Mobile Video Dissemination for Community Health

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ABSTRACT

We examine the dissemination of mobile phone videos in the context of Projecting Health - a community health project in rural India. Our research objective was to identify the most effective means of promoting the distribution of health videos on a largely offline network of mobile phones in a resource-constrained environment. We compared three different distribution channels: mobile shop owners, laptop owners, and community health workers in a fourteen-week intervention that relied on data collected via missed calls from viewers and callbacks made to them. We present the design of our experiment, describe the challenges in deploying this experiment, and discuss overall findings. All three distribution channels were successful in targeting the community; mobile shops had access to most community members but the community health workers were most successful in getting videos out to those who were most interested in viewing them. Many participants were motivated to distribute the videos for the benefit of community. However, the number of missed calls received decreased over time, suggesting the exploration of alternative mechanisms to extrinsically motivate intermediaries and viewers for broader video distribution.

Keywords

Mobile video dissemination; mobile; health; ICTD; HCI4D

Categories and Subject Descriptors

H.4 [**Information Systems Applications**]: Miscellaneous

1. INTRODUCTION

Maternal and infant mortality rates in numerous developing countries remain persistently high. Addressing these became a global priority with the introduction of the Millennium Development Goals in 2000 [32] and falls again under the purview of the newly determined Sustainable Development Goals [28]. The problem is multi-faceted and its solutions lie in various domains, including the provision of better nutrition, improved health services, innovative technologies for infant care, among others. In Projecting Health, as introduced in [10], we target this problem by improving access to relevant and necessary information so that new and expectant mothers are better equipped to tend to their and their children's health.

Projecting Health, set in a state of India with high maternal and infant mortality rates, uses the Community-led Video Education model (CVE) discussed in [10] to disseminate maternal and newborn health messages to rural women and their families. In Projecting Health, locally created health education videos are shown in group settings using portable video projectors. One important discovery [7] during the implementation of Projecting Health was that community members had acquired mobile versions of these videos on their personal devices and were actively sharing them with others. This organic mobile distribution of videos contributed to increased coverage of Projecting Health by including people who were not reached by group screenings.

Our work set out to determine *the best way to promote the distribution of health videos on an offline network of personal mobile phones.* We were aware that mobile video sharing was popular, but did not have a good understanding of the extent of this sharing. We also received a suggestion from members of the community that local mobile shops would be an effective channel for distributing videos. These mobile shops are the focal point where people in rural areas get prepaid mobile airtime and mobile media files [9]. Our formative research also identified laptop owners - students who received a laptop from the state government after graduating from high school, and Accredited Social Health Activists (ASHAs) - community health workers responsible for providing and promoting health information in their communities, as potential distributors of mobile videos [7]. To identify the most effective channel of distribution, we conducted a fourteen-week experiment and tracked the spread of mobile videos through a process that entailed missed calls and callbacks. We distributed a set of videos through each distribution channel, requested missed calls from viewers if they liked the video, and conducted callbacks to measure the geographic reach and spread of the videos. In fourteen weeks of deployment, we received 436 missed calls from video viewers and conducted 378 call backs, 47 semi-structured interviews, and two focus group discussions with various stakeholders.

As a primary contribution, we present the first analysis of mobile video dissemination in resource-constrained rural settings along three distribution channels comprised of dif-

ferent community actors. Through our analysis, we discuss how this complex sociotechnical system allows for health information to reach members of its diverse targeted audience. We verified that all three distribution channels were successful in disseminating health videos in rural communities. However, the distribution by ASHAs was the most effective at getting videos out to people who were most interested in seeing them. As a secondary contribution, we identify the strengths and weaknesses of our technique for tracking distribution of videos through missed calls and callbacks. We synthesize these findings and offer recommendations for future interventions targeting mobile video distribution in resource-constrained settings.

2. RELATED WORK

We now lay out the areas of research that we draw on and extend with our work. Our goal is to contribute in the areas of mobile health and information dissemination - especially timely due to the increasing penetration of mobile coverage in rural environments, local video production and storytelling practices - key for regions where print literacy is likely to remain a concern for the foreseeable future, and the application of Interactive Voice Response (IVR) technology as a design probe to study the scope of an intervention such as ours.

2.1 Mobile Health

Prior 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. [18] 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 [19]. Fiore-Silfvast et al. [2] studied the use of mobile videos by midwives for patient education during postnatal care examinations and Treatman [27] considered the use of CommCare for showing multimedia health content. Molapo and Marsden [15] designed a tool to aid rural health trainers in creating mobile content for training low-literate Community Health Workers in Lesotho. Mathur et al. [14] 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. We extended this work in [7] by examining the growing adoption of mobile devices by village women and integrating mobile dissemination into the design of Projecting Health. In this paper, we further build on prior findings to enrich our understanding of the role that mobile devices can play in initiatives that target improved health and wellness practices in rural and largely offline communities.

2.2 Offline Dissemination of Mobile Media

Mobile media practices in Indian settings have been a subject of study for the past 4-5 years, since the penetration of mobile devices became more widespread. Smyth et al. [25] found that urban multimedia mobile users were adept at maintaining and transferring media libraries on their phone. Kumar et al. [8] studied the folk music ecology in rural India, highlighting the production, consumption, and dissemination of various folk media on multimedia mobiles.

Building on this work, [9] and [11] discussed the growing adoption of mobile media and the informal economy that has emerged in support. Vashistha et al. [29] studied offline educational content production and sharing practices employed by visually impaired people in rural and peri-urban India. None of these works, however, attempt to assess the spread of information through communities. Sambasivan et al.'s intervention in [22] was the first to examine information diffusion across urban slums and peri-urban communities in and around Bangalore at a time when video CDs (VCDs) were in vogue. With the mass transition from physical to non-physical digital media, information flows have also evolved. We analyze the dissemination of information across rural and largely offline social networks with the hope of benefiting interventions that target effective information dissemination in public health and beyond.

2.3 Local Videos and Storytelling

The Community-Led Video Education (CVE) approach that we use for Projecting Health [10] was adapted from Digital Green [4], a non-profit that teaches farmers about better agricultural practices using locally crafted films. This approach, in turn, was inspired by Digital Study Hall's [26] 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. Frohlich et al. [3], Reitmaier et al. [21], and Bidwell et al. [1] 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 [13] highlight the instructional value of a digital storytelling approach that combines motivational content with narrative framing. In our intervention, we focus not only on distributing video for better health and wellness, we are also in a unique position to obtain feedback from community members who wish to have their voices heard.

2.4 Interactive Voice Response

Interactive Voice Response (IVR) systems are popular tools to report, access and disseminate information among low-literate people with access to basic mobile phones. Thus far, IVR technology has spanned diverse domains, including civic engagement [6, 16], agriculture [17], health care [24], education [5], employment [20, 31], and social media platforms [30]. In our study, we have used an IVR-based design probe to measure the reach and spread of videos, and to obtain feedback directly from the community.

3. PROJECTING HEALTH

The Projecting Health community health project has been in operation in the Raebareli district of Uttar Pradesh, India since October 2012 [10]. In this project, health information is captured in videos created of, by, and for the community and shown in facilitated group screenings. Since the start of the project, 70+ health videos have been produced on topics including birth preparedness, breast feeding, family planning and immunization, and more than 8,000 video screenings have been conducted.

3.1 Distribution Channels

The notion of intermediaries has been studied in depth in ICTD research. In [7], we found that there were a few different community actors who could play the role of inter-

mediaries to further the reach of Projecting Health videos. In November 2014, we conducted focus groups and interviews to ascertain three main categories of intermediaries that we describe below.

The first category is that of mobile shop owners (MSOs). Mobile shops have become increasingly ubiquitous even in exceedingly remote Indian locations and act as the primary access point for mobile media needs [9]. Though the shop owners are in the business for material gain, several also expressed a desire to be of help to their community, particularly in matters pertaining to the health of women and children [7].

The second category is of local laptop owners (LOs). These are youth who received laptops from the state government upon graduation according to the *free laptop distribution scheme*, also mentioned in [7]. Most villages have 2-4 of these LOs who act as community media hubs, sourcing media needs of their social circles at zero cost. Many of them use their laptops for listening to music or watching videos.

The third category is that of the ASHAs, employed by the state health system, who are responsible for facilitating the disseminations in Projecting Health. Though the ASHAs we interface with are keen to support the spread of Projecting Health videos, their technical expertise is limited. They are not always able to conduct Bluetooth file transfers, for example, but frequently do find others (such as children or husbands) to help them with the task.

4. VIDEO TRACKING

The objective of our experiment was to understand the dissemination of mobile videos and the role played by the different intermediaries in the process. The low penetration of smartphones and Internet in rural areas ruled out designing a smartphone application capable of monitoring and reporting mobile media transfers. Though feature phones are prevalent, because the videos were distributed on personal phones, it was infeasible for us to gain access to all of them. Though we considered designing a Java application that could monitor and self-report mobile media transfers on feature phones using watermarking or device logging, it appeared non-trivial to motivate people to download and install the application. We also considered giving financial incentives to people for sharing mobile media transfer information. However, the implementing organizations were worried about the detrimental impact of financial incentives on the expectations of people from Projecting Health in the long run. Because higher technology approaches such as watermarking, device logging, or automatic notification of transfers were unsuitable, we designed a simple measurement technique comprising of missed calls for reporting the reach and geographic spread of distribution and callbacks to understand distribution strategies.

To track the distribution of videos through rural offline networks, we selected three videos from each of two blocks where Projecting Health has been deployed since 2012. The topics covered included birth preparedness, hand washing, exclusive breastfeeding, thermal care, and delayed bathing. The videos were in a local dialect of Hindi, roughly ten minutes in length. They were edited to begin and end with a plea from a local doctor or nurse in-charge in each block to the viewers to support our efforts by making a 'missed

call' to a given number if they liked our video[1]. These messages were recorded in the local dialect with the objective of connecting to as wide an audience as possible - including men *and* women in our target communities. The text for the short appeal, which appeared at the beginning of the videos, was *"If you like this video, please send us a missed call on phone number."* The text for the longer appeal, appearing at the end, was *"We make these videos for you with a lot of enthusiasm and effort. If you like this video, please send us a missed call on phone number to appreciate us. Please note that by calling this number, your phone balance will not be deducted. Upon receipt of your missed call, our project coordinator will return your call very soon. We make these videos for you and your opinion and appreciation is very important to us so that we can continue to produce such videos."* The phone number was spoken aloud and also appeared on the video three times in large type so it was visible on phones with small screens. The videos were converted to 3GP, MP4, and AVI formats to accommodate the range of mobile devices that our formative research had revealed to be prevalent.

Callback numbers selected were different for each of the three distribution channels and across the two blocks (*i.e.,* there were six callback numbers in total - see Table 1). NGO staff in both blocks followed up with the selected MSOs, LOs and ASHAs once in two weeks to ensure that the study was progressing smoothly and resolve any challenges faced in the interim. When a call was received, we sent a callback with a pre-recorded voice message to the caller conveying that the missed call had been registered and they would be contacted shortly. We also dispatched a text message with the call information to our project staff assigned the task of conducting callbacks. This role was played by a female staff member so that women callers would be at ease.

4.1 Implementation

We conducted six three-hour long training sessions with the MSOs, LOs, and ASHAs. The goals of these sessions were to ensure that all participants understood the overall motivations underlying our project as well as the specific parts they had been recruited to play. The sessions began with an overview of Projecting Health and a description of the intervention, before emphasizing the need for mobile dissemination of Projecting Health videos. We explained to the participants what we were out to accomplish and how they could help us achieve the goals.

The number of participants registered for each dissemination channel (# registered) and the number of participants who attended the training (# trained) in both blocks are given in Table 1. All MSOs were male. There were 14 male and 21 female LOs in the first block, and 18 male and 18 female LOs in the second block. All ASHAs were female. Gender roles in these field sites are rigidly defined but we aimed for a balanced distribution when possible (e.g., with the LOs). A majority of the LOs were pursuing a Master's degree. However, one LO was in middle school and three were in high school. All MSOs knew how to transfer mobile media. Among the LOs who attended the training, roughly 60% did not know how to use a memory card reader, 25% did not know how to use Bluetooth, and 20% did not know cut-copy-paste operations. Only two ASHAs in the first block

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[1]Sending a missed call refers to the practice of calling a number and hanging up before the recipient can answer.

Medium	Block 1			Block 2		
	Phone #	# Registered	# Trained	Phone #	# Registered	# Trained
Mobile shop owners	011 3045 3618	50	45	011 3045 3621	45	39
Laptop owners	011 3045 3619	35	35	011 3045 3622	36	36
ASHAs	011 3045 3620	55	49	011 3045 3623	40	32

Table 1: Details for dissemination channels in each block

and five ASHAs in the second block knew how to use Bluetooth. Thus, we also conducted technology training of LOs on how to use memory card reader and of ASHAs on how to use Bluetooth for mobile video distribution (see Figure 1). Only 12 ASHAs in the first block and 13 ASHAs in the second block owned a multimedia phone. However, roughly 80% of them claimed to have shared access to a multimedia device.

We gave an 8GB USB flash drive pre-loaded with selected videos in MP4, AVI, and 3GP formats to MSOs and LOs, and gave videos in 3GP format to ASHAs who had multimedia devices. We asked all participants to distribute these videos widely to everyone in their social network (not just pregnant women and new mothers) using online (e.g., WhatsApp, Facebook, YouTube) and offline (e.g., Bluetooth, memory card transfer) means. We gave all participants a memento and certificate. We also gave a card-reader to LOs and a diary to ASHAs. The NGO staff followed up individually with those who could not attend our training sessions to ensure that they received the same instructions and benefits.

5. METHODOLOGY

We used a combination of qualitative and quantitative methods for formative research, data collection, and analysis. The qualitative data was collected between November 2014 and December 2015 over the course of five field visits. The quantitative data was collected during a fourteen-week intervention beginning September 2015. Preliminary research in the form of focus group sessions (7) and semi-structured interviews (27) with various community members and NGO staff in November 2014 enabled us to identify the targeted intermediaries - MSOs, LOs, and ASHAs - we needed to recruit for our study. In early 2015, we recruited MSOs for our study through random sampling from a large, exhaustive survey of 122 MSOs conducted by the NGO staff to identify participants who would be willing to distribute Projecting Health videos to their clientele. A similar process was undertaken to identify LOs (significantly fewer in number). All 95 ASHAs who were part of Projecting Health were included.

In March 2015, we designed the intervention using a participatory design approach and conducted three sessions, lasting ten hours of discussions between the two partner grassroots organizations, PATH (a global health organization), researchers, and community members. In April-May 2015, we completed a trial run of our experiment to iron out any complexities and hurdles we had not anticipated. In June 2015, we conducted a set of intermediate interviews with MSOs (5 per block), LOs (3 per block), and focus group sessions with ASHAs, mothers groups, and staff (1 per block) to obtain feedback on the intervention. We identified the challenges that arose and iterated on our design to roll out a robust experiment in September 2015. We returned to the field after seven weeks to conduct semi-structured interviews of seven MSOs, 13 LOs, 10 ASHAs, 15 missed callers, and two NGO staff responsible for conducting surveys of missed callers. We also conducted group discussions with the entire NGO staff to glean insights from their experience with facilitating the intervention. These surveys, interviews, and group discussions were distributed equally across both blocks.

All interviews and focus group sessions were conducted in Hindi, which is the native language of the first, second, and third authors of this paper. These lasted approximately 30 minutes to an hour each. For our final phase of data collection, we conducted interviews until we had reached data saturation. The findings we present in the remainder of this paper include a qualitative analysis of interview and focus group data, a geographic analysis of missed calls, and a quantitative analysis of callbacks.

6. FINDINGS

We received 768 missed calls from 436 unique missed callers (see Table 2). We normalized the total missed calls obtained by the number of participants trained for each dissemination channel. The time series analysis of distinct missed calls received for each dissemination channel is depicted in Figure 2. The number of missed calls received for videos disseminated by ASHAs in both blocks were significantly higher than the number of missed calls received for videos disseminated by MSOs and LOs.

6.1 Demographics

The MSOs we interviewed were all male and largely in their early 20s with an average age of 22.8 years. Two MSOs had completed middle school, one had completed high school, and the remaining had a bachelor's degree. Four of them owned a smartphone and three had a feature phone. All MSO participants were regular users of Internet and SMS services, six had an account on Facebook and WhatsApp, and five were YouTube users. All were proficient in using Bluetooth and conducting mobile media transfers. MSOs reported transferring the videos to an average of 80 customers out of whom 93% were male and 7% were female.

We interviewed six male and seven female LOs. Their average age was 21.2 years and they were more educated on average. Four of them held or were pursuing a Master's degree while nine held or were pursuing a bachelor's degree. Only four of them were self-dependent, earning an average monthly income of USD 100. Most LOs were from low-income families earning roughly USD 150. Nine of them owned a phone while three shared a phone with their family members and one participant did not have access to a phone. The distribution of smartphones, feature phones, and basic phones was even among them. A majority were less technologically savvy than MSOs. Only six LOs used the Internet, five had Facebook and WhatsApp accounts, and three used YouTube for entertainment. One participant had never used

Figure 1: ASHAs attending the orientation and training sessions.

SMS, two did not know how to use Bluetooth, and one did not know how to transfer media content on mobile phones using a memory card reader. Two participants had completed basic computer training and only three participants used software other than a media player. For most LOs, the laptop was a device to listen to songs, watch movies, and transfer media content to/from mobile devices. LOs reported transferring videos to an average of 16 people out of whom 57% were male and 43% were female.

ASHAs were older than other participants with an average age of 37 years. Their average monthly income was USD 18 and around 25% of it came from biweekly screenings of health videos to mothers' groups and adolescent girls. Four ASHAs owned a basic phone and six owned a feature phone. None of the ASHAs had ever used the Internet. All of them used Bluetooth for conducting mobile media transfers and six were proficient in sending texts. Most of them learned how to use Bluetooth in our training sessions. These ASHAs reported that they had transferred the videos to an average of 13 men and women (split even between men and women).

6.2 Missed Calls

We conducted semi-structured interviews of fifteen people who placed a missed call on the phone number belonging to MSOs (N=5), LOs (N=3), or ASHAs (N=7). Four participants were male and 11 were female. The participants were young with an average age of 25.6 years. Most participants came from families of farmers, laborers, and shop owners with an average monthly family income of USD 108. Twelve participants owned a feature phone and the rest owned a basic phone. The participants placed missed calls because they wanted to convey their appreciation for the video (N=9) or because they liked the video and the sender had asked them to place a missed call (N=4) or because the sender requested them to send a missed call (N=1) or out of plain curiosity (N=1). Ten of these participants also reported sharing our videos with family and friends.

Though the videos were on maternal and newborn health, their audience included male family members as well as people who did not have a new mother or pregnant woman in their families. Among the interview participants, five were mothers of a child older than three years, three were lactating women, two were fathers of a newborn, one was a pregnant woman, and one each was a mother, brother-in-law, and sister-in-law of a pregnant woman. One of the participants did not have a new mother or pregnant woman in the family. Among those who participated in our phone survey,

54 were sisters-in-law of a pregnant woman or new mother, 30 were brothers-in-law, 27 were husbands, 19 were pregnant women, 19 were lactating women, 11 were mothers-in-law, ten were fathers, nine were mothers, four were brothers, three were sisters, two were fathers-in-law, and the remaining had no pregnant women or new mother in family. The finding is supported by previous research [12] that identified in-laws and husband as critical decision makers for the health and well-being of pregnant women, new mothers, and newborns. The number of calls we received from sisters-in-law and brothers-in-law was higher than those from mothers-in-law and fathers-in-law probably because the penetration of mobile phones (and feature phones especially) is greater among younger users.

Though we anticipated receiving a high number of missed calls from women, the videos had high traction among male viewers as well; they were responsible for roughly 39% of missed calls. We confirmed during the interviews and survey that these male members were not proxies for female family members or friends. Callbacks indicated that our videos also transcended geographic boundaries. Among the missed callers, 154 were from block 1, 190 were from block 2, 12 were from a different block, 11 were from a different district, and five were from a different state. Though Projecting Health operate in 27 villages in block 1 and 30 villages in block 2, we received missed calls from 34 villages in block 1 and 55 villages in block 2.

6.3 Motivation to Distribute Videos

The intermediaries we interviewed expressed strong sentiments regarding the importance of distributing health videos via mobile phones. They were motivated to bring the benefits of health videos to their relatives, friends, and clientele. An LO expressed that he shared the videos with others so that *"people will also appreciate it and learn from it."* Many MSOs and LOs distributed these health related videos *"to contribute to the well-being of society."*

As found in preliminary research [7], ASHAs saw several benefits to mobile video distribution. Seven ASHAs found it challenging to convince people to come to mothers' groups. They also observed that after these meetings, women's retention of key health messages was low since they were unable to review the videos. Thus, they considered mobile videos an effective means of allowing women to learn, review, and share health information at a convenient time and place.

The fact that MSOs and LOs were invited to a training, appreciated for their time, and requested to improve public

Location	Medium	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Total	Normalized
	MSO	11	2	3	0	1	6	0	0	0	0	0	0	0	0	23	0.51
Block 1	LO	17	4	2	0	0	3	3	1	3	3	0	0	0	0	36	1.03
	ASHA	21	27	18	17	10	22	4	11	0	1	0	0	0	0	131	2.67
	MSO	13	6	5	2	2	1	3	1	0	0	1	2	1	4	41	1.05
Block 2	LO	25	11	16	3	11	11	1	1	1	2	1	0	0	1	84	2.33
	ASHA	6	35	9	4	28	20	11	5	2	0	0	0	1	0	121	3.78

Table 2: Unique missed calls received for dissemination channels in each block
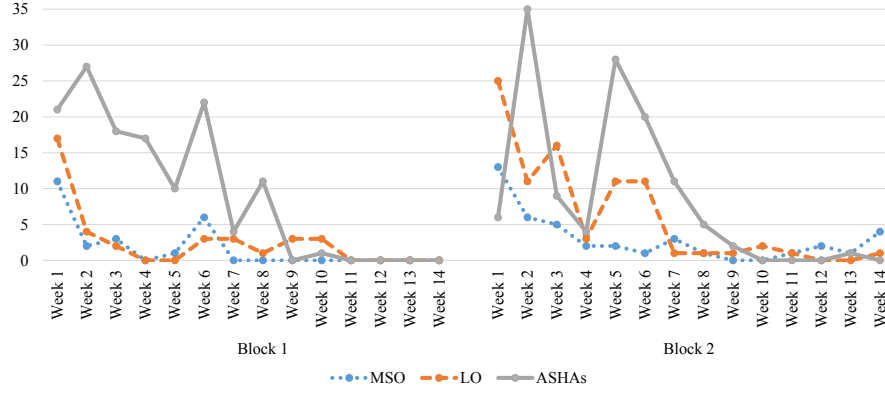

Figure 2: Unique missed calls received during our study

health by disseminating videos made them *"feel important."* They liked receiving a memento and certificate during the training. Of 11 MSOs we visited after the training, ten had publicly displayed the memento or certificate. A female laptop owner (P1) shared her motivation for distributing videos:

> I went to the training and was told that this is a very important work. These videos will improve the health and well-being of people in my village. That's why I am sharing the videos with people in my community.

Several MSOs distributed the videos because they saw themselves as being in a unique position to target *en masse* dissemination, as opposed to the other intermediaries. One MSO (P2) shared:

> ASHAs use a projector to show the videos. Similarly, this is my way of distributing the videos in the community. This is important for the health of the mother and newborn. This is a humanitarian effort and we all have to come together. It is impossible for anyone to distribute the videos door-to-door, but much easier for me as I can transfer the videos on phones of customers by spending an extra two minutes.

6.4 Mobile Media Distribution

Our interviews with MSOs, LOs, and ASHAs revealed that participants shared videos with family members, relatives, friends, customers, and social contacts. People used a wide variety of social settings to share videos including transferring videos to customers coming to a mobile shop, guests visiting home, laborers working in a farm, relatives attending a family function, neighbors attending evening informal meetups, and friends and co-workers at college. The participants used a range of technologies for distributing videos. In the phone survey, 172 people reported receiving the video through Bluetooth, 98 people through mem-

ory card downloads, 49 people watched it on others' phone, 43 watched it on others' laptop, three people received it on WhatsApp, two people received it in a flash drive, one person each watched it on YouTube and received a link to the video in an email.

6.4.1 Common Strategies

MSOs shared videos mostly with their customers and family members. LOs shared the videos mostly with family members, relatives, neighbors, and friends. Often MSOs and LOs introduced these videos as *"something new, different and useful"* to their customers and social connections. Several LOs reported that transferring health videos became a *"part of their everyday schedule"* and they share videos whenever they meet people in their social circle. For instance, an LO gave the videos to guests attending a housewarming function. Three LOs went door-to-door in their village to disseminate the videos while five transferred the videos when people came to their house for getting mobile content. One LO, who worked as a part-time farmer, gave the videos to other laborers working on the farm who expressed interested in showing videos to family members. Three LOs started screening videos outside their or others' houses where 10-12 people used to gather for watching the videos. As one male LO (P3) shared:

> I show the videos to people in the evening when they sit outside their home. That's where they have intellectual exchanges and discussions on topics of national and regional interests. I asked them to show it to their mothers and sisters. I also shared videos with people who came to my house to get mobile content.

Most female LOs relied on Bluetooth transfers or intermediated sharing, that is [23], while male LOs used a gamut of online and offline means depending on the access to technology that people in their social circle had. One of the male LOs (P4) shared:

For friends who owned a laptop, I transferred the videos using the flash drive you gave. For people with multimedia phones, I transferred the videos using Bluetooth. Many of my friends are online now. Thus, I sent the videos to six people on WhatsApp as well.

ASHAs transferred the videos in several settings including mothers' groups (N=4), discussions at the local health centers (N=3), specially organized sessions (N=2), and during routine house visits (N=5).

6.4.2   Help from Family

Though some ASHAs were proficient in using Bluetooth, six ASHAs struggled with it, turning to outside help, mostly from family members. An ASHA had conversations about the videos with people who visited her son's shop while he gave the videos via Bluetooth to people who expressed interest. Another ASHA focused her attention on creating awareness about the videos during her house visits and asked male members of the house she was visiting to transfer the video using Bluetooth. Most LOs and ASHAs complained about low availability of multimedia phones among women. They coped with it either by showing them videos on mobile phones or laptops or transferring videos on the multimedia devices of their family members. An ASHA started taking her daughter for house visits so she could help with Bluetooth transfers. Another ASHA transferred the videos herself, but also asked her son and husband to share the videos with farmers and laborers at work. Similarly, another ASHA asked her brother-in-law to disseminate the videos via Bluetooth. One LO overcame technical obstacles in transferring the videos by taking help of her cousin. She collected multimedia mobile phones of people in neighborhood and asked her cousin to transfer the videos via Bluetooth.

6.4.3   Permission for Transferring Videos

Several participants transferred the videos without taking permission from the recipients. Our findings revealed that it is common for MSOs to load memory cards with movies and songs of their own choice since most customers do not have specific content requests. Some MSOs, thus, did not feel the need to take permission for transferring the videos, either to save time or because they suspected that people would decline in the moment but might like them if they saw them later, or because they felt that there was enough trust between them and the recipients that they did not find it necessary to seek permission. However, three MSOs were particular about taking permission to avoid any uncomfortable situation. Two MSOs reported playing the videos on laptop repeatedly in the evenings and transferring the videos only if asked.

6.4.4   Targeted Distribution

Interviews revealed that some participants transferred videos specifically to people living in a different block, district or state for making the videos shot in their block go viral. One LO shared videos mostly with people in Kanpur where he is currently working and sent the videos to his friends in the states of Madhya Pradesh and Gujarat. An ASHA gave videos to a relative visiting from Bangalore as she wanted the video to spread to different geographical locations. Another ASHA (P5) reported:

I gave videos only to people who are not from my village. It is easy to give videos to people in the village. If I give videos to people outside my village, then the videos will reach new audiences in new locations where it is impossible for us to go. I gave videos to people who came to my village to cast votes in a block level election.

An MSO transferred the videos to migrant laborers in West Bengal, Delhi, and Rajasthan when they visited their village during the holiday season. A migrant laborer sent the videos to Delhi through WhatsApp and reported receiving appreciation from his friends for transferring *"something unique and useful"*. We got a missed call from Ahmedabad, a city 715 miles away from block 2, where the caller reported watching the videos on YouTube. One of the ASHAs in block 2 received a call from a person from her village who is a migrant laborer in Kuwait. He watched the video on YouTube and called her to ask if it was really her in the video or her doppelganger. Some participants' strategy was to give videos only to a specific set of people. For instance, an ASHA gave the videos only to women and adolescent girls as she believed that showing videos to them will reap the most benefits.

6.4.5   Involvement of People Outside the Study

The training and incentives given to participants were enticing to individuals who were not initially recruited in our study. For instance, an MSO broke his laptop a few days after the orientation session. However, another MSO, who was not part of our study, took the videos from him and distributed the videos to roughly 20 customers. He requested us to consider him for participation in the next training. Two LOs and one ASHA gave videos to five other LOs who were not part of the study and requested them to distribute the videos. One female LO asked her two uncles who own a mobile shop in a nearby village to transfer the videos to their customers. Another LO showed the video to her uncle who liked the video so much that he brought several people to her home so she could give them these videos.

6.4.6   Mixing of Dissemination Channels

The interviews revealed interweaving of different dissemination channels where several participants strategized to capitalize on the strengths of other channels for more effective dissemination. For instance, an LO asked his mother - an ASHA - to bring memory cards or phones of people when she made house visits so he could transfer the videos to them. He also transferred videos onto the phones of those who visited his house to consult with his mother. He gave the LO callback videos to his connections and the ASHA callback videos to those contacted by his mother. An ASHA gave videos to her son who is an LO and instructed him to share them with neighbors and relatives. She also gave the videos to an MSO and requested him to give the videos to his customers.

6.5   Barriers to Distribution

There were various barriers - of social and technical nature - that came in the way of distributing videos. Two LOs were unable to distribute videos to certain households in their village because of a feud. An LO could not invite people from lower-caste to his home. However, ASHAs and MSOs did not pay heed to caste during video distribution.

Four LOs found video dissemination non-trivial because they had to try hard to convince people to watch and store videos. Similarly, two ASHAs found it challenging to explain people the importance of watching these videos. One of them stated, *"People in villages are low-literate, it takes more time to explain them the importance of videos."* Some women had already seen the videos multiple times in mothers' groups. They were not interested in repeating the videos and asked for new ones.

Two ASHAs found it difficult to read English font on mobile phones and three found it challenging to operate Bluetooth in unfamiliar phones. Several ASHAs shared that other ASHAs were struggling to disseminate videos because either they did not own a multimedia phone or they found Bluetooth confusing. One ASHA had resorted to purchasing a multimedia device. Other ASHAs borrowed their husbands' phones as a workaround but expressed that this dependence had a negative impact on their work. For example, an ASHA (P6) shared:

> I borrow my husband's phone to transfer the videos during house visits. He always asks me to come home as soon as possible because he needs the phone. I am tense during the visits and this has compromised the time I spend in house visits. I try to finish my work early to return the phone to him.

6.6 Distribution by Intermediaries

Our interviews with intermediaries and missed callers revealed that many people were skeptical in placing a missed call and thought that MSOs or LOs would make money from these missed calls. Two missed callers thought that a missed call was a tree marketing exercise. The intermediaries had to offer detailed explanations to place these concerns at rest. As one MSO (P7) shared:

> Many people ask me "why are you asking me to give a missed call? What do you get?" I ask them to watch the video carefully and then go to the end where the doctor asks people to send a missed call. I tell them that I don't get anything and they can go to the hospital to verify with the doctor.

Most ASHAs indicated that they did not have to try too hard to convince people to place a missed call. They told their audiences that if they place a missed call more such videos could be produced. Four ASHAs and three MSOs told people that a *" missed call is a way to prove the project staff that you have seen the video."*

According to self-reported data, MSOs distributed video to six times as many people than LOs and ASHAs. However, missed calls placed on these videos were the lowest in number. MSOs appeared not to have the power to convince as ASHAs did. The project staff shared:

> One MSO gave the video to a customer and asked him to make a missed call if he likes the video. The customer said that he would watch the video but NOT make a missed call. He said that he was unsure what questions they would ask when the project staff called him back - "I do not want to be questioned..."

We asked the participants which dissemination channel they thought was most effective for video distribution. A majority believed that MSOs would be most effective simply because of the sheer number of customers who visit their shops for mobile content daily. One MSO (P8) mentioned:

> If I put the videos in the memory cards of customers, then someone will surely watch them. A person with a mobile phone goes to a shop for getting mobile content. If he won't come to my shop, he will go to another shop. If all of us start transferring the videos then he will have no option but to watch them.

However, MSOs do not enjoy quite that monopoly, given the growing presence of the LOs. A few participants believed that LOs would be the most effective distributors not only because they are young, energetic, and adept with new media, but also because they have a good reputation in the community. An LO reported, *"people owe us a lot as we transfer mobile content for free on their phones and save them the trouble to go to a mobile shop".* Many ASHAs felt that their strong ties with the community and access to the target population would allow them to lead the video distribution at the start. However, poor technology skills and access to Internet would leave them an inferior distribution channel in the long run. One ASHA (P9) reported:

> An LO in my village told me she has put the video on WhatsApp group and it has reached many people in different states. How can I compete? We can only show these videos in our village.

Four ASHAs were hopeful that they would be the most effective dissemination medium and generate the maximum number of missed calls. According to one of them (P10):

> ASHAs conduct frequent house visits. They have stronger social connections. They are social servants and want people to get more information. ASHAs have good relationships with both men and women. Years of community service make them trustworthy. People respect ASHAs and know that they do not have an ulterior motive. Thus they take videos and make a missed call.

Six participants stated that the best strategy for mobile video dissemination was to use all three channels as each had its advantages and disadvantages. Another six participants reported that peer-sharing is the future of mobile video distribution. An MSO stressed that it was impossible to distribute videos individually, however, individuals could send the videos to each other through mobile phones. It would appear from our interviews that the dissemination through MSOs maximizes distribution - particularly among a population that currently lies outside of Projecting Health's reach - while the dissemination through ASHAs maximizes viewership and feedback.

6.7 Evidence of Propagation

Since it is important for our project that people who receive videos also feel motivated to share them, we asked our missed callers and intermediaries questions regarding further propagation of the videos. Eight missed callers reported sharing videos with people outside of their family. A small farmer shared the videos via Bluetooth with his friends in

another block, asking them to place a missed call to encourage us to expand to that block as well. A new mother showed the videos on her phone to her aunt but could not transfer since her aunt's phone did not have enough free space. A pregnant woman shared that she had shown the videos to her mother-in-law and sister-in-law and shared them with four women living in the neighborhood. A female missed caller sent her son to show videos to three neighboring families. Another female missed caller gave the videos using Bluetooth to her neighbor who is a new mother. One jewelry shop owner, who received videos from an MSO, showed the videos to roughly 20 friends because one of the videos featured a popular local priest. He reported that two of his friends gave a missed call in his presence. These examples from our interviews suggest that our means of assessment of the spread of videos can be approximate at best, since the above nuances are lost in the system of callbacks.

6.8 Feedback on Videos

We asked each of our intermediaries for feedback they had received from members of the community on the videos. Although ASHAs claimed to have received only positive feedback from the mothers they had shared videos with, MSOs and LOs had more colored feedback to share. This is likely due to the close ties that ASHAs share with our primary target audience - pregnant women and new mothers. MSOs came across several (male) clients - particularly adolescents - who deleted the videos immediately because they found them uninteresting or irrelevant. Two MSOs remarked that married men had thanked them for the videos. An LO shared that people liked the videos since they carried information for the health and wellbeing of the family. Another LO reported that women and married men understood the importance of these videos and found them useful.

There was an overwhelming demand for extending the scope of the videos in particular and the project in general. Eight missed callers, seven LOs, five ASHAs and four MSOs asked us for more videos to distribute and on diverse health topics such as dengue, sanitation, pregnancy, menstrual hygiene, and birth preparedness. A new mother commented that older adults discouraged her from watching our videos, asking *"why are you glued to your mobile screen all the time?"*; she asked that we make a video to increase the awareness of older adults regarding why watching these videos is important for women like her.

Several participants offered suggestions to improve the videos. Three participants requested us to add more songs and entertainment in them. Two LOs suggested that we feature people who are popular among villagers. One of them said, *"if respected people are featured in the video then people will watch the video to see them. No one wants to listen to general people."* Another participant advocated for diversity and requested us to also feature people from the Muslim community as well as tribal people so that the videos could be made more appealing for a broader audience.

We received varied feedback on our use of the local dialect. Some participants asked for better quality of production and more refined Hindi. However, ASHAs reported that the videos were immensely popular in current form because the women could relate to the characters, scenarios, settings, and language used. One ASHA also shared that people were so much more excited about the videos created in their own villages that they never deleted these from their phones.

7. DISCUSSION

Although there exists prior work that focuses on mobile media practices of rural populations [8, 9], ours is the first to examine large-scale dissemination of mobile media in primarily offline, rural settings. Not only do we contribute an enriched understanding of the roles that different dissemination channels play in the process, we also make a methodological contribution for tracing this dissemination. Moreover, we leverage the connections we made with our missed callers to obtain community feedback. The intervention sets precedent for dissemination of educational videos produced in agriculture [4] and education domain [26] where grassroots workers and mobile media actors could be channelized to broaden the reach of educational videos.

7.1 Understanding Dissemination Channels

The number of missed calls received for videos distributed by ASHAs was significantly higher than the number of missed calls received for videos distributed by LOs who are far more technologically savvy and by MSOs who conduct mobile media transfers for commercial gain. This is despite the fact that MSOs appear to have given out the most videos. The reasons are threefold: the ASHAs have stronger ties with the women, they have come to be viewed as domain experts, and they also appear to have made more effort to stress the importance of placing missed calls. Missed calls received on the number corresponding to LOs in block 2 was also high. These LOs were successful primarily because they used a gamut of online and offline sharing strategies, expressly wanted to bring social change by disseminating the videos, and were perceived as insiders in the community with no business interest, unlike the MSOs.

Of course, only the very motivated MSOs, LOs, and ASHAs distributed the videos. Most MSOs claimed they were extremely busy during business hours and found it difficult to explain the importance of our videos or to convince their clients to watch these videos. Similarly, a majority of the LOs were busy with studies or household chores. ASHAs were also overloaded with work and household-related responsibilities. Several of these intermediary participants suggested that we provide incentives to them for distribution as well as incentives to viewers for calling, as opposed to relying on *pro bono* actions. ASHAs requested mobile phones, whereas MSOs and LOs requested financial incentives in return for more focused distribution and diary logs. Though incentives do seem necessary and fitting in return for the work that we requested, there is a down side to them as well, which we had considered before the start of our experiment. Apart from administrative overheads, it would have been challenging but crucial to watch out for freeloaders. Further, there was a common perception that the state might disapprove of disturbing their healthcare system by introducing incentives - for ASHAs in particular.

7.2 Effectiveness of Video Tracking Process

There were a host of benefits and challenges associated with our process of using missed calls and callbacks. Our tracking scheme was as much an intervention as a design probe, since it not only gave a platform for community members to voice their feedback, it also facilitated wider dissemination of our content. Though we recommend it for other ICTD initiatives interested in either tracing the spread of information or collecting community feedback, we also de-

scribe the problems that our target users had with it. Some participants reported that they wanted to place a missed call but were unable to remember the number shown in the video and needed another phone to place the call. Many were skeptical about placing missed calls to unknown parties (us). Some did not like the videos enough to call or were skeptical of speaking to a stranger and unsure about the questions they would be asked. Moreover, several women participants did own a phone but were unable to place a missed call as they had no balance on their SIM cards; their phones were used for incoming calls alone[2]. There may have been still more reasons for not calling that we did not get to hear. Not all our sources of dissemination were consistent in distributing videos through our study, not all our audience members were consistent in reporting the videos they had seen, and nor can we assume that if they called, it was because they had actually seen any portion of any video.

Our video tracking technique based on missed calls was ill-equipped to capture offline video sharing network. Our ideal scenario would have been to attain a complete and accurate mapping of the movement of videos across the areas of our study. Though it is possible to design a tracking scheme using IVR technology to map the sharing network, this would have added cost and complexity for users. Designing a more sophisticated IVR intervention and experimenting with financial incentives to motivate participants to report video sharing activities will be a key focus moving forward. Embracing the many irregularities in the data we collected, we believe nonetheless that our study has been significant in giving us an approximate idea of the reach of our videos, their geographical spread, who is watching (and that it isn't just the mothers), and modes of sharing.

7.3 Sustainability and Scalability

One limitation of our work is the short duration of tracking video distribution using missed calls and callbacks. Although many participants shared these videos for the welfare of community, even in the short duration, their initial enthusiasm dampened either because of efforts in convincing people to watch and share these videos or because the novelty effect of videos wore off. We purposely stopped follow-up with participants and missed callers at the end of eighth week and found that the number of missed calls dropped significantly. This accentuates not only the need to set up regular follow-up with participants for boosting their morale, but also to explore alternative schemes to keep them extrinsically motivated. For investigating long term sustainability, it would be beneficial to deploy the intervention over a longer period of time to ascertain whether participants continue to transfer videos, what extrinsic motivations improve video distribution and reporting, is there a need to identify new actors (e.g. low-skilled medical practitioners, midwives, postman) for distributing videos, and what operational and scalability issues arise in the long run.

7.4 Community Feedback

The hyper-local content in our videos certainly has value. It attracts local villagers to watch the videos, creates a sense of ownership among them, and is particularly favored by members of the cast who are then recognized by others from the part they played in the film, as discussed in [10]. How-

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[2]Incoming calls are free in India.

ever, this does not imply that there would not *also* be an audience for more 'universalized' content. Our study revealed, in fact, that there *is* just such an audience. Though ASHAs reported that, in their assessment, audiences preferred the hyperlocality of our videos since it made them easier to connect with, other participants claimed that there might be greater interest in the videos if the production quality was improved or if we featured seasoned actors and the Hindi was more refined (not a local dialect). The missed calls received from individuals outside the purview of our project indicate that our videos successfully managed to transcend geographical boundaries, thanks to physical movement as well as some online transfers via social media. These are the key observations that demonstrate that linguistic and cultural boundaries and limitations are more fluid than we thought at first. What then, we must question, is the value of hyperlocal? Could we, or should we, sacrifice hyperlocality in the interest of scaling up our project? This will be a key focus moving forward.

8. CONCLUSION

With this paper, we contributed the first study of mobile media dissemination in a low-resource environment. We shed light on the roles played by key intermediaries - mobile shop owners, laptop owners, and ASHAs - in enabling this dissemination. We also made a methodological contribution by implementing a simple video tracking mechanism of missed calls and callbacks, offering a platform for members of the community to provide inputs and feedback.

9. ACKNOWLEDGEMENTS

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