (the girls consider) valuable for their health is representative of the quality of advocacy that Bardzell [2] suggests as being a necessary component of Feminist HCI. The practice of downloading and distributing the files has also been taken on by some of the youth in the village who own a laptop[2].

Our interviews with ASHAs, other village women, schoolchildren, and village youth, all affirmed that children and youth have been regular aides for delivering mobile content to women - not just our target population, but old and young alike. This is useful not just for our current deployment, but also for future target populations - women who may become pregnant and their (present or future) mothers-in-law.

Mobile Shops for Offline Distribution
In our conversation with ASHA Durga Devi about the PH videos she had on her multimedia mobile phone, she mentioned in passing that she had taken her phone to "Vinay's shop" and asked Vinay to transfer the video files to his computer so he could download them onto the mobiles of the women who came to his shops requesting the latest songs or films as they frequently do. When we visited Vinay's shop, he confirmed that he had indeed been given the videos by Durga 5-6 months ago. There were 5 or 10 films, he said, which Durga had asked him to transfer to his customers' mobiles, telling them, *"If anyone near you is pregnant, be sure to show her these videos."* Vinay had done an average of 80-100 downloads of PH videos in the last few months but could not say how many of his customers would have seen them.

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[2]These laptops were not purchased; they were distributed by the state's political leaders to those youth who attend college, promised during the campaigns for the last state assembly elections.

The nature of these mobile shops has been discussed in depth by Kumar and Parikh [15] in their analysis of mobile media landscapes in rural and small-town India. We found them to be quite as prevalent in our field sites - at one market intersection, for instance, we identified six mobile shops. These act as hubs of mobile content for the village residents - old and young, male and female. For INR 20-40 (USD 0.30-0.60), they transfer ready mixes to their customers' mobiles. We interviewed five shop-owners and asked if they knew about PH and the films that were being produced locally. Some did, some did not. They were all willing however, once equipped, to distribute these videos to their mobile media customers from the villages nearby. One of them also said:

> "Why won't I distribute them? Of course I will distribute them. If there is content in these films that is good for our mothers and sisters and for their health, of course I will give it to my customers... of course I would try to reach out to remote audiences."

As with the schoolgirls, we see a sense of community involvement among the shop-owners. We cannot say that their words will convert to action necessarily, but again, the desire to participate in facilitating the transfer of information for the benefit of their community's women is important to note.

Rural Women and Technology
Women in settings such as ours - rural India - are generally assumed to have limited technological expertise. This is in part due to their actual low expertise, but also because they are less visible than the men. One of the mobile shop-owners, on being asked whether women were less technologically savvy than the men, said: *"No no... they are far ahead of the men."* He went on to say that they were also more private about their mobile use, which is why it was hard to tell. In one of our focus groups, a participant showed us a video that she had recorded during the session. Based on the group's response we assume this was not a novelty. However, we saw a range of expertise levels and cannot generalize. Several young brides are confined within their households and their uses of the mobile phone are not as rich.

Figure 3. All the women in one of our focus groups show us how it's done as they play Projecting Health videos on their mobiles.

Shroff and Kam [31] point out that as women are initiated into the process of using technology, they can be seen as different users over time in terms of their confidence levels and agency, among other things. If we view our entire set of target users, we can see them as individuals occupying the different stages of that spectrum. Some are more confident, more active than others. Others are more passive consumers of content. This diversity in expertise levels is not surprising; it is to be expected. However, there is a danger in our taking an "out there" perspective [34] for it might lead us to see all rural women as identical, similarly adept or similarly inept. Taking the pluralistic perspective Feminist HCI affords us is to understand the needs and limitations of our target users, but also to seek a more nuanced understanding of the users as individuals, without a compulsion for 'difference-making.'

The women's ownership of more versatile devices than before also influenced the extent of use. As Fig 3 shows, with greater access to personal multimedia devices, the women are more likely to experiment and get to know their phones better. This also contributes to greater mobile listening and viewing. Mobile shop-owners and project staff claimed alike that a significant percentage of the women already had multimedia-enabled mobiles, as our survey also indicated. More importantly, however, we found that the local mobile shops were no longer selling mobiles without multimedia functionality (or very rarely). This implies that the next generation of women mobile owners is likely to have multimedia-enabled devices.

Not enough research highlights the engagement of women with technology in low-resource environments. Though this engagement seen in isolation may not be very illuminating - beyond providing results as in our survey section above, seeing it in the context of social, situated practices can lead to deeper insights about the potential of this technology to influence communication patterns and development outcomes.

Mobile Disseminations for Projecting Health
As mentioned, the goal of our study was to evaluate and iterate on our original PH deployment. We were interested in determining whether *(a)* existing mobile media sharing could potentially contribute to PH, and *(b)* whether mobile screenings would render projector screenings unnecessary. The above subsections address (a). We now address (b). Each time we asked whether one mode of communicating was preferable to the other, we heard a consensus that both were equally important. Though our participants sounded enthusiastic about watching PH videos on their mobiles, they wanted to continue the projector screenings as well. There are several reasons for this shared love of both. Their affordances are different but complementary, as our interviews conveyed.

PH screenings take place in closed rooms. Since we were conducting our fieldwork in the summer heat, there was a unanimous view that these spaces were uninviting and uncomfortable, in contrast to mobiles, which were portable and could be used in any setting of choice (such as *"out here on the porch"*). Further, these group screenings had limited reach. They took place 2-3 times a month at best, as opposed to mobile screenings, which could take place several times a day, as per every viewer's convenience. Another advantage

of mobile viewing that was voiced by our interviewees was that the videos could be seen by various family members in the confines of their home. For instance, as we mentioned above, the men had no other access to this content. Of course, ASHAs liked mobile screenings as well since these required less effort on their part. The pico projectors have to be procured from and returned to a central location that may be several kilometers away. This requires effort and coordination, in addition to setting up and operating the projector, making sure that it is charged, and troubleshooting if needed. Though the convenience and versatility of mobile videos is undeniable, projector screenings play the invaluable role of bringing several women together socially, to a session facilitated by the ASHA (who may not always be present at mobile screenings), where the video is higher resolution and easier to watch than on a small mobile screen. These social gatherings remain indispensable, because they enable discussions between the ASHA and the mothers, allowing various questions to be raised and doubts dispelled.

Of course, mobiles are not for personal viewing alone. This addresses one of the ASHAs' use case scenarios that surfaced in our interviews. ASHA Janaki said:

> "As you know, in rural areas, there are a lot of disputes between households. It makes more sense to do screenings for smaller sets of households, instead of one for everyone."

Although the screen space offered is minimal, it is common for 2-3 women to collect around a mobile and watch a screen. As also captured by our survey, several screenings have taken place thus.

When we asked the ASHAs and women in our focus groups whether mobile media sharing could be useful for the distribution of PH films to increase outreach, one ASHA said thoughtfully but with determination:

> "Yes... it could be done. I could definitely make sure that every house in the village has these videos."

We suggested that if this seemed like too much work for her, she could also perhaps *"do a send"* of these videos to five other households and ask them to do the same. Her face immediately lit up. She said, *"that would be like a chain... I can do that right now.* The other women in the focus group animatedly discussed the feasibility of this distribution mechanism, also voicing their inclination to help in the process. This design interaction that took place with the village women and the ASHAs highlighted for us the agency of these women towards crafting their own solutions to their problems, stressing the importance of giving them a voice in the process and aligning with the principles of Feminist HCI.

DISCUSSION
Our findings above have given us clear next steps to pursue with PH for a more effective and ecologically fitting information dissemination model. We now discuss the insights we have gleaned, with the hope that they can also be applied towards other initiatives, not in the space of health care alone but for information dissemination more generally.

Community-Powered Iterative Design

Our study presents a unique combination of interventionist and interpretivist approaches by aiming to study women's mobile practices, broadly speaking, but in the larger context of a public health intervention. We were interested in studying how women were interacting with their personal devices - individually and socially - in and of themselves. Our subsequent agenda was to identify whether these practices could be leveraged towards the iterative design of PH's dissemination model. Our deeper, more nuanced understanding gained from studying the women, their technologies, and existing social structures and relations led us to conclude that mobile phones would be feasible to incorporate as an additional mechanism for disseminating PH media. Multimedia mobiles are becoming increasingly ubiquitous, intermediaries are present to support technology use and adoption, there is encouraging community support for PH, and distribution channels exist in the combined network of commercial (shops) and non-commercial (friends and family) entities. The next 'prototype' of PH, therefore, will entail using these findings to drive mobile distribution of content and supplement group disseminations. This brings us back, especially, to the qualities of participation, advocacy, and ecology discussed in [2] as we find that our community-centered approach allows us to iterate on our design by channeling the agency of the women we study in ways that can be supported by their community, socially and practically.

More than just Local

The PH model evidently supports pluralism in its localization of the films. These educational videos are not just popular because they are in the local language. They are also popular because there are no other films that are shot so close to home in language, style, or content. This content is closer to what our rural audiences desire as entertainment and includes elaborate story lines and local music forms they are familiar with. PH films thus aim to provide both entertainment and useful health information. Stories the audience can easily identify with for their cultural relevance and interspersed regional songs provide the hook that is needed to engage the viewers. Outside of a Mothers Group meeting and on a multimedia mobile device, PH films compete with various other entertainment media residing on the phone. Being local and entertaining is key to win over others in that competition.

Mobile Videos for Outreach

Prior HCI literature that focuses on videos has highlighted the value of using a storytelling or video-based approach in order to get the message across to a primarily low-literate audience. We confirm these findings but add that it is not merely the instructive value of the video that is relevant in this context, but also the fact that there exists a social and technological infrastructure for sharing them. We refer back to Sambasivan et al.'s work [28] on the viral nature of information diffusion in developing communities. In our study, we found similarly prevalent media sharing practices. Given our additional findings that multimedia mobiles are rapidly becoming ubiquitous and rendering basic handsets obsolete, there is a strong case for using videos for outreach. Additional affordances that make videos more attractive in this setting, especially in contrast to the group disseminations of PH, include the ability for unsupervised viewing, and that the files can be stored as a reference for later consultation.

Negotiating Authority within the Household

Kumar et al. [17] argue in their work that *"the locus of behavioral action is the household."* This is what we found with PH as well. The provision of accurate, globally approved health information is not sufficient. For that information to be willingly adopted towards behavior change, it is essential that existing information structures are sensitively dealt with as well. As [12] discusses, the daughters-in-law must negotiate their relationships with their mothers-in-law in order to take actions in the interest of their or their child's health. Health initiatives that target the adoption of new, scientifically informed health practices must also find a way to negotiate older practices steeped in culture. ASHAs did this by inviting mothers-in-law to video screenings, as well as making them a target for mobile dissemination. In addition, given that the support of men is important for the women to fully participate, mobile videos make it easier to access them as a peripheral audience, as stated in our findings. The mobile - equipped with PH videos - that allows for collective viewing in intimate household quarters thus takes on the embodiment of the qualities of pluralism, advocacy, and ecology all at once.

Intermediated Technology Access

The role of intermediaries in contexts such as ours has been frequently discussed in HCI4D research [29, 22]. We see in the work of Kumar and Rangaswamy [16], for instance, that when technology skills are limited, human intermediaries and mediators step in to facilitate technology use. In this study too, we found a significant presence of intermediaries helping the women with their technology use needs. Our unique finding was that these intermediaries were largely children and youth, often found in the same households as the women.

When we commenced our study, we expected the women's interactions with their mobiles to be limited. Several factors were responsible for this. These women operate within strict patriarchal structures with limited freedom. They are generally not highly educated and enjoy more restricted access to technology than the men. Doing Bluetooth exchanges of mobile media is not an activity we would have expected them to undertake. Broadening our purview to include the role of intermediaries, however, and considering other actors in the neighborhood who could help with these tasks, altered our view of the media landscape significantly. Even when the women are unable to conduct Bluetooth transfers or play videos, there are children and youth (male and female) in the household who are generally more adept with the mobile devices and readily able to help. Even the schoolgirls we spoke to expressed great enthusiasm and willingness to take on the responsibility of transferring PH videos to the mobiles of their mothers, relations, and neighbors if this would be of use to them. Notwithstanding the possibility that it was our advocacy of PH content that we saw a reflection of in them, we believe that the potential of children as change agents or 'action research assistants' is not to be underestimated.

Going Beyond User-Centered Design

An important lesson for the HCI community that our study offers is how pushing the boundaries of user-centered design and going beyond the target user can constructively impact a technology intervention. We stress the importance of looking not only at users but the context they operate within - including the technological and human elements that influence their social and cultural activities. For instance, perhaps women on their own are not aware of the full range of functions that their mobile offers, but the fact that there are children or youth around who are is important to factor in. This becomes especially relevant for societies like rural India's that have collectivist leanings. We push, therefore, for a greater focus on community- and context-centered design in HCI.

CONCLUSION

We studied mobile media practices of rural Indian women in the context of Projecting Health, a public health initiative that targets the dissemination of health information for pregnant women, lactating mothers, and their newborns using locally crafted short films. We used a Feminist HCI approach to inform the iteration of our information dissemination model, examining the potential of incorporating existing mobile media practices and taking a community-centered approach to design.We maintained our focus on the qualities of pluralism, advocacy, ecology, and participation as discussed by Bardzell [2] and showed that although there are strict social conventions and patriarchal norms that constrain various practices of these women, they are able to exercise agency and mobilize help within their communities as needed. Our next steps with Projecting Health will build on the insights we gleaned from this study.

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