Telemedicine Provision Centers and Reproductive Age Women, Rural Uttar Pradesh, India

by

Terrence Quock-Kit Lo

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Committee:

Professor Michael Jerrett (Co-Chair)
Professor Julia Walsh (Co-Chair)
Professor Malcolm Potts
Professor Jenna Burrell

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Abstract

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From November 2008, World Health Partners (WHP), a New Delhi based non-governmental organization, began establishing telemedicine provision centers (TPCs) in rural areas of three districts in northwestern Uttar Pradesh, India. Communities in rural Uttar Pradesh, the most populous state in India with nearly 200 million people, lack access to qualified medical physicians and have a large unmet need for family planning. Through a live streaming audio/video Internet connection, rural communities were able to consult with qualified physicians located elsewhere in India. This large “pilot” project of 116 TPCs provided health services to 1293 villages with an estimated population in excess of 6 million. TPCs were specifically marketed to reproductive age women with the goal of increasing their access to healthcare and family planning. The TPCs were also established as social franchises. These telemedicine franchises generated revenue for their entrepreneurs in the form of consultation fees and drug sales, and in return, they had to provide family planning products and services in their rural communities.

From April 2009-December 2010, 28,970 telemedicine consultations occurred with a mean of 19.7 (s.d. = 20.3) per 30 days of TPC operation. The telemedicine consultations, however, rapidly decreased after the start dates of the TPCs either due to the actions of the rural entrepreneur or decreased patient demand for telemedicine services. Despite the decrease in consultations, TPC entrepreneurs still fulfilled their family planning obligations. Overall, from the family planning services and products sold, the couple years of protection (CYP) was 288,119 (MSI/DKT calculations) which corresponded to a cost per CYP at USD$5.84.

Spatial analyses demonstrate that the 90% catchment area for TPCs for reproductive age women was approximately 4.9 kms. Location-allocation models in Bijnor district comparing an optimal configuration of TPCs to their actual resulted in a locational efficiency of 0.84. Twenty additional TPCs would be needed to achieve a population weighted mean distance equal to the catchment distance for women. Semi-structured qualitative interviews with reproductive age women indicated that while acceptable, telemedicine was being tested by women, and it provoked feelings of fear of how to communicate through the computer as well as how to interact with the doctors. Ultimately, it was judged by its ability to provide relief since these women needed to be healthy to fulfill their household and family responsibilities.
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Introduction

India has an estimated population in excess of 1.2 billion people (Government of India 2011) and is expected to be the most populous country by 2030 (United Nations Population Division 2006). Providing essential healthcare services to its sizable population base remains a high priority for India despite its recent rapid economic growth (Patil, Somasundaram et al. 2002; Bagchi 2008). A critical shortage of medical personnel has resulted in a ratio of people to western-trained physicians of 1,634 to 1 in 2006 (World Health Organization 2006; Neelakantan 2008). In addition to healthcare worker shortages, other healthcare issues include addressing access barriers to medical facilities and to public health services such as family planning.

The lack of adequate healthcare services is particularly acute in rural communities in which nearly three-fourths of the Indian population resides (Govt. of India (b) 2007). Although 27,000 allopathic doctors in India are trained annually, less than 25% work in rural areas providing medical care to 72% of the population or 716 million people (Patil, Somasundaram et al. 2002; Bagchi 2008). Overall, only 0.9% of India’s GDP is devoted towards investing in public health resources (Patil, Somasundaram et al. 2002). In the Indian rural public healthcare sector, physician absenteeism is a major problem as doctors assigned to rural areas do not report for duty (Chaudhury and Hammer 2003; Neelakantan 2008). Furthermore, only 20% of all public facilities provide services to the rural population. Professional isolation, a lack of cultural opportunities and development, and a dispersed, impoverished patient population have all been cited as reasons for a lack of physicians living and practicing in rural India (Radwan 2005; Bagchi 2008).

In addition to an uneven distribution of healthcare resources, there are also issues with healthcare quality in rural India. While 80% of rural health services are provided by the private sector, there is a wide range in private medical practitioner training and skills many of whom are outside the formal healthcare sector (Banerjee, Deaton et al. 2004). Furthermore, private practitioners focus less on preventative services such as family planning which are not as economically attractive as curative services. Overall, the unmet family planning need for rural India is 14.6% among married women of reproductive age (Govt. of India (b) 2007).

Advancements in information and communication technology, however, make the remote delivery of quality health services to a rural population a possibility. Through “teleconsultation,” or the broader more commonly used term “telemedicine,” remote patients can consult with medical personnel via an Internet connection. Telemedicine seeks to address healthcare inequities by serving as a local medical resource for rural communities.

Telemedicine definition

Telemedicine has been previously defined as “tools that enable the communication and sharing of medical information in electronic form” (Bagayoko, Müller et al. 2006) and the practice of medicine from a distance (Jaatinen, Forsstrom et al. 2002). Furthermore, telemedicine
is a process and not a technology onto itself (Wootton 1996). Past usage of the term “telemedicine” has broadly referred to medical consultations via telephone or email (Cooke and Holmes 2000; Vassallo, Hoque et al. 2001; Graham, Zimmerman et al. 2003), the monitoring of the treatment and health status of patients (Lucas 2008), the transfer of radiologic images for interpretation (Wootton 1996; Zhao, Nakajima et al. 2002), remote medical education (Geissbuhler, Bagayoko et al. 2007), and the examination of pathological specimens (Baruah 2005). Current usage of the term “telemedicine,” however, refers to the real-time audio/video consultations for healthcare via the Internet (Hudson 2005). It is this definition that will be used throughout this dissertation.

**Telemedicine use in rural areas and in India**

Telemedicine has been proposed as a solution to address the inequities of rural healthcare access in both developed (Whitten and Adams 2003; Hudson 2005; Smith, Bensink et al. 2005) and developing countries alike (Martinez, Villarroel et al. 2004). The proposed advantages of utilizing telemedicine in developing countries for clinical purposes has involved its ability to overcome geographic distance to general and specialized medical providers, lower costs in comparison to building physical healthcare infrastructure, and the reduction of time in seeking healthcare consultation; all of which purportedly provide cheaper and better quality healthcare to rural patients who have limited options (Singh 2005; Wootton 2008). In India specifically, implemented telemedicine projects have ranged from being utilized for the purposes of outbreak detection, medical disaster response, primary care, and specialty care purposes, such as ophthalmology, dermatology, neurology, pathology, and diabetes management (Ganapathy 2002; Ayyagari, Bhargava et al. 2003; Baruah 2005; Bagchi 2006; Bai, Murali et al. 2007; Bali and Singh 2007; Chronaki, Berthier et al. 2007).

**Telemedicine for healthcare consultations in developing countries**

A telemedicine review in 2002 determined that nearly 90% of telemedicine consultations have been interactions for second opinions between physicians or other medical personnel rather than for direct patient-physician consultations (Jaatinen, Forsstrom et al. 2002). These consultations between healthcare providers have been through a store-and-forward model of telemedicine. Scarce reports of telemedicine projects have reported direct patient-physician consultations in developing countries such as the model of World Health Partners. Direct telemedicine patient-provider consultations have been reported in Mali for neurology and oncology patients and specialists through the Reseau Afrique Francophone de Telemedecine (RAFT) project (Geissbuhler, Ly et al. 2003; Bagayoko, Müller et al. 2006), but no assessments have been published to date. In India specifically, in addition to the Apollo telemedicine report in Chennai, other patient-physician telemedicine consultations have been reported by Aravind’s
telemedicine network of local vision centers for ophthalmology in the state of Tamil Nadu (Surana, Patra et al. 2008) and the use of mobile phones for community consultations in rural Haryana (Bali and Singh 2007). Limited assessments on these specific projects in India have been published, although Bali et al. found that 91% of the 387 mobile phone patients who were interviewed found the advice helpful and 78% followed the advice which was given (Bali and Singh 2007).

Virtually no reports have been published on the use of telemedicine for primary care consultations or family planning in developing countries. Cone et al. describe a primary care telemedicine system established in rural Ecuador for referral consultations among health providers that mostly involved ultrasounds (Cone, Hummel et al. 2007). In Peru, email and radio communications between health personnel for patients at rural health posts were found to have 96.7% of inquiries satisfactorily answered (Martinez, Villarroel et al. 2004). A web-based project has reported the use of telemedicine for delivering family planning services (Gomperts, Jelinska et al. 2008). Specifically, the Women on the Web group permits telemedicine consultations with a physician for the termination of pregnancies using Misoprostol or Mifepristone for women living in countries with barriers to accessing safe abortion services.

To date, no publications were found of any population-based formal impact evaluations of telemedicine projects. Wootton et al. report through case study methodology that store-and-forward telemedicine was beneficial to assisting in patient diagnosis and overall patient outcomes in Papua New Guinea (Wootton, Menzies et al. 2009). No reports or publications, however, have addressed the implementation of telemedicine as a social franchise healthcare resource. Furthermore, there is no published literature on the factors for patients utilizing telemedicine for primary care or for family planning consultations.

While past projects with telemedicine have documented difficulties with functioning equipment and systems for telemedicine, published reports of user experiences are non-existent for telemedicine consultations in rural areas of a developing country. This project also differs from past telemedicine projects in its use of synchronous telemedicine for primary care and family planning and in its scale as a stand-alone healthcare resource for direct patient-provider consultations. In addition, rural Indian women of reproductive ages were a specific target population for this project. They are a population in critical need of health services and family planning and face the largest barriers to access to both which this project seeks to address. Therefore, it is the purpose of this dissertation to provide a descriptive and spatial analyses of this telemedicine and family planning social franchise project with a particular emphasis on the experiences of reproductive age women.
Paper 1: Delivering Primary Care and Family Planning Services through Telemedicine Social Franchises in Rural Uttar Pradesh, India

Objective:

The purpose of this paper is to describe and present descriptive statistics of a telemedicine and family planning social franchising project in rural Uttar Pradesh, India.

Key Points:

1. Telemedicine and social franchises involving rural entrepreneurs and other village workers can be networked and leveraged to provide locally available health care and family planning on scale in rural Uttar Pradesh. These increased access to services for residents, particularly for rural women of reproductive ages.

2. Telemedicine consultations rapidly decreased after the start of the center either due to the actions of the rural entrepreneur or decreased patient demand for telemedicine services. Quality and impact of services difficult to assess without a baseline assessment and patient follow-up surveys.

3. Financial profit may not be the only incentive for rural entrepreneurs to participate in a branded social franchise- increased community prestige may be another factor.

Introduction:

India, with an estimated population in excess of a billion people, has a substantial shortage of trained medical personnel to meet the health care needs of its people. A workforce evaluation estimated a ratio of 3.8 allopathic doctors per 10,000 population, nearly a fourth of what is recommended by WHO (Rao, Bhatnagar et al. 2009). Despite having three-fourths of the population residing in rural areas, medical resources are also disproportionately concentrated in urban centers (Balarajan, Selvaraj et al. 2011): less than 25% of newly trained allopathic physicians choose to practice in rural environments (Patil, Somasundaram et al. 2002; Bagchi 2008). Health worker absenteeism is also a frequent occurrence. Women physicians are underrepresented; only 17% of all MBBS doctors overall and 6% in rural areas are female which impacts the availability of health services provided to rural women (Rao, Bhatnagar et al. 2009).

In addition to healthcare worker shortages, other substantial barriers for rural residents to access essential health services include the shortages of medicines and medical products, and the long travel distances to facilities. In India’s tiered system of government health care, MBBS (Bachelor of Medicine and Bachelor of Surgery) physicians are available in rural areas through primary health centers (PHCs) and community health centers (CHCs). One PHC is to provide services to 30,000 people and a CHC to 120,000 and has specialists (Ministry of Health and Family Welfare (a) 2009). Their spatial distributions, however, have been found to be inadequate
relative to rural populations in need of health services (Kumar 2004), and substantial shortfalls overall exist to meet their facility to population ratios (Ministry of Health and Family Welfare 2009). Both factors contribute to lengthy travel times to public facilities. Rural Indian women in particular are sensitive to these distances because of cultural norms (i.e., “purdah”) that dictate that they should not travel alone and must remain near their households (Vissandjée, Barlow et al. 1997). In addition, the poorest, who often suffer from higher levels of morbidity, are less likely to be recipients of government services (Balarajan, Selvaraj et al. 2011).

Instead approximately 80% of health care is through an immense locally-based private sector which largely consists of unregulated rural health providers (RHPs) that have a wide range in medical training and backgrounds (Rohde and Viswanathan 1995; Banerjee, Deaton et al. 2004; Rao, Bhatnagar et al. 2009). RHPs include traditional healers, and practitioners of ayurvedic, allopathic, or a hybrid of multiple medical systems. These for-profit rural private providers will focus on the more lucrative curative services rather than preventive services that are not as commercially viable.

Health franchising, however, has emerged as a promising model in an attempt to engage the private sector for the delivery of health services that have been viewed as the responsibility of the public sector (Montagu 2002; Prata, Montagu et al. 2005). By offering private entrepreneurs a profit incentive for providing and marketing health services or products identified by a franchisor, a distribution and network system can be organized in areas where populations have been underserved. As of 2009, 36 health franchising programs globally have been implemented that deliver family planning to clients, but only the Gold Star Network in Kenya and Sehat First in Pakistan have also involved telemedicine (Schlein, Kinlaw et al. 2010).

With the recent advancements in information and communication technologies, the remote delivery of health services to rural populations is possible. Through “teleconsultations,” or the more commonly used term “telemedicine,” remote patients can consult with medical personnel via a live audio and video streaming Internet connection over some distance. Telemedicine has been previously utilized to address health care needs to underserved rural populations in developing countries (Wootton and Bonnardot 2010). The potential of a health franchising delivery model with telemedicine to deliver healthcare and family planning to a rural population in a developing country, however, has yet to be fully explored particularly on a large scale. This is a report of the experiences of a large “pilot” project covering over 6 million people that utilizes a telemedicine social franchise model to deliver healthcare and family planning in three districts in rural western Uttar Pradesh, India.

Setting:

The healthcare shortages and inequities in India are reflected in its most populous state of Uttar Pradesh (UP). In addition to having a projected population exceeding 190 million with nearly 80% being rural (Census of India 2001), Uttar Pradesh is also one of the poorest with rankings at or near the bottom of state development indicators. Current population growth estimates predict India to become the most populous country by 2025 (U.S. Census Bureau 2009) which will be driven by states such as UP. Government medical facilities are unable to meet the demands of UP’s sizable rural population. Only 15% of rural UP households reported seeking care from public facilities, and the main reasons for their inadequacy were their
perceived poor quality (53.0%) and distance to services (47.8%) (National Family Health Survey 2005; International Institute for Population Sciences (IIPS) and Macro International (c) 2008).

In addition to facing a shortage of healthcare services, UP rural communities have a high unmet need for family planning services— a need that must be addressed to prevent their unsustainable population growth. Unmet need is defined as married women of reproductive ages (15-49 years) expressing a desire not to become pregnant but not currently using contraception. In rural UP, the unmet need for family planning was 23.1%, higher than the 12.8% for rural India overall and higher than the 15.1% for urban UP (International Institute for Population Sciences (IIPS) and Macro International (a) 2008; International Institute for Population Sciences (IIPS) and Macro International (b) 2008). Knowledge of family planning methods does not appear to be a barrier as 99.5% of married rural women knew of at least one modern method (International Institute for Population Sciences (IIPS) and Macro International 2008). No source of family planning was known by 28.6% of rural UP women with an unmet need which may indicate issues of supply, distribution, and access. In addition, government facilities were overwhelmingly the first source of family planning for current users (94.2%) and are the main source for non-users with unmet family planning needs (66.3%) (International Institute for Population Sciences (IIPS) and Macro International (c) 2008). With known problems accessing PHC/CHCs for general healthcare, physical accessibility to family planning at public facilities is a certainty.

In rural UP, 58.1% of women could not attend a health facility alone and 73.0% could not travel outside their home village unaccompanied (National Family Health Survey 2005). Issues of distance (64.0%) and transportation (59.0%) to facilities were the top barriers to seeking healthcare for themselves which indicate a need for local services. This telemedicine and social franchising pilot project seeks to increase access to healthcare and family planning in rural Uttar Pradesh.

**District profiles**

Meerut, Bijnor, and Muzaffarnagar are adjacent districts in north-western Uttar Pradesh, the most populous state in India (Figure 1). Together, these districts cover an area of 11,164 km² and have a total population in excess of 10.3 million according to the 2001 Census of India. Despite being predominately rural, these densely populated districts correspond to a density of 927 persons per square kilometer. The ratio of PHCs per 30,000 rural population (based upon the 2001 Census of India) was 0.8. Only 4 of the 32 PHCs in the districts reportedly had female physicians as of 2007 (International Institute for Population Sciences (IIPS) and Ministry of Health and Family Welfare (MHFW) 2008). The rural unmet family planning needs were 25.3% in Meerut, 35.7% in Muzaffarnagar, and 38.5% in Bijnor (International Institute for Population Sciences (IIPS) and Ministry of Health and Family Welfare (MHFW) 2008)- all higher than rural UP overall.

**Program Description:**

For this pilot project in rural UP, WHP was funded solely to increase the provision of family planning in these areas. WHP’s goal, however, was to increase access to both healthcare
and family planning services. Telemedicine would be a means to attract potential family planning clients as well as to incentivize RHPs and other network affiliates to provide family planning. By doing so, the costs of providing a network of family planning services would be cross-subsidized in contrast to a strictly vertical family planning program. As a component in a social franchise model, telemedicine would be used to leverage the available resources into a rural network addressing both acute healthcare and family planning needs on scale.

**Telemedicine Provision Centers (TPCs)**

From November 2008, World Health Partners (WHP) implemented a pilot project of 116 telemedicine sites in Meerut, Bijnor, and Muzaffarnagar districts on a rolling basis. Through a streaming audio/video Internet connection, Indian allopathic physicians at centralized facilities in New Delhi and Patna consulted with patients at rural village-based Telemedicine Provision Centers (TPCs or “Sky Health Centers,” Figure 2) through proprietary ReMeDi software and peripheral equipment (Neurosynaptic 2008). Each TPC had basic diagnostic capabilities that were digitally transmitted through the telemedicine system (Figure 3). These included a thermometer, electrocardiogram, blood pressure cuff, stethoscope, with ultrasound a future possibility. WHP directly contracted with manufacturers to supply and brand commonly prescribed medications, oral contraception, and medical abortion to ensure their quality, control their costs, and ensure their availability in the project areas. For needed in-person examinations or medical procedures, patients were referred to a partner “franchise clinic” in a nearby town (Figure 2).

TPCs were franchised by WHP to local village entrepreneurs who were either existing RHPs or married to a RHP with an exception of 9 auxiliary nurse midwives (ANMs), Government of India rural workers trained for maternal and child health care (Table 1). In the project area, these represented the ANMs available and willing to become entrepreneurs. Criteria for TPC locations included those that were near a major road for access to larger towns for supplies and those that served as a central village for nearby catchment villages. TPCs were spaced according to an assumed service area of 10 kms, but some catchment villages overlapped among TPCs to stimulate competition for patients. TPCs formed partnerships with surrounding RHPs in these catchment villages (“Sky Care,” Figure 2) to provide patient referrals for telemedicine consultations for 10Rs (approximately USD$0.22). These partnerships also formed an on-the-ground network for WHP family planning project activities and the selling of family planning products. Overall, the project area villages had a total population of 7.5 million based on self-report from local village leaders.

TPC franchises were established for a buy-in fee that included a computer, printer, promotional marketing, furniture, Internet connectivity, telemedicine equipment, maintenance, and training. Promotional material and events in the project villages included branded signs and posters, vehicular loudspeaker announcements, and village shows of Bollywood movies interspersed with WHP commercials and messages. Training sessions for entrepreneurs included how to use the computer and telemedicine equipment, health education, family planning, phlebotomy, and TPC management and entrepreneurship. To promote female entrepreneurship and consultations by rural women, all franchises were female owned, and female entrepreneurs were available for all trainings and telemedicine consultations with female patients.
The initial franchise fees were 25,000/40,000Rs (approximately USD$555/888) for rural/semi-rural locations with an additional 20,000Rs loan that is to be repaid back between years 3-5 of operation. TPC entrepreneurs received 10Rs from every 50Rs (USD$1.11) patient consultation fee. For families with Government of India-issued below poverty line (BPL) cards, patient consultation fees were 10Rs for pink (poorest) and 30Rs for white (poor) card holders (TPCs still received 10Rs for telemedicine consultations by BPL patients). Additional revenue streams included the selling of WHP branded pharmaceuticals and family planning products, charging client fees for family planning services, receiving referral payments from higher order healthcare services, and for a few computer-savvy entrepreneurs, offering additional computer related services (i.e., selling of Internet railway tickets and photographs). TPC entrepreneurs purchased IUDs at 35Rs from WHP but were allowed to set their own prices for insertions by ANMs. TPCs reportedly charged patients on average 150-200Rs before a payment of 500Rs per day to an associated ANM for performing the insertions.

To further develop a field presence and strengthen referrals for family planning, pilot partnerships in May 2010 were developed with 30 accredited social health activists (ASHAs or village health workers) to offer family planning counseling and door-to-door mobile phone telemedicine consultations in 17 villages. ASHAs charged 50Rs per consultation with MBBS doctors. Other sources of revenue for ASHAs included being paid referral fees for villagers who consult via the computer telemedicine system and for patients who adopt family planning. WHP utilized ASHAs as a field resource to identify potential clients for family planning as well as serve as a family planning contact for rural women and received training from WHP on these areas.

**Family Planning Products and Services**

As a non-conditional agreement of being a telemedicine franchise, TPC entrepreneurs committed to achieving family planning targets and organizing monthly family planning events beginning in November 2008. Financial incentives were offered for the top TPCs surpassing their family planning goals as well as the possibility of purchasing pharmaceuticals and family planning products at reduced costs. Overall program family planning targets were established based on the population of the project villages, the unmet family planning need, and the likelihood of family planning method adoption. TPC entrepreneurs unable or unwilling to meet the family planning targets received warning letters, and continued non-performance led to franchise closure. Closed TPCs were typically replaced by another entrepreneur nearby to maintain the continuity of services.

All appropriate telemedicine patients were counseled on family planning options by WHP providers, and those who indicated a desire for contraception were “tagged” for follow-up by TPC entrepreneurs. Patients could purchase condoms, oral contraception, emergency contraception, or medical abortion (with telemedicine consultations with MBBS doctors included in the purchase cost of medical abortion) or be given contraceptive injections at TPCs who maintained a supply of these family planning products. TPCs in turn, distributed a supply of family planning products among their associated referral rural health providers in surrounding catchment villages. Franchise clinics (FC) in nearby towns also offered all family planning options including surgical abortion. TPC entrepreneurs, referral RHPs in surrounding catchment villages, and ASHAs served as local resources for family planning referrals and addressing
concerns or questions on family planning methods. Patients could also consult with MBBS doctors through the telemedicine system for problems related to family planning.

TPC entrepreneurs identified village locations, sterilized equipment, and organized patients for monthly IUD insertion transit clinics in conjunction with an associated ANM who performed the procedures. Periodic village-based sterilization clinics were also coordinated by TPCs with their associated FCs. All network providers who referred patients for family planning services at the transit clinics and at FCs in town were paid a referral fee. This referral fee was typically 10Rs per patient but was considered to be negotiable within the domain of an entrepreneurship and not fixed by WHP. All TPC family planning activities were randomly surveyed by WHP monitoring and evaluation members for quality of services.

WHP has established linkages with the Government of India on various aspects of family planning provision. Currently, WHP participates in the Government of India’s contraception social marketing program to purchase IUDs and oral contraception pills at subsidized prices. WHP has also submitted an application for expedited processing of family planning reimbursements, a government program to incentivize the provision of family planning by healthcare providers. In addition, the Government of India employed auxiliary nurse midwives insert IUDs at monthly clinics organized and paid by TPC entrepreneurs. These ANMs supplemented their government salaries through these additional insertions, and every TPC franchise was associated with an ANM.

Sources of data:

The results presented in this article draw on numerous sources of project data that are outlined below.

1. *ReMeDi electronic medical records*- telemedicine patient data that captured basic demographic and consultation details

2. *Client satisfaction survey (CSS)*- a convenience survey of 939 patients (representing 38.4% of those consulting from April through September 2009) probed on household demographic data, health seeking behaviors, and perceived quality of care

3. *Family planning sales*- data on the sales of family planning products from WHP to network providers

4. *Family planning services*- data on the family planning procedures performed by network providers. From the second half of 2010, line-listed patient data was reported to WHP for IUD insertions at monthly insertion clinics

5. *WHP financial records*- programmatic costs and revenue data maintained by WHP and used in couples year of protection (CYP) calculations

6. *Village surveys*- GPS spatial and village demographic and travel data collected for project area villages from 1/10-5/10
7. Qualitative patient interviews- semi-structured interviews of 22 reproductive age female patients from 3/10-7/10 on their experiences at telemedicine centers, expectations of good healthcare, and health seeking behavior

Discussion and Evaluation:

Telemedicine consultations

As of December 2010, 100 TPCs in the project area were in operation and included a network of 1046 RHPs and 30 ASHAs (Table 1). Data pertaining to patient consultations are presented from April 2009 through December 2010 due to consultation fees not being fixed at 50Rs prior to this time. During this period, 28,970 telemedicine consultations were conducted with a mean of 19.1 (s.d.=20.3) consultations per 30 days of TPC operation. A wide variation in the number of telemedicine consultations occurred among TPCs due to the entrepreneurs experiencing a learning curve of the telemedicine system, technical difficulties (i.e., malfunctioning equipment/software), a lack of electricity or Internet, and project disinterest. From April 2009 through December 2010, 16 TPCs were eliminated from the network for non-performance or non-interest in the project.

Figure 4 shows that the mean number of telemedicine consultations (per 30 day intervals) has steadily decreased from the start date of patient consultations at TPCs. It is unclear if this downward trend was due to the actions of TPC entrepreneurs or from an actual decrease in patient demand. From patient interviews, TPC entrepreneurs had significant influence over who consults via the telemedicine system. As rural health providers, they also consulted with patients and telemedicine served both as a means to attract patients as well as a potential competitor for services. Based on interviews with TPC entrepreneurs, reasons for these decreases widely varied and included the expenses incurred when operating a generator when electricity was unavailable, reputation of telemedicine services in the community, length of consultation times, patient demands for additional facilities (i.e., x-ray capabilities) to be available, and overall low profit margins on telemedicine consultation fees. With the exception of one, regular client satisfaction surveys were not conducted in the project areas making an assessment of any changes in patient and community satisfaction impossible. Despite the decreases in telemedicine consultations, the overwhelming majority of entrepreneurs indicated that they broke even financially with their investment and still remained committed to the project.

Table 2 shows that among the 28,980 telemedicine consultations, the majority were among those above 45 years of age (34.7%), female (57.3%) compared with the rural areas in the districts being 46.8% female (Census of India 2001). Nearly two-thirds of clients were from families who owned their own land and only 2.3% held a BPL card. However, the client satisfaction survey (CSS) found that 32.4% of clients came from the lowest 2 wealth index quintiles (standardized to the 2006 National Family Health survey for rural Uttar Pradesh) and 41.2% were illiterate. Although consultation fees were fixed at 50Rs (or less for BPL card holders), this survey indicated substantially higher out-of-pocket expenses. On average, these patients reported spending 172Rs for medications alone.

Overall, the most common diagnoses were for gastrointestinal issues (25.2%), respiratory infections (17.7%), muscular-skeletal issues (12.7%) and neurological/psychiatric illnesses
(9.2%). WHP marketing efforts geared towards rural women and the local availability of services were successful in drawing RA women to services as 36.3% \((n=10,507)\) of all consultations were specifically among married women of reproductive ages (15-49 years). Among these women specifically, 64.2% consulted with a female physician with 24.7% having gynecological/reproductive health issues and 5.2% being pregnant or having pregnancy related complications. Less than 17% of patients who consulted at TPCs were from referrals from catchment area RHPs or ASHAs indicating a weak patient referral network for consultations. Interviews with entrepreneurs have indicated that the 10Rs referral fee was an insufficient profit motivation. However, spatial analyses of the actual patient catchment areas of the TPCs indicate that lengthy travel distances to facilities may have limited their ability to attract patients from surrounding villages.

**TPC spatial locations and catchment areas**

From the project area villages, TPCs were geographically situated closer than the nearest government medical facilities with an allopathic doctor. Based on Euclidian (“straight line”) distances, Table 3 shows that project area villages were on average 5.4 kms to the nearest PHCs/CHCs with self-reported travel times of 31.0 minutes. The nearest district hospitals were 27.9 kms and 100.8 minutes away from project area villages. In the surrounding catchment area villages, the distances and travel times were shorter and the transportation costs were less to their nearest TPCs than to their nearest government PHC/CHC (both \(p<.0001\)).

The actual 90% catchment area for TPCs was 5.2 kms, a much shorter service area than the 10 kms initially assumed when WHP located villages for TPC placement. This is consistent with past reported catchment distances for rural government facilities (Rohde and Viswanathan 1995). For women of reproductive ages, the 90% catchment area was shorter than that for men at 4.6 kms. Overall for the 83% \((n=24,053)\) village locations that could be mapped, 49.7% of patients came from the same village as the TPC, 31.0% were from within a TPCs set of catchment villages, and 15.4% were from another TPCs set of catchment villages, indicating that competition had occurred among them for patients. Greater than a third of patients attending TPCs reported walking as their primary mode of transportation, and the CSS indicated that patients traveled on average for 13 minutes to a TPC.

**Experience of RA women at TPCs**

As a critical population for family planning, TPCs were specifically marketed to reproductive aged women. In conservative rural India, TPCs had to function as an appropriate health resource for rural women in order to facilitate the provision of family planning. Qualitative in-depth interviews with 22 RA female clients, indicated that the women initially felt fear and apprehension prior to telemedicine consultations. They expressed an uncertainty of how to speak to a physician through a computer and what a “city” doctor might say during their consultations. Prescribed medication effectiveness and physician bedside manner were both major factors in their determination of the quality of services received. The main factor, however, was if they experienced relief or not. In addition to seeking long term medical relief (“cure from the root”), RA women wanted to be healthy to be able to perform their household responsibilities. During telemedicine consultations, TPC entrepreneurs served a major role in
using telemedicine diagnostic equipment and procedures, facilitating communication between MBBS doctors and rural patients, as well as in patient follow-up for prescribed medications, laboratory tests, and/or referral.

*Family planning*

The overall distribution of family planning products and services in the project area was successful. With the exception of Depo-Provera injections (in limited supply from the Government of India until mid-2009) and oral contraceptives (in limited supply in the second half of 2010), Table 4 shows that the number of family planning products sold and services conducted all exceeded the programs’ targets. Intra-uterine devices were heavily promoted by WHP and were the second to female sterilizations as the most common long-term contraceptive method adopted. Overall, the transit clinics organized by TPCs accounted for 81.6% of female sterilizations, 77.8% of IUD insertions and 70.6% of DMPA injections. These percentages are an underestimation since patient referrals to the associated franchise clinics for family planning could not be tracked and included.

Using district rural demographic percentages from the 2001 Census of India and unmet need estimates from the 2007-2008 District Household Surveys, an estimated 806,521 women with unmet need resided in the project area villages. At a theoretical ideal, family planning services would have reached 4.5% of these women. The actual percentage is undoubtedly smaller, but without a project area and a comparison group population-based baseline and follow-up estimates, however, it is impossible to determine how many WHP family planning clients would have obtained family planning services elsewhere if the program did not exist. From November 2008 through December 2010, the couple years of protection (CYP) was 288,119 (MSI/DKT calculation) with the cost per CYP at USD$5.84 (USD$7.87 for non-reoccurring costs over 5 years).

As a local resource for family planning, TPCs facilitated the ease for some rural women to access modern family planning. Among 3,379 IUD patients in the second half of 2010, nearly half indicated that they were “secretive” meaning that they withheld knowledge of their IUD insertions from either their in-laws or from their husbands. Follow-up with these patients proved extremely difficult as the women could not risk their confidentiality being violated by strangers interviewing them within their households, and they were unable to be interviewed at neutral locations without arousing suspicions. Limited feedback from these secretive clients and from the ASHAs and TPC entrepreneurs have indicated that they could not travel beyond their own villages and would not otherwise been able to obtain family planning services. They sought family planning services at TPCs under the guise of general “women’s healthcare.” More detailed exploration of these secretive family planning clients are currently in progress.

Despite the decreasing telemedicine consultations, TPCs continued meeting their family responsibilities. Figure 5 shows the mean number of IUD insertions versus the mean number of consultations for TPCs per 30 days. In a social franchising model, a decrease in the revenue generated from the telemedicine consultations and drug sales in theory would result in a lower motivation for TPCs to conduct family planning activities. Figure 5 demonstrates this relationship between telemedicine consultations and family planning activities did not hold true. TPCs continued to organize IUD transit clinics despite them being the most labor intensive since they required the monthly organization of patients in coordination with ANMs. Upon closer
examination, the willingness of TPCs to perform their family planning franchise obligations was not at complete odds with their profit motivations. TPCs could profit from IUD insertions. Using the estimated IUD purchasing costs and fees, approximately 3 IUD insertions per month would be needed for TPCs to break even. Approximately half of TPCs averaged greater than that. During interviews, TPC entrepreneurs also indicated that financial gain was not their only benefit from being a franchise. Other reasons included an increase in community prestige and awareness by being associated with a large organization, being associated with modernity and progress because of the use of new computer technologies, and having the opportunity to observe patient consultations with qualified MBBS physicians. To what extent these factors are capable of motivating rural health providers to fulfill their social franchising responsibilities remains to be explored.

**Evaluation needs**

While this project was funded solely as a family planning project, telemedicine within a social franchise model was used to develop a network to deliver both family planning and healthcare services utilizing existing resources. Limitations, however, existed to prevent a rigorous impact evaluation of this project goal. Although the TPCs, ASHAs, and catchment RHPs identified and counseled appropriate patients who expressed an interest in family planning, formal data systems were not in place to track network referrals for family planning—these were independent financial transactions between a TPC franchise and their associated referral partners with no involvement by WHP. As private entrepreneurs, TPCs were expected to develop their franchises and meet their family planning targets. As a result, routine data collection by TPCs overall was limited given that entrepreneurs and their associated referral network were not WHP employees. Furthermore, the project’s overall impact on unmet family planning need, contraceptive knowledge, and method outcomes were not possible as a baseline and follow-up assessments in the project area villages were not funded. Family planning patients were difficult to interview due to inadequate locating information in rural villages, the high proportion of secretive clients, and the possibility of retribution for women and TPCs alike if confidentiality of these clients was broken. Moving forward, incentives and franchise standards have been developed to promote more rigorous enhanced data collection as well as methods to interview these family planning patients.

Despite a lack of a formal programmatic impact evaluation to assess the family planning, healthcare, or social franchising outcomes, the descriptive statistics as well as qualitative in-depth interviews with patients and TPC entrepreneurs suggest that WHP’s model has increased the accessibility of health services and family planning to a rural population in need of both. As a technology, telemedicine has demonstrated the ability to overcome geographic and health resource limitations. This pilot project was an attempt to leverage this technology with social franchising to make use of existing rural resources in an area with acute needs. In addition to healthcare, RHPs as TPC entrepreneurs did provide widespread family planning products and services at reasonable cost in rural UP, an area lacking infrastructure making the provision of such services difficult. Without pre/post population-based data or a comparison group, however, the project’s impact cannot be quantified. Upcoming modifications to the project intend to make future more rigorous evaluations of this project more feasible.
**Next Steps:**

While this pilot project was successful in delivering telemedicine and family planning to rural communities in Uttar Pradesh, programmatic adjustments will be implemented as the project progresses. WHP intends to expand to other districts in rural UP. As WHP received funding solely for increasing family planning in UP, WHP intends to ensure the telemedicine component is financially self-sustaining. Other goals include adjustments to enhance telemedicine consultations, to maintain provider interest, to expand the services to patients, and to improve data collection for evaluation.

1. **Full investment in TPCs**- The initial TPC franchise start-up costs have been subsidized by WHP and included computer equipment and maintenance. Future telemedicine franchises will be responsible for all costs and will be responsible for purchasing and maintaining all of their own computer equipment. The ReMeDi telemedicine equipment, however, will be annually leased to the entrepreneurs.

2. **Open TPC franchise investment**- Given the high availability of RHPs and ANMs in the rural villages, entrepreneurs willing to invest and meet the family planning targets will be allowed to do so. Telemedicine franchises were initially spaced upon the assumption of a 10 km service range. The actual catchment areas for TPCs were nearly half, and an open investment should result in a more ideal spacing of facilities.

3. **Entrepreneur consultation pricing**- Pricing for the telemedicine consultations will be left fully to the discretion of the entrepreneurs. TPC entrepreneurs have indicated that some patients had the ability to pay much more than the fixed 50Rs consultation fee which would increase their profit margins. A sliding scale for consultation fees is consistent with the medical practices of RHPs (Rohde and Viswanathan 1995).

4. **Improvements to the ReMeDi telemedicine software**- To facilitate the ease of software updates and computer operability, ReMeDi software is being developed as a web-based application. Doing so would decrease maintenance costs to update software as well as address computer system compatibility issues. Additional changes include improvements to the provider interface and implementation of disease algorithms to assist with diagnoses.

5. **Appointment based bookings**- As of November 2010, WHP has begun implementing an appointment based booking system. This allows for the scheduling of consultation times with specific doctors as well as enables the availability of specialists. Patients can request specific doctors, and it allows WHP to be able to plan personnel staffing more efficiently.

6. **Strengthening ASHA village level referrals and networks**- Patient referrals by surrounding rural health providers in catchment areas were not particularly effective as referral fees were too low. Further expanding the network of ASHAs who visit houses
will be undertaken as well as developing financial incentives in addition to mobile phone consultations and referral commissions such as the sales of household goods.

7. *Enhanced data collection*- In addition to developing data systems to track patient referrals and entry points into the WHP network, the “on-the-ground” network of ASHAs enables the collection of identification of potential family planning clients as well as the collection of household data and patient follow-up. Secretive clients can be examined in more detail. In addition, community-level project impacts can be explored.
Figure 1: Map of India, project area and districts, TPC locations
Figure 2: World Health Partners Referral Network

Figure 3: ReMeDi telemedicine equipment
Table 1: Overview of WHP Network, November 2008-December 2010

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telemedicine Provision Centers (TPCs)</td>
<td>116</td>
</tr>
<tr>
<td>Operated by auxiliary nurse midwives (ANMs)</td>
<td>9</td>
</tr>
<tr>
<td>Semi-rural</td>
<td>17</td>
</tr>
<tr>
<td>Closed</td>
<td>16</td>
</tr>
<tr>
<td>Catchment villages</td>
<td>1177</td>
</tr>
<tr>
<td>Rural health practitioners (RHPs) referral network</td>
<td>1046</td>
</tr>
<tr>
<td>Accredited social health activists (ASHAs) referral network</td>
<td>30</td>
</tr>
<tr>
<td>Mobile phone consultations</td>
<td>138</td>
</tr>
<tr>
<td>Reproductive aged women tagged for family planning services</td>
<td>98</td>
</tr>
<tr>
<td>Franchise clinics</td>
<td>16</td>
</tr>
<tr>
<td>Telemedicine MBBS doctors</td>
<td>9</td>
</tr>
</tbody>
</table>

Figure 4: Mean consultations by 30-day intervals from TPC start date
Table 2: Telemedicine patient demographics, April 2009 - December 2010

<table>
<thead>
<tr>
<th></th>
<th>Sex</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male N (%)</td>
<td>Female N (%)</td>
</tr>
<tr>
<td>Total consultations</td>
<td>12345</td>
<td>16635</td>
</tr>
<tr>
<td>Age category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5</td>
<td>446 (3.6)</td>
<td>153 (0.9)</td>
</tr>
<tr>
<td>5-10</td>
<td>483 (3.9)</td>
<td>208 (1.3)</td>
</tr>
<tr>
<td>11-14</td>
<td>562 (4.6)</td>
<td>318 (1.9)</td>
</tr>
<tr>
<td>15-19</td>
<td>958 (7.8)</td>
<td>1236 (7.4)</td>
</tr>
<tr>
<td>20-24</td>
<td>1114 (9.0)</td>
<td>1888 (11.4)</td>
</tr>
<tr>
<td>25-29</td>
<td>844 (6.8)</td>
<td>1935 (11.6)</td>
</tr>
<tr>
<td>30-34</td>
<td>976 (7.9)</td>
<td>2016 (12.1)</td>
</tr>
<tr>
<td>35-39</td>
<td>1067 (8.6)</td>
<td>2024 (12.2)</td>
</tr>
<tr>
<td>40-44</td>
<td>1026 (8.3)</td>
<td>1664 (10.0)</td>
</tr>
<tr>
<td>45+</td>
<td>4869 (39.4)</td>
<td>5193 (31.2)</td>
</tr>
<tr>
<td>Reproductive ages (RA) and married</td>
<td>10507 (36.3)</td>
<td>10507 (36.3)</td>
</tr>
<tr>
<td>Below poverty line (BPL) card</td>
<td>229 (1.9)</td>
<td>424 (2.6)</td>
</tr>
<tr>
<td>Knowledge of TPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advertisement</td>
<td>6329 (51.3)</td>
<td>8411 (50.6)</td>
</tr>
<tr>
<td>Word of mouth</td>
<td>3338 (27.0)</td>
<td>4699 (28.3)</td>
</tr>
<tr>
<td>From TPC owner</td>
<td>620 (5.0)</td>
<td>775 (4.7)</td>
</tr>
<tr>
<td>From RHP</td>
<td>2057 (16.7)</td>
<td>2724 (16.4)</td>
</tr>
<tr>
<td>From ASHA</td>
<td>10 (0.1)</td>
<td>10 (0.0)</td>
</tr>
<tr>
<td>Traveled to TPC alone</td>
<td>6411 (51.9)</td>
<td>3972 (23.9)</td>
</tr>
<tr>
<td>Walked to TPC</td>
<td>4211 (34.1)</td>
<td>6030 (36.3)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastro-intestinal</td>
<td>2987 (24.2)</td>
<td>4311 (25.9)</td>
</tr>
<tr>
<td>Respiratory</td>
<td>2759 (22.4)</td>
<td>2361 (14.2)</td>
</tr>
<tr>
<td>Neuro-muscular</td>
<td>1368 (11.1)</td>
<td>2321 (14.0)</td>
</tr>
<tr>
<td>Neurologic/psychiatric</td>
<td>1070 (8.7)</td>
<td>1584 (9.5)</td>
</tr>
<tr>
<td>RA women only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consulted with a female doctor</td>
<td>---</td>
<td>6739 (64.1)</td>
</tr>
<tr>
<td>Reproductive health/gynecological issue</td>
<td>---</td>
<td>2600 (24.8)</td>
</tr>
<tr>
<td>Pregnant/post pregnancy complication</td>
<td>---</td>
<td>549 (5.2)</td>
</tr>
</tbody>
</table>
Table 3: Distance, time, and cost to healthcare services

<table>
<thead>
<tr>
<th>Project Area (TPC and Catchment) Villages to the nearest:</th>
<th>Mean (s.d.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHC/CHC</td>
<td>5.4 (3.6)</td>
</tr>
<tr>
<td>DHC</td>
<td>27.9 (13.2)</td>
</tr>
<tr>
<td>&quot;Large&quot; town</td>
<td>9.9 (10.4)</td>
</tr>
<tr>
<td>Private MBBS</td>
<td>10.6 (7.4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>From Catchment Villages to TPC</th>
<th>Mean (s.d.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (km)</td>
<td></td>
</tr>
<tr>
<td>Travel time (min)</td>
<td></td>
</tr>
<tr>
<td>Public transportation cost (Rs)</td>
<td></td>
</tr>
<tr>
<td>Distance (km)</td>
<td>4.2 (4.8)</td>
</tr>
<tr>
<td>Travel time (min)</td>
<td>28.1 (12.2)</td>
</tr>
<tr>
<td>Public transportation cost (Rs)</td>
<td>5.1 (5.0)</td>
</tr>
</tbody>
</table>

Table 4: Family planning services and sales, November 2008 through December 2010

<table>
<thead>
<tr>
<th>Family planning services performed</th>
<th>Number (% of target)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sterilization</td>
<td>13,024 (98.6%)</td>
</tr>
<tr>
<td>intra-uterine devices (IUD) inserted</td>
<td>10,179 (115.8%)</td>
</tr>
<tr>
<td>Depo-Provera (DMPA) injections</td>
<td>8,944 (56.1%)</td>
</tr>
<tr>
<td>medical abortion</td>
<td>1,723 (212.5%)</td>
</tr>
<tr>
<td>surgical abortion</td>
<td>2,819 (204.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family planning products sold</th>
<th>Number (% of target)</th>
</tr>
</thead>
<tbody>
<tr>
<td>oral contraception</td>
<td>170,880 (70.7%)</td>
</tr>
<tr>
<td>emergency contraception</td>
<td>4,560 (170.1%)</td>
</tr>
<tr>
<td>condoms</td>
<td>2,389,216 (163.3%)</td>
</tr>
<tr>
<td>Depo-Provera</td>
<td>15,160 (113.4%)</td>
</tr>
<tr>
<td>medical abortion</td>
<td>8,810 (118.6%)</td>
</tr>
</tbody>
</table>

¹ Depo-Provera availability was limited until mid-2009
² oral contraception supply was limited from April through December 2010
Figure 5: Scatterplot of mean IUD insertions versus mean telemedicine consultations per 30 days of operation by TPC, 2010
References:


International Institute for Population Sciences (IIPS) and Macro International (b) (2008). National Family Health Survey (NFHS-3), Fact Sheet: India. Mumbai, IIPS.


Determinants of healthcare seeking behavior

Previous studies in rural Bangladesh and Pakistan, which are developing countries similar to India, have reported the impact of factors such as education level, household poverty, illness length, cultural factors, and patient gender on health seeking behaviors (Ahmed, Adams et al. 2000; Ahmed, Tomson et al. 2005; Shaikh and Hatcher 2005; Shaikh, Haran et al. 2008). A willingness to travel longer distances, seek treatment earlier, and endure higher healthcare expenses were found for seeking healthcare of sick male versus female children in West Bengal, India (Pandey, Sengupta et al. 2002). In rural UP, a qualitative assessment found influential family members, such as older male heads of households and community leaders, to play a key role (Jain, Nandan et al. 2006). In addition, factors such as the physical presence or absence of various healthcare options, travel distance/time, perceived quality of medical care, and cost of services also have been found to influence healthcare seeking behavior in India (Ager and Pepper 2005; Sharma and Piyush 2008).

Distance, however, has been consistently identified as being one of the most impactful factors on the utilization of health services. In Uttar Pradesh overall, 85% of households did not generally use government health facilities with the lack of a nearby facility (54%) being the second most cited reason (International Institute for Population Sciences (IIPS) and Macro International 2007). Distance decay, the lower utilization of healthcare services with increasing distance or time, has been well-documented for both developing countries and developed countries alike (Muller, Smith et al. 1998; Cromley and McLafferty 2002(a)). Rural women in Uttar Pradesh are likely to be a population that is most sensitive to distances when seeking health services.

Healthcare seeking behavior in Indian women

For women in rural India, substantial barriers to seeking healthcare emerge. A lack of healthcare decision making autonomy, an inability to travel, and an inability to seek medical consultations alone without accompaniment by a family member have been previously cited (Vissandjée, Barlow et al. 1997; Bloom, Wypij et al. 2001; Jain, Nandan et al. 2006; Mohan, Iyengar et al. 2008). In the 2005-2006 National Family Health survey, women in India most commonly cited distance (25%), transportation (23%), and a lack of female medical provider at health facilities (19%) as substantial barriers to accessing healthcare (International Institute for Population Sciences (IIPS) and Macro International 2007). Furthermore, rural Indian women may be responsible for household work or for the caretaking of young children. Such responsibilities may make them more sensitive distance barriers to healthcare services causing them to forgo seeking healthcare altogether (Vissandjée, Barlow et al. 1997).

Telemedicine has substantial promise in addressing this distance barrier for rural women. This project seeks to provide local access to health services and family planning close to the rural population with the greatest needs and with the least autonomy to travel distances. By having TPCs operate directly in rural communities, women who may not be able to travel lengthy distances would be able to access services in their own communities. The telemedicine provision centers, however, still require a physical facility which people must travel to for consultations.
The location of TPCs, and therefore the distances that women would have to travel in order to attend them, will have an impact on their utilization. Therefore, it is the purpose of Paper 2 to use spatial analyses and location-allocation models to examine the current spatial arrangement of telemedicine facilities in the project area and suggest improvements that can be made to shorten the overall mean travel distance to them.
Paper 2: Location-allocation Models of Telemedicine Provision Centers in Three Districts of Rural Uttar Pradesh, India

Objectives:

The purpose of this paper is to determine:

- What was the catchment area of the telemedicine provision centers (TPCs)?
- What was the locational efficiency of the “actual” versus an “optimal” configuration of TPCs?
- How does the mean distance calculated from LAMs change if additional facilities are added to the current configuration?

Key Points:

- Travel distance to health facilities is a major barrier in their utilization in rural Uttar Pradesh, India, especially for rural women.
- Stand-alone telemedicine provision centers (TPCs) for primary care consultations and family planning services had catchment areas of 5.2 kms which is consistent with those reported for rural Indian government facilities. For reproductive age women, a target population by this project for family planning services, the catchment distance was 4.9 kms.
- While not located inefficiently based upon the population-weighted demand of catchment area villages, either contracting the project area and relocating TPCs or adding 20 TPCs would be necessary to achieve a mean distance in the project area based upon a 4.9 km catchment range.

Background and Setting:

*Indian Rural Healthcare*

India, with three-fourths of its estimated 1.2 billion population being rural, faces enormous challenges in providing sufficient health services to its population. These include having shortages of medical personnel, worker absenteeism, and the perceived poor quality of government medical services (Rao, Rao et al. 2011). The distribution of medical resources is also inequitable; resources are concentrated in urban centers disproportionate to India’s large rural base (Balarajaj, Selvaraj et al. 2011). In India’s tiered system of government health care, MBBS (Bachelor of Medicine and Bachelor of Surgery) physicians are available in rural areas through primary health centers (PHCs) and community health centers (CHCs). One PHC is to provide
services to 30,000 people and a CHC to 120,000 and has specialists (Ministry of Health and Family Welfare (a) 2009). For patients needing tertiary care, government facilities are at district health centers (DHCs) located in the district cities.

However, substantial shortfalls in the number of PHC/CHC facilities exist particularly in its most populous states like Uttar Pradesh (Ministry of Health and Family Welfare (b) 2009). Related to the shortfall in the number of facilities, PHCs/CHCs were found to have an inefficient geographic distribution relative to populations in need of health services (Kumar 2004). Instead, the majority of rural healthcare is provided through locally-based rural health providers (RHPs): informal private providers with a wide range of medical background, training, and qualifications (Rohde and Viswanathan 1995). RHPs include traditional healers, and practitioners of ayurvedic, allopathic, or a hybrid of multiple medical systems.

Related to the shortages of government health facilities, geographic barriers to access also exist. Distance decay, or the lower utilization of healthcare services with increasing distance, has been well documented in both developing countries and developed countries (Muller, Smith et al. 1998; Rahman and Smith 1999; Cromley and McLafferty 2002(a)). In rural Uttar Pradesh (UP), only 15% of households reported that government facilities were their typical source of health care (National Family Health Survey 2005). Nearly half reported that their non-utilization was due to facilities not being located nearby, second only to 53% reporting their low perceived quality of care. However, when asked to rank their criteria in determining the quality of care for health services, a focus group study of a rural UP population found physical accessibility to be the third most important component behind treatment effectiveness and cost ((Social & Rural Research Institute 1992) as cited in (Rohde and Viswanathan 1995)). Travel distance to health facilities clearly is a critical factor in their utilization.

Women in rural India, especially those of reproductive ages (married, 15-49 years) who are a critical population to reach for public health services such as family planning, are especially sensitive to travel distances to health facilities. A lack of healthcare decision making autonomy, a difficulty in traveling long distances, and an inability to seek medical consultations without being accompanied by a relative have been previously cited as obstacles to health care access (Vissandjée, Barlow et al. 1997; Bloom, Wypij et al. 2001; Jain, Nandan et al. 2006; Mohan, Iyengar et al. 2008). In the 2005-2006 National Family Health survey (NFHS-3), women in India reported the most common barriers to be distance (25%) and transportation (23%) to accessing healthcare. In addition, 58% said they could not seek health care unaccompanied and 73% could not travel beyond their home village alone (International Institute for Population Sciences (IIPS) and Macro International 2007). Rural Indian women, with responsibilities such as household work or the caretaking of young children, may forgo seeking healthcare altogether if the distances are too great (Vissandjée, Barlow et al. 1997). To improve the utilization of qualified healthcare services in rural India, particularly by women, facilities must be located nearby.

*Telemedicine and Family Planning Services in Rural Uttar Pradesh*

Telemedicine, or “medicine over a distance,” has demonstrated promise in overcoming the geographic barriers to health care. With the rapid advancement of Internet technologies and connectivity, patients are able to locally consult with clinicians based elsewhere through a streaming audio/video connection. Telemedicine has been previously used in rural developing countries to provide healthcare including India (Wootton and Bonnardot 2010).
Since November 2008, World Health Partners (WHP) implemented a pilot project of 116 rural telemedicine sites in the north-western districts of Meerut, Bijnor, and Muzaffarnagar in Uttar Pradesh (Figure 1) on a rolling basis. For a fee of 50Rs (approximately USD$1.10), patients were able to consult with Indian allopathic physicians at centralized facilities in New Delhi and Patna at rural village-based Telemedicine Provision Centers (TPCs) through proprietary ReMeDi software and peripheral equipment (Neurosynaptic 2008). Each TPC had basic diagnostic capabilities that were digitally transmitted through the telemedicine system (Figure 2). These included a thermometer, electrocardiogram, blood pressure cuff, and a stethoscope. Commonly prescribed medications were branded and supplied by WHP and sold locally. For needed in-person examinations or medical procedures, patients were referred to a partner “franchise clinic” in a nearby town. A more detailed project description is described elsewhere and online (http://www.worldhealthpartners.org).

To promote female entrepreneurship and female patient utilization, TPCs were owned by women who either were rural health providers or were married to one or were auxiliary nurse midwives (Government of India rural health workers trained for maternal and child healthcare). These entrepreneurs bought into a telemedicine franchise for a subsidized fee that included telemedicine and computer equipment, Internet connectivity, marketing materials, and promotional events. TPCs were also established as social franchises (Schlein, Kinlaw et al. 2010); the profit generated from the telemedicine consultation fees and the sales of drugs or family planning products served as an incentive for the providing and marketing of other health services and products. As a non-conditional agreement to being a WHP franchise, each TPC also provided family planning products and services. TPCs maintained a stock of condoms, oral contraception, and medical abortion pills and organized IUD insertion and contraception injection clinics. Annual family planning targets were established for TPCs. All married women of reproductive ages (RA), were counseled for family planning when they utilized services at TPCs. Failure to achieve family planning goals resulted in the elimination of the franchise.

Criteria for TPC locations included those that were nearby a major road for access to towns for supplies and marketing purposes and those that served as a central location for surrounding catchment villages. As a new technology and type of health facility, no previous literature exists on the service area distances for stand-alone telemedicine centers. It was assumed by WHP that patients within a 10 km radius, distances accessible by walking, cycling, and using rural public transportation options, would visit the centers. TPCs and their allocated catchment villages were roughly spaced based upon this assumption. Some catchment villages also overlapped among TPCs to stimulate competition for patients. TPCs formed partnerships with surrounding RHPs in these catchment villages to provide patient referrals for telemedicine consultations and the distribution of family planning products. In addition, intense marketing efforts occurred in these villages and consisted of branded signs and posters, vehicular loudspeaker announcements, radio advertisements, and village shows of Bollywood movies interspersed with WHP commercials and messages. TPC villages and their surrounding catchment villages were considered to be the project area.

While WHP’s telemedicine model is promising in delivering healthcare and family planning and overcoming geographic barriers and health resource limitations in rural areas, it still required locating facilities in rural villages. Patients traveled from their residences to utilize the telemedicine provision centers. Programmatically, the challenge becomes to spatially position the telemedicine and family planning facilities in optimal locations that will be the most
beneficial to populations in need of their services. With the enormous impact of distance on health facility utilization, location-allocation models can be utilized to evaluate and improve upon the positioning of these telemedicine facilities.

**Location-allocation models**

Location-allocation models (LAMs) have been developed as a quantitative method to optimize the locations of facility sites. In health service research, LAMs have been used to evaluate accessibility, assess catchment areas, identify new locations, and simulate potential facility sites (Kumar 2004). The first two applications are of direct relevance in assessing the physical accessibility of TPCs purely by geographic distance. Past published research in developing countries have focused on utilizing LAMs as a retrospective evaluation in an attempt to locate government health facilities more efficiently given the finite resources available and the large unmet needs of rural populations (Oppong and Hodgson 1994; Rahman and Smith 1999; Rahman and Smith 1999; Rahman and Smith 2000; Moller-Jensen and Kofie 2001). Using LAMs to improve geographical accessibility can be viewed as minimizing proximity or maximizing coverage (Oppong and Hodgson 1994). LAMs require a set of demands, a set of facilities to meet these demands, and a network connecting the two (Kumar 2004). Further discussion on LAMs and model choice for this paper are discussed in more detail below.

**Project area profile**

Meerut, Bijnor, and Muzaffarnagar are adjacent districts in north-western Uttar Pradesh, the most populous state in India. Together, these districts cover an area of 11,164 km² and have a total population in excess of 10.3 million according to the 2007-2008 District Household Survey. Despite being predominately rural, these well-populated districts correspond to a density of 927 persons per square kilometer. Topographically, the rural areas in the districts are flat, alluvial, agricultural plains with the Ganga river bordering Muzaffarnagar and Bijnor districts. Elevation measurements at TPCs averaged 223 meters. In these districts, the ratio of PHCs per 30,000 rural population (based upon the 2001 Census of India) was 0.8, and only 4 of the 32 PHCs reportedly had a female physicians as of 2007 (International Institute for Population Sciences (IIPS) and Ministry of Health and Family Welfare (MHFW) 2008). The rural unmet family planning needs, the proportion of married women of reproductive ages (15-49 years) expressing a desire not to have children and not using contraception, was 25.3% in Meerut, 38.5% in Bijnor, and 35.7% in Muzaffarnagar (International Institute for Population Sciences (IIPS) and Ministry of Health and Family Welfare (MHFW) 2008).

Table 1 shows that 106 TPCs were active in the three districts and had 1111 catchment villages in 2010. Overall, these 1217 project villages had a total population in excess of 6 million. Only 3.3% of households possessed a below poverty line (BPL) card, a Government of India standard in identifying impoverished families. Less than 8% of project villages had a PHC/CHC in their own village, and nearly half had a PHC/CHC that were more than 5 kms away. On average, reported travel times to PHC/CHCs were just over a half an hour and to DHCs over 100 minutes. TPCs were situated closer to catchment villages, had shorter travel times, and shorter public transportation costs in comparison with PHC/CHCs. There were,
however, large standard deviations for mean distances, travel times, and costs among the project area villages.

**Methods:**

*Village Surveys and Global Positioning System Measurements*

From 12/09-5/10, village surveys were conducted in 106 villages with telemedicine centers as well as their 1111 surrounding catchment villages (Table 1). Village surveys probed on population, the availability of nearby health resources, and the travel times and public transportation costs to these facilities as well as to the nearest town. For the surrounding catchment villages, the travel time and cost of public transportation to the nearest TPC location were also probed. As local administrators responsible for maintaining village records, village leaders (*sarpanch*) were interviewed. The reported health facilities, travel times, and transportation cost data were reconfirmed by the TPC entrepreneurs and through convenience interviews of residents at *choupals*, the village communal meeting places.

Global position system (GPS) measurements of villages and health facilities were taken using a Garmin Etrex Venture H device. Locations of villages were recorded “on approach,” from the entrances of villages closest to the main road, and facility measurements were taken from their main gate. District administrative boundaries were extracted from the Survey of India’s village boundary database for Uttar Pradesh (2001). All spatial data were imported into Environmental Systems Research Institute’s (ESRI) graphic information system (ArcGIS v.10).

*Spatial Analyses and Location Allocation Models*

Villages of residence from electronic records of patients consulting at TPCs in 2010 were matched with village demographic and spatial data from the village surveys. SOUNDEX, an algorithm to code a string of letters phonetically, and SPEDIS, a measurement of word closeness by spelling that accounts for word length, were functions used in combination to identify matches of village names in SAS (v.9.2) (Gershteyn 2000; Fan 2004). To account for the possibility of repetitive village names, the comparison datasets of villages from the village surveys were restricted only to those within the TPC’s catchment area and of neighboring TPC catchment areas within a 30km radius. Geographic distances, descriptive statistics, and 90% catchment areas were calculated using *proc geodist* and *proc tabulate* in SAS.

For these spatial analyses, the objective will be to minimize the average demand-weighted travel distance given the enormous impact of distance on health seeking behavior in rural India. Therefore, P-median models were used in LAM; the P-median problem is to locate *p* number of facilities so that the total weighted travel distance between demand and facilities is minimized (Church and Sorensen 1994). Details of the integral formula of the P-median problem that is computationally “solved” has been presented and discussed at length previously (Church and Sorensen 1994; Rahman and Smith 1999; Kumar 2004). A primary assumption of the P-median model is that shorter distances increase the accessibility of facilities. Given that TPC locations and their surrounding catchment villages were purposefully situated by WHP along a continuum with the intention of maximizing marketing efforts, entrepreneurial relationships
among providers, and stimulating competition among neighboring TPCs, the P-median was chosen because it assigns all demand (project villages) to TPC facilities. The grouping of project area villages was a priority, and other LAMs that not utilizing the P-median problem do not provide results consistent with this programmatic goal. In previous research involving the use of LAMs in developing countries, the P-median problem has been utilized and found to provide acceptable results for distance minimization (Oppong and Hodgson 1994; Rahman and Smith 1999; Kumar 2004).

The geographic coordinates of villages served both as nodes of demand as well as for potential candidate facilities. Village populations were used as proxies of the demand and served as the weights. Only two project area villages out of 1217 did not have at least one ANM or RHP and were therefore excluded as potential candidate locations for TPCs. A linear network was used to connect demand and facility locations. For other LAMs in rural areas of developing countries, Euclidian (“straight line”) distances have been used previously because of the unavailability of rural road network data, topographic homogeneity, and because straight line distances approximate walking (Oppong and Hodgson 1994; Moller-Jensen and Kofie 2001; Kumar 2004); all are circumstances that are relevant to the project area. Walking was the most commonly reported method of conveyance to TPC facilities by clients.

Location allocation models were calculated in ArcGIS using the network analyst extension to solve the “minimize impedance” (P-median) problem. Due to computational difficulties in LAM calculations involving a high number of facilities and candidate locations, only LAMs for Bijnor district were ran. ArcGIS uses both the Teitz and Bart heuristic and a metaheuristic to identify the best solution with a tradeoff with computational time.

In this analysis, results from two groups of LAMs are presented. The first set evaluated the current or “actual” locations of the 106 TPCs compared to their “optimal” configuration as identified by the LAM. Three types of models were ran (1) no restrictions (2) with an assigned demand maximum distance constraint of 10 kms (the assumed catchment areas of the TPCs) (3) with an assigned demand maximum distance constraint corresponding to the 90% catchment area for reproductive age women. As family planning was an emphasis, this project specifically targeted reproductive age women and facility locations should be optimized for this group. Comparisons of configurations to the LAM optimal were calculated by a locational efficiency (LE) ratio by dividing the optimal with the actual mean distance (Rahman and Smith 2000; Kumar 2004). The second set of LAMs examined the impact on mean distance of having additional TPC facilities (“add more”) considering the current configuration as being fixed. This was justified given that once established, telemedicine franchises would not be relocated to neighboring villages unless for non-fulfillment of their family planning responsibilities.

Results and Discussion:

In 2010, 16,933 patients consulted at 106 telemedicine centers. TPCs were successful in attracting women as 59% of patients were female and 37% were married and of reproductive ages overall. Villages of residence were matched to spatial data collected by the village surveys for 83% of patients. Among those mapped, 53% resided in the same village as the TPC and 32% came from their TPC’s programmatic catchment area. An additional 13% came from another TPCs catchment area (but still from a project area village) which is an indication of competition
among TPCs for patients and supports WHP’s model to have continuous service areas of TPCs. However, 472 (42%) catchment area villages did not have any patients consulting at TPCs, a sizable percentage. Although programmatic data indicates that only 16.5% of patients were referred to TPCs by referral RHPs in surrounding villages, a weak referral network was likely not the only contributing factor to the non-utilization of TPCs by their surrounding communities. Distances to TPCs may have been a barrier. Calculations of the actual catchment areas of TPCs indicated that their service areas were substantially shorter than the assumed 10 km radius.

Catchment area calculations

Overall, Table 3 shows that the mean distance that patients traveled to TPCs was 2.2 kms. The 90% catchment area was 5.2 kms, nearly half of the 10 kms that was initially assumed. By district, Muzaffarnagar had a much smaller catchment area than the other two districts, but this may be due to the geographical spacing of the rural villages within the district. As expected from the past health seeking behavior research for rural India, the actual catchment distance for men (5.6 kms) consulting at TPCs was greater than that for women (4.8 kms). Female patients who traveled alone, who accounted for less than a quarter of consultations among females overall, also had a shorter catchment area (4.0 kms). This result was also expected with the cultural barriers that rural Indian women face when traveling alone to health facilities. Given the project’s emphasis on providing health services for reproductive age women and that shorter catchment areas are still accessible by those capable of traveling further, the “add more” LAMs were based upon obtaining an ideal mean catchment distance of 4.9 kms for the TPCs.

Locational efficiency of the actual and optimal TPC configurations

The current spatial locations of TPCs in Bijnor district, while not optimal, were not drastically inefficient. Table 4 shows that the P-median model with no distance limitations for the “actual” locations of the TPCs resulted in a mean distance 6.34 kms from surrounding catchment area villages to TPCs. This was greater than the “optimal” distance of 5.32 kms which corresponds to a locational efficiency ratio of 0.83. The optimal model only retained 14 (31%) of the current TPC locations. In both the actual and optimal models, all project area villages were assigned to a TPC resulting in inequitable distances assigned to some villages. The LAM assigned 93 (18%) villages to travel distances greater than 10 kms including a maximum in excess of 37 kms, an unrealistic assumption. This inequity is a known limitation of the P-median model with no demand restrictions placed upon it (Rahman and Smith 2000).

P-median models assigning demand restrictions, meaning that villages had to be assigned to a TPC within a pre-specified distance, resulted in mean distances that were less than the calculated catchment distance of the TPCs. A P-median model assigning a constraint of 10 kms, the initially assumed catchment area of TPCs, resulted in a mean distance of 4.18. An even more restrictive model set at 5 kms, the calculated TPC catchment area for RA women, resulted in a mean distance of 2.25 but with 22% fewer project villages served. Both actual P-median models were more efficient than their optimal counterparts because they assigned fewer project area villages to TPCs.

Results of these LAM models suggest that two programmatic options exist to achieve a mean travel distance equivalent to the actual catchment area for reproductive age women: to
either contract the project area in the number of villages served or to add TPC facilities to more adequately serve the existing demand. Programmatic and RHP provider relationships, intense marketing campaigns, and supply networks already exist in the project area villages, and the relocation of TPCs or service area contraction are not realistic programmatic options. Therefore, the impact of adding additional TPC facilities on mean distances from villages to TPC facilities was modeled.

“Add-more” LAMs

Modeling the improvement in accessibility by adding additional TPCs to the project area in Bijnor district required LAMs that retained the current configuration while optimally locating additional ones. Marginal improvements were seen in decreasing mean distances by adding additional TPCs. From these “add more” models in Table 5, 13 additional facilities (p=58) would be needed to achieve the same mean distance as an optimally located set of 45 TPCs. To achieve a mean distance equivalent to the calculated catchment area of the TPCs, 20 additional TPCs would have to be added (Figure 5). The addition of 20 TPCs would enable 93% of the project area population to be assigned within 10 kms and 79% within 5 kms, both higher than 87% and 64% for the actual, 92% and 75% for the optimal configuration of TPCs respectively.

Conclusion:

While telemedicine has tremendous promise in its ability to overcome health resource limitations and distance barriers in developing countries, rural patients still must travel to a facility in order to consult. An unknown when initially establishing the telemedicine sites in western UP was the extent of their service areas, and they were located with an assumed range of 10 kms. Their calculated catchment area, however, was considerably less and was consistent with previous reports of 5 kms for attendees of rural government primary care facilities in India (Rohde and Viswanathan 1995). Despite being operated as a private franchise, the catchment area for RA women in particular is closer to that reported for women in Karnataka attending government facilities and not private ones (Bhatia and Cleland 2001). With the multitude of barriers both physical and cultural that women face in accessing health services in rural India, shorter travel distances will be beneficial to this group. Location-allocation models have considerable utility in this regard.

More important than calculating the locational efficiency of existing facilities through retrospective analyses, the strengths of LAMs are in suggesting programmatic improvements that can be made moving forward. In previous uses of LAMs in rural areas of developing countries, LAMs were used to examine the placement of government health facilities. Despite LAMs identifying optimal locations, the authors noted that the locating of additional public facilities or relocation or current ones were subject to funding limitations, coverage policies, and political processes (Oppong and Hodgson 1994; Rahman and Smith 1999; Rahman and Smith 1999; Rahman and Smith 2000; Kumar 2004). As privately owned social franchises, TPCs, however, are not subject to these constraints. By utilizing existing RHPs and their facilities, the infrastructure costs of TPCs are considerably less than that of clinics. Furthermore, with plans to expand to other districts in UP as well as in the neighboring state of Bihar, WHP will require
future TPC entrepreneurs to fully absorb the initial franchise costs which will further lessen their costs. Potential TPC locations are not limited by the availability of village RHPs, as demonstrated by only 2 villages out of the 1217 lacking either, but rather by the willingness of entrepreneurs to own and operate a franchise. Future placement of TPCs can be spaced to enable shorter travel distances by rural populations.

In these LAMs, potential TPCs locations were not weighted based on their proximity to PHC/CHCs or to private MBBS providers. Although these facilities also provided consultations by qualified MBBS physicians, they were not seen as direct competitors given the high degree of “healer shopping,” or the serial or concurrent seeking of health services from multiple providers (Kroeger 1983), and the low levels of government facility usage in rural UP communities. “Healer shopping” is a well-known phenomenon in rural India, but its extent has not been quantified in rural India. Previous research on health service utilization in rural Orissa and Gujarat states have shown that percentages for provider type visited exceeded 100% because of the seeking of healthcare from multiple providers within their studies time frames (Vissandjée, Barlow et al. 1997; Ager and Pepper 2005). Although not a population-based representative sample, as part of a qualitative study of health seeking behaviors among TPC patients, all of the 22 RA women interviewed had consulted with other health providers prior to their visit to TPCs. Furthermore, no correlation was found between the number of TPC consultations and distance to PHC/CHCs. Therefore, in the models presented in this paper, other facilities with other qualified physicians were not treated as competitors for patient services.

Similar to other location-allocation studies in developing countries, these LAMs also utilized Euclidian distances among facilities as a network. The rationale for the use of straight-line distances to connect villages is the unavailability of network data and that they approximate walking, the most common mode of transportation. Moller-Jensen and Kofie (2001), however, present a hybrid network that is a combination of a 1 km omni-directional buffer zone around health facilities to simulate “free movement” over short distances that link with a larger vector transportation network (i.e., the main roads) where one could find public transportation options. They argue that those living in rural environments are unlikely to walk in a straight line for distances greater than 5kms. While this is very likely true for those living in the project villages in rural UP, even if available, the shortest distance mapped along a road network would unlikely be an accurate reflection of the actual transportation routes. Rural UP public transportation options include buses, auto-rickshaws, tractors, and ox-drawn carts- many of which were available from within the villages. It is highly unlikely that these transportation options would follow the shortest routes to destinations given that they collect passengers from nearby villages and factors such as waiting time would have to be considered. In addition, although main highway network data was available in the project districts, data was not available on smaller roads that are more likely used by these rural public transportation options. To collect public transportation network data in a level of detail to accurately reflect true travel distances is beyond the resources for this study and other studies in developing countries when large numbers of candidate facility locations have to be considered. While not without disadvantages, the only option readily available, therefore, is the use of straight line distances as a network.

This study has additional limitations. First, physical accessibility is only one component of many factors that influences the utilization of health facilities (USAID 2009). Although travel distance is a major barrier, other considerations impacting health seeking behavior include the costs of services, perceived quality of care, and range of services offered. The LAMs do not
account for these factors. Secondly, overall population from a village survey was used as the weights in the LAMs. This is appropriate for examining TPCs as a health resource for all populations. Reproductive age women, however, were specifically targeted for family planning services by this project, but their population in project area villages was unavailable. The use of overall population numbers assumes correlation between the two- that larger villages have larger numbers of RA women and vice versa. And lastly, the calculated catchment areas were for those seeking telemedicine consultations and not necessarily those seeking family planning services. There is debate as to whether or not distance to family planning and services is a major barrier to their utilization (Cleland, Bernstein et al. 2006). In rural UP, however, government facilities were overwhelmingly the first source of family planning for current users (94.2%) and are the main source for non-users with unmet family planning needs (66.3%) (International Institute for Population Sciences (IIPS) and Macro International (c) 2005). Combined with the high levels of physical inaccessibility reported for rural government facilities, it is extremely probable that family planning utilization is similarly impacted as health service utilization by travel distance in rural UP communities. This suggests that future applications of LAMs can be used to optimize distances to family planning services.

**Abbreviations:**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP</td>
<td>Uttar Pradesh</td>
</tr>
<tr>
<td>WHP</td>
<td>World Health Partners</td>
</tr>
<tr>
<td>TPC</td>
<td>Telemedicine provision center</td>
</tr>
<tr>
<td>RHP</td>
<td>Rural health provider</td>
</tr>
<tr>
<td>MBBS</td>
<td>Bachelor of Medicine and Bachelor of Surgery (qualified physician)</td>
</tr>
<tr>
<td>PHC/CHC</td>
<td>Primary health center/Community health center</td>
</tr>
<tr>
<td>DHC</td>
<td>District health center</td>
</tr>
<tr>
<td>GPS</td>
<td>Global positioning system</td>
</tr>
<tr>
<td>LAM</td>
<td>Location-allocation model</td>
</tr>
<tr>
<td>RA</td>
<td>Reproductive ages (married women, 15-49 years)</td>
</tr>
<tr>
<td>ASHA</td>
<td>Accredited Social Health Activist (“village health worker”)</td>
</tr>
<tr>
<td>ANM</td>
<td>Auxiliary Nurse Midwife (“paramedic”)</td>
</tr>
</tbody>
</table>

**Tables and Figures:**
Figure 1: Map of project area districts

Figure 2: ReMeDi telemedicine system equipment
Table 1: Description of project area villages, 2010

<table>
<thead>
<tr>
<th></th>
<th>District</th>
<th>Bijnor</th>
<th>Meerut</th>
<th>Muzaffarnagar</th>
<th>Overall</th>
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<tbody>
<tr>
<td>Number of TPCs</td>
<td></td>
<td>45</td>
<td>28</td>
<td>33</td>
<td>106</td>
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<tr>
<td>Number of catchment</td>
<td></td>
<td>505</td>
<td>268</td>
<td>338</td>
<td>1111</td>
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<tr>
<td>villages</td>
<td></td>
<td>550</td>
<td>296</td>
<td>371</td>
<td>1217</td>
</tr>
<tr>
<td>Total project area</td>
<td></td>
<td>1,842,828</td>
<td>1,921,010</td>
<td>2,272,849</td>
<td>6,036,687</td>
</tr>
<tr>
<td>villages</td>
<td></td>
<td>550</td>
<td>296</td>
<td>371</td>
<td>1217</td>
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<tr>
<td>Total population</td>
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<td>1,921,010</td>
<td>2,272,849</td>
<td>6,036,687</td>
</tr>
<tr>
<td>% of households below</td>
<td></td>
<td>3.3%</td>
<td>2.7%</td>
<td>3.9%</td>
<td>3.3%</td>
</tr>
<tr>
<td>poverty line (BPL)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>% of villages with a</td>
<td></td>
<td>4.5%</td>
<td>8.1%</td>
<td>12.2%</td>
<td>7.8%</td>
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<td>PHC/CHC located:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>in the same village</td>
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<td></td>
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<tr>
<td>&lt;2 kms</td>
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<td>9.0%</td>
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<td>7.6%</td>
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<td>2-4.9 kms</td>
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<td>34.6%</td>
<td>34.7%</td>
<td>32.9%</td>
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<tr>
<td>5+ kms</td>
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<td>51.9%</td>
<td>47.4%</td>
<td>47.3%</td>
<td>49.3%</td>
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<td>Number of ANMs (per</td>
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<td>1.6</td>
<td>0.8</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>5000)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Number of ASHAs (per</td>
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<td>0.3</td>
<td>0.4</td>
<td>0.4</td>
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<tr>
<td>1000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of RHPs (per</td>
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<td>0.7</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>1000)</td>
<td></td>
<td></td>
<td></td>
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</table>

Table 2: Mean distances, travel times, costs to health facilities and from catchment villages to telemedicine provision centers

<table>
<thead>
<tr>
<th>From Project Area (TPC and Catchment) Villages to the nearest:</th>
<th>Mean (s.d.)</th>
<th>Public transportation cost (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHC/CHC</td>
<td>5.4 (3.6)</td>
<td>31.0 (15.4)</td>
</tr>
<tr>
<td>DHC</td>
<td>27.9 (13.2)</td>
<td>100.8 (42.5)</td>
</tr>
<tr>
<td>&quot;Large&quot; town</td>
<td>9.9 (10.4)</td>
<td>37.6 (16.2)</td>
</tr>
<tr>
<td>Private MBBS</td>
<td>10.6 (7.4)</td>
<td>27 (14.6)</td>
</tr>
<tr>
<td>From Catchment Villages to TPC</td>
<td>4.2 (4.8)</td>
<td>28.1 (12.2)</td>
</tr>
</tbody>
</table>

37
Figure 3: Map of project area village population by quintiles
Table 3: Mean travel distances and 90% catchment areas by district, gender, and other characteristics

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean (std)</th>
<th>90% Catchment</th>
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<tbody>
<tr>
<td>Overall</td>
<td>12073</td>
<td>2.2 (4.8)</td>
<td>5.2</td>
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<tr>
<td><strong>District</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bijnor</td>
<td>4503</td>
<td>2.5 (5.6)</td>
<td>6.3</td>
</tr>
<tr>
<td>Meerut</td>
<td>2898</td>
<td>2.0 (3.9)</td>
<td>6.0</td>
</tr>
<tr>
<td>Muzaffarnagar</td>
<td>4672</td>
<td>2.0 (4.6)</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4985</td>
<td>2.4 (5.0)</td>
<td>5.6</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7079</td>
<td>2.1 (4.7)</td>
<td>4.8</td>
</tr>
<tr>
<td>Reproductive ages(^1)</td>
<td>4506</td>
<td>2.2 (4.9)</td>
<td>4.9</td>
</tr>
<tr>
<td>Traveled alone to TPC</td>
<td>1508</td>
<td>1.4 (3.9)</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Walked to TPC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4462</td>
<td>0.7 (2.8)</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Below poverty line</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>471</td>
<td>1.7 (4.0)</td>
<td>4.6</td>
</tr>
</tbody>
</table>

\(^1\) Married women between the ages of 15-49

Table 4: P-median LAMs for actual and optimal arrangements of TPCs, Bijnor District

<table>
<thead>
<tr>
<th>Type of LAM</th>
<th>Demand constraints</th>
<th>&quot;Actual&quot; distance (km)</th>
<th>Number of villages unassigned</th>
<th>&quot;Optimal&quot; distance (km)</th>
<th>Number of villages unassigned</th>
<th>Locational efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>mean</td>
<td>median</td>
<td>max</td>
<td>mean</td>
<td>median</td>
</tr>
<tr>
<td>P-median</td>
<td>n/a</td>
<td>6.34</td>
<td>5.04</td>
<td>37.25</td>
<td>0</td>
<td>5.32</td>
</tr>
<tr>
<td>P-median</td>
<td>&lt;= 10 km</td>
<td>4.18</td>
<td>3.90</td>
<td>9.99</td>
<td>93</td>
<td>4.64</td>
</tr>
<tr>
<td>P-median</td>
<td>&lt;= 5 km</td>
<td>2.25</td>
<td>2.44</td>
<td>4.96</td>
<td>269</td>
<td>2.72</td>
</tr>
</tbody>
</table>
Figure 4: Maps of actual and optimal TPC (p=45) locations, Bijnor District
Table 5: Table of mean, median and max distances from additional TPCs and percent of project area population assigned, Bijnor District

<table>
<thead>
<tr>
<th>Number of additional facilities</th>
<th>Distance (km)</th>
<th>% of population assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>median</td>
</tr>
<tr>
<td>+5</td>
<td>5.81</td>
<td>4.36</td>
</tr>
<tr>
<td>+10</td>
<td>5.50</td>
<td>4.07</td>
</tr>
<tr>
<td>+11</td>
<td>5.44</td>
<td>4.01</td>
</tr>
<tr>
<td>+12</td>
<td>5.39</td>
<td>3.96</td>
</tr>
<tr>
<td>+13</td>
<td>5.26</td>
<td>3.84</td>
</tr>
<tr>
<td>+14</td>
<td>5.26</td>
<td>3.86</td>
</tr>
<tr>
<td>+15</td>
<td>5.11</td>
<td>3.72</td>
</tr>
<tr>
<td>+16</td>
<td>5.08</td>
<td>3.72</td>
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<tr>
<td>+17</td>
<td>5.06</td>
<td>3.71</td>
</tr>
<tr>
<td>+18</td>
<td>5.01</td>
<td>3.64</td>
</tr>
<tr>
<td>+19</td>
<td>4.97</td>
<td>3.62</td>
</tr>
<tr>
<td>+20</td>
<td>4.94</td>
<td>3.60</td>
</tr>
<tr>
<td>+25</td>
<td>4.71</td>
<td>3.36</td>
</tr>
</tbody>
</table>
Figure 5: Optimal configuration of 20 “add-more” TPC facilities to the existing configuration (p=65), Bijnor District
References:


Church, R. L. and P. Sorensen (1994). Integrating Normative Location Models into GIS: Problems and Prospects with the p-median Model. Santa Barbara, NCGIA.


Social & Rural Research Institute (1992). Client's Perspective on Quality of Care. Delhi, IMRB International

USAID (2009). Health Seeking Behavior in Rural Uttar Pradesh: Implications for HIV Prevention, Care, and Treatment. Discussion Brief. Washington DC, USAID.


The success of World Health Partner’s project to increase modern family planning use in project areas is dependent on patient use of TPCs, particularly by young women of reproductive ages. Young, married women are a central focus of the project’s social marketing efforts as they are critical to achieving family planning goals. For this demographic, however, it is unknown if the telemedicine consultations and services are meeting their healthcare needs and what their perceived quality of care at TPCs is. For this project to be successful in providing family planning to rural women, the TPCs must be viewed in their rural conservative communities as an appropriate healthcare resource for women. If they were not seen as such, female patients would attend TPCs for health services.

As previously mentioned, to date no published reports are available about patient experiences with telemedicine in developing country. Exploring the experience of women who sought healthcare at TPCs not only addresses this gap in the research literature, but it will assist WHP on improving the quality of services offered and to better address the needs of rural women overall. Furthermore, exploring their experiences at TPCs and their health seeking behavior will provide a basis for better understanding TPC utilization patterns from a patient perspective.
Objective: The purpose of this paper is to describe (1) the experiences of RA female patients at telemedicine provision centers and (2) how well the experience correlates with their expectations of good medical care.

Key Points:
- Reproductive age women explored multiple sources of healthcare including at telemedicine provision centers in search of permanent relief from their medical conditions. Good health was expressed as a necessity to fulfill their responsibilities in their households and families.
- Telemedicine, as a new healthcare resource, was tested and explored by women, and it provoked feelings of fear of how to communicate through the computer as well as how to interact with the doctors.
- With the exception of the importance assigned to physical touch for some women, telemedicine conformed to their expectations of “good” healthcare services. Ultimately, however, it was judged by its ability to provide relief.

Background/Setting:
Telemedicine, or “medicine over a distance,” has shown substantial promise in overcoming the geographic barriers to healthcare. Through telemedicine, clinicians based elsewhere are available for consultations with other medical providers or patients in the field. It has been previously used in rural areas of developing countries to provide healthcare including India (Anupindi, Aundhe et al. 2009; Mishra, Kapoor et al. 2009; Wootton and Bonnardot 2010). In the past, telemedicine has taken various forms including asynchronous or store-and-forward communication between medical providers through E-mail for specialty care. With the increase in Internet availability, compression technology, and bandwidths, live audio/video consultations between patients and providers have also become a possibility.

Rural communities in India could benefit greatly from telemedicine. With three-fourths of its estimated 1.2 billion population being rural, India faces enormous challenges in providing sufficient primary care and other health services to its population. These include having shortages of medical personnel, worker absenteeism, and the perceived poor quality of government medical services (Rao, Rao et al. 2011). Rural government primary care is provided at primary health/community health centers, but substantial shortages of facilities exist (Ministry of Health and Family Welfare (b) 2009). Nearly half of households surveyed in India’s 2005-2006 National Family Household Survey claimed that distance to services were the main reason for their non-use (International Institute for Population Sciences (IIPS) and Macro International (c) 2008). Instead greater than 80% of rural healthcare is through private providers, typically locally-based rural health providers (RHPs). RHPs are informal practitioners with a wide range of medical backgrounds, training, and qualifications and include traditional healers and
practitioners of ayurvedic, allopathic, or a hybrid of multiple medical systems (Rohde and Viswanathan 1995). In theory, telemedicine could help address some of the shortages in the provision of quality primary care in rural India. The Government of India has been exploring the potential of telemedicine to expand medical services to its immense rural population (Mishra, Kapoor et al. 2009). While past reports of telemedicine implementation in developing countries have focused on project descriptions, virtually nothing is known about the experiences of telemedicine patients: a critical factor in determining if telemedicine is acceptable or not as a credible healthcare resource by a rural population in a developing country. In rural conservative Uttar Pradesh, the location of this project, computers are still a new technology and are present in less than 1% of households (International Institute for Population Sciences (IIPS) and Macro International (c) 2008). If rural patients in these communities do not view the telemedicine technology as capable of fulfilling their needs and expectations of healthcare services, they will not utilize it and “vote with their feet” - an appropriate idiom to mean that they will seek healthcare elsewhere, an undesired outcome. Healer shopping, or the seeking of healthcare from multiple providers concurrently or serially, is a well-known phenomenon in rural India and other developing countries (Kroeger 1983). This could lead to excessive patient healthcare expenses and consultations with informal RHPs. This qualitative study is an attempt to describe the experiences specifically of female patients of reproductive ages (RA) who consulted at telemedicine provision centers and relate them with their expectations of good medical care.

**Rural Indian women and health seeking behavior**

Rural Indian women face substantial barriers to accessing health services and would greatly benefit from having healthcare facilities locally available. Women of reproductive ages (married, 15-49 years), who are a critical population to reach for public health services such as family planning, are especially sensitive to travel distances to health facilities. A lack of healthcare decision making autonomy, a difficulty in traveling long distances, and an inability to seek medical consultations without being accompanied by a relative have been previously cited as obstacles to health care access (Vissandjée, Barlow et al. 1997; Bloom, Wypij et al. 2001; Jain, Nandan et al. 2006; Mohan, Iyengar et al. 2008). In the 2005-2006 National Family Health survey (NFHS-3), women in India reported the most common barriers to be distance (25%) and transportation (23%) to accessing healthcare. In addition, 58% said they could not seek health care unaccompanied and 73% could not travel beyond their home village alone (International Institute for Population Sciences (IIPS) and Macro International 2007). Rural Indian women, with responsibilities such as household work or the caretaking of young children, may forgo seeking healthcare altogether if the distances are too great (Vissandjée, Barlow et al. 1997). To improve the utilization of qualified healthcare services in rural India, particularly by women, facilities must be located nearby.

**Telemedicine in rural Uttar Pradesh communities**

Since November 2008, World Health Partners (WHP), a New Delhi based NGO, has implemented a pilot project of over a hundred rural telemedicine sites in the north-western districts of Meerut, Bijnor, and Muzaffarnagar in Uttar Pradesh (UP). UP is India’s most
populous state with 190 million people, and rural households have low ownership of computers (0.2%) and televisions (1.5%) (International Institute for Population Sciences (IIPS) and Macro International (c) 2008). For a fee of 50Rs (approximately USD$1.10), patients were able to consult with Indian allopathic physicians at centralized facilities in New Delhi and Patna at rural village-based telemedicine provision centers (TPCs) through proprietary ReMeDi software and peripheral equipment (Neurosynaptic 2008) (Figure 1). Telemedicine consultations were through a synchronous audio and video streaming connection online over satellite or DSL Internet. Each TPC had basic diagnostic capabilities that can be digitally transmitted through the telemedicine system. These included a thermometer, electrocardiogram, blood pressure cuff, stethoscope, and in the future, ultrasound. Printed prescriptions and laboratory tests were given to patients. Commonly prescribed medications were branded and supplied by WHP and sold locally.

TPCs were franchised to local entrepreneurs who were RHPs themselves or married to a RHP. These RHPs already had an existing patient population that consulted with them. In addition, TPCs were social franchises (Schlein, Kinlaw et al. 2010); the profit generated from the telemedicine consultation fees and the sales of drugs served as an incentive for the providing and marketing of family planning services and products. All appropriate women were counseled on family planning options. A more detailed project description is described elsewhere and online (http://www.worldhealthpartners.org).

In order to provide family planning to women in conservative rural India, TPCs were specifically designed and marketed as a credible health resource for women. Services were locally based which would overcome geographic barriers and travel limitations that rural women face in accessing many healthcare facilities. Furthermore, TPC advertisements were marketed to women, franchises were female-owned, and female physicians and TPC entrepreneurs were available for telemedicine consultations. The need to reach RA women in rural India for essential health services combined with the dearth of research on patient telemedicine experiences makes them an important population to study.

Methods:

From March – July 2010, 22 semi-structured patient interviews were completed in the districts of Meerut, Muzaffarnagar, and Bijnor in western Uttar Pradesh, India. These patients had consulted from 14 TPCs and resided in 17 different villages (Table 1). Criteria for female patients to be interviewed included those who were married and of reproductive ages and consulted at telemedicine provision centers within the past 3 weeks. This time frame was chosen to minimize issues of recall and to allow sufficient time for patients to follow-up with laboratory tests and medical treatments. Patients were randomly chosen from all 3 project districts and within TPCs categorized into tertiles (“low,” “medium,” and “high”) based upon the number of consultations that were completed in the past 3 months. This sampling was utilized to account for varying, recent TPC activity levels in their communities and would likely represent a diversity of patient experiences in seeking healthcare at telemedicine facilities.

All interviews were conducted in Hindi in patient households by an Indian female research assistant who was also from Uttar Pradesh. Prior to interviews, the research project and interview topics were discussed with the patients and informed consent was obtained. The semi-structured interviews probed on their socio-demographic characteristics, experiences during the
telemedicine consultations, past health seeking behavior, and their expectations of “good” healthcare services. Interviews were digitally recorded and transcribed into English. ATLAS.ti software (v.6.2) was used to code and analyze the transcriptions in accordance with grounded theory principles. Data collection and analysis were done concurrently, and revisions to the semi-structured guide were made to obtain more detailed information about the patients’ concepts of health and issues of good medical care.

Results:

Exploring multiple sources of healthcare for long term relief

“There are so many doctors in the world, if one is not giving relief then we consult another one. We cannot sit to only one and eat his medicine only.”

- Patient 3 in her final statement before ending the interview

One theme that emerged during analysis was the seeking of healthcare from multiple providers to address their need for relief. Despite consulting at TPCs for a primary medical complaint, the interviewed women actually described suffering from a range of other issues for extensive periods of time (Table 1). In their search of relief from their ailments, they visited multiple providers since their satisfaction was either short-lived or non-existent from their previous treatments. In these instances, medical pluralism refers not only to the range and number of public facilities, private hospitals consulted at and rural health providers consulted with but also the varying systems of medicine practiced as well. In their seeking of healthcare, however, the systems of medicine practiced and the provider qualifications were less of a consideration than the relief that they ultimately sought.

Some interviewed women expressed being cognizant that the RHPs that they had consulted with lacked formal training and credentials. They consulted regardless, and reasons for doing so varied and included having trust in the treatment of RHPs because of their long standing practices in the community, recommendations by family members, and past experiences with them. Sub-themes of divine intervention, fatalism, and eventually finding relief in seeking healthcare from multiple sources also emerged during interviews. Relief or lack of from medical conditions was attributed to God or chance. For one particularly pious Muslim woman, medicine could be prescribed by medical providers who were human, but it was “God’s will” that ultimately decided who would experience relief. For others, it was believed that providers could not cure everyone, and relief was expressed in terms of “destiny” or “chance.” This was captured by Patient 8, who did not experience relief after consulting at the TPCs and with local RHPs as well as trying home remedies for her condition of 3 years.

“Sometimes it [spending money on healthcare] doesn’t give any benefit….Like in your shop 10 customers are coming but 5 are getting relief only, if somebody has to get relief then he gets it from mud, but if it is not relieving then ash is useless. This is all things.”

50
Only by exploring multiple sources of healthcare, however, would their chances increase of eventually obtaining relief.

Overwhelmingly, RA women were seeking healthcare for a type of relief that was permanent; a “cure from the root” was a phrase commonly expressed. Permanent relief was of critical importance and a high priority in their health seeking behavior. To illuminate how important this relief was to them, women made grandiose claims about the lengths they would hypothetically undertake to achieve such relief. They described their willingness to consult with any provider, try any treatment, travel lengthy distances to any facility, and spend exorbitant amounts of money on medicines and tests— all of which “do not matter” but with the caveat being that their efforts had to lead to permanent relief. These extravagant claims, however, were tempered by their limitations when actually seeking care. The costs of healthcare, their lack of control over household finances, their difficulties in traveling distances, and their inability to consult alone were all expressed as barriers and are consistent with previous health seeking behavior literature. This tension between their health seeking limitations and their extravagant claims of what they would be willing to endure are an indication of how strong of a priority they assigned to permanent relief.

Financial reasons emerged as their primary motivation for seeking permanent relief. They did not want to be burdened with their medical conditions and lose time and money in continuously seeking treatment. Women described their households taking loans from the village lender and mortgaging their farmlands to cover their healthcare costs. Patient 20 estimated spending upwards of 50,000Rs on her healthcare costs despite coming from a poor household that struggled to have 2 meals a day. Some proclaimed that no expense was too great for a permanent cure while others lamented about the financial burden placed upon their households by their medical expenses for ineffective treatments. The value assigned to the money spent on healthcare costs was directly linked to if they experienced permanent relief. If the consultations did not result in relief, it produced “sorrow” or “pain” and money was “wasted”. If medical treatments were successful, however, then the money spent was ultimately worth it.

*Health is everything and is needed for responsibilities*

“Health is important otherwise who will do the work. If health is not fine then who will run the house, my family. Someone is constructing their house in my neighborhood and there is so much of dust and mess because of that and suppose if my house is dirty and you come, what will you say ‘oh ho, her house is so dirty’ so I need to clean it. Therefore, everything else comes later but health comes first. Everything is related to health, either reading, writing, running home...everything.”

- Patient 20 who faced enormous family pressure to have children but has been infertile for 13 years
Probing on reasons for the importance assigned to permanent relief provoked strong responses on the need to be healthy for the interviewed RA women. Health was everything. Good health was necessary for all aspects of their lives, but this need was not expressed in individualistic terms but instead in the context of their ability to function in their households and families. Interviewed women were fearful that poor health would render them “useless” and prevent them from fulfilling their responsibilities which included work, household chores, and raising their children. Being incapacitated and unable to contribute in their households was to be avoided at all costs. It would be disruptive to not only their physical well-being but, more critically, in their roles in their families and in their relationships with other family members. Being unproductive because of illness could potentially cause conflict among household members. As is customary in rural UP, married couples reside in their husbands’ villages in extended households often with domineering mother-in-laws. This was captured by the experience of Patient 17, a 30 year old Muslim woman housewife who suffered from multiple medical conditions including TB.

“...if disease is inside then life is worst. If a person is ill and not able to get up, then how could she complete her domestic work and the responsibilities of children. And if I am ill everytime and work is not taking place as per their timings then fights between my mother-in-law and me and with others also starts in the home. So we have to think, everything is for the family.”

These priorities of seeking permanent relief and the need for good health to fulfill their responsibilities and family roles give context to interviewed women seeking healthcare at facilities including at TPCs.

**Telemedicine: a new but unknown healthcare resource to test**

“I thought that I am going for treatment and if I would get relief then I would take treatment further from here [at the TPC] and if not then again go for the place from where I have been taking treatment since long and this was the thinking I have.” [upon additional probing on her reason for going to TPCs]

“We have gone there to take a chance of taking treatment from a computer doctor who is coming from Delhi to villages, and there must be something when a doctor is giving treatment on computer from Delhi. That is why I have gone there, that he would definitely tell us any problem.”

– Patient 10 who suffered from head and leg pain, but chose not to reveal medical issues of her head during the TPC consultation

New among the spectrum of available services in their communities, telemedicine was another healthcare option to be explored. Interviewed females came to know about telemedicine facilities through posters, microphone announcements, or other advertisements in their villages,
through word of mouth from family members and peers, and from the TPC entrepreneurs themselves with whom they may previously had non-telemedicine consultations with. The possibility of being able to consult with a “city” doctor was attractive to some of the interviewed patients. Interestingly, despite heavy promotion about the availability of consultations through computers with a doctor based in New Delhi, a few women lacked any concept of computers prior to their consultations or that the telemedicine doctors would be based elsewhere. They consulted at TPCs merely to explore the possibility of treatment from a new medical resource in their communities.

Some women also revealed that they suffered from multiple illnesses and symptoms, but did not discuss all of them with the telemedicine physicians. They wanted to determine if the telemedicine physicians could help with one first before revealing the other. There was a need first to establish “faith” and trust in the consultations at TPCs. Similarly, this may have factored into their decisions for many women to not follow-up with laboratory tests. In India, it is common medical practice for doctors to prescribe some medications before having test results so that patients will not leave feeling unsatisfied by the consultation. In some instances, women revealed that they took the medicines prescribed by telemedicine physicians to see if the prescribed treatment would first be effective and did not follow-up with ordered tests.

Although patients were testing the effectiveness of medical treatment from the new healthcare resource, saving money was a major factor in the lack of follow-up. One female patient from a below poverty line household described how her husband, who had control of the finances, was unwilling to spend additional money on an ordered X-ray without first knowing the effectiveness of the prescribed medications. Another female patient who did not obtain relief from the prescription and did not follow-up with tests characterized her desire to save money as being “greedy” and was a “bad” thing. She admitted that to not completely fulfilling the instructions by her telemedicine doctor to get laboratory tests done (at added expense) which could have changed her treatment regimen and possibly her outcome. It was an attempt to obtain relief at minimal expense.

**Fear of the unknown: consulting through telemedicine**

“Yes, my heart was shivering when they [computer doctor] have started talking on the computer. My heart was shivering at that time, and when I reached there [at TPC], I again got faint due to thinking about the computer. My heart started shivering even thinking about the smallest thing.”

– Patient 13, a 40 year old woman who had never seen a computer before but knew that the TPC used them for telemedicine consultations

The telemedicine consultations produced intense feelings of fear in many interviewed women before and during their consultations. They often used wording such as physically “shivering,” “shaking,” and being “petrified” to describe their fear while enroute to the TPCs. Their unfamiliarity with computers resulted in anxiety. The interviews revealed that it was not a
fear of the technology itself that provoked their feelings, but rather it was the uncertainty of how to communicate through this new technology. This was evident in the phrases used to describe their experiences which included worrying about “speaking wrong,” “making a mistake,” “wondering how should I talk,” and it being “scary to talk.” It was the physical act of communicating through an unknown medium that caused their fears. One patient recalled opening her mouth but feeling that the wrong sounds came out because of her discomfort with the equipment in communicating with the telemedicine doctor.

To counteract this fear in communicating through the telemedicine computers, TPC entrepreneurs or relatives were asked to speak on the behalf of patients instead. For others, the prospect of treatment and the encouragement by the RHPs and telemedicine doctors gave them the “courage” to overcome their fears and speak “openly.” Many of the female patients recognized that their fear of a computer was largely due to their using it to communicate for the first time. While waiting for the telemedicine video stream to load, Patient 7 recalled wondering how exactly would the telemedicine doctor “come” to consult with her. At the exact moment seeing her “photo” on the screen as well as the telemedicine doctor’s video image, she immediately realized how they would communicate via the computer. Similar to other women, her fear abated after gaining some experience, and they expressed confidence for future telemedicine consultations once the unknown became more recognizable.

For some women, relating telemedicine and computers to technology already familiar to them also lessened their fears. The telemedicine microphone for instance, was often referred to as a “phone” during the interviews since it served the same function as a device where one would have to speak through it to be heard. “Why should I be scared to talk through a phone?” was a rhetorical question asked by women who were unafraid of using the telemedicine equipment. Video images on the computer screen also were referred to as “photos.” Despite the low prevalence of televisions in rural UP households, all of the interviewed women also had seen a television previously. Comparisons of the telemedicine consultations as being analogous to watching television were made but with a key difference. It was the process of having to interact through this unfamiliar technology that created fear. This difference and their fear of speaking were exemplified by Patient 13, an educated woman who consulted at the TPC at the behest of her husband-

“it was running like TV, but I was scared while speaking on it. I was thinking what should I say and how to speak on it. Although we’ve seen TV, we couldn’t understand how to speak on it at the first time.”

[upon further probing on the differences between the telemedicine computer and tv]

“Ya, on TV we cannot talk to people, they are also not solving anything. We can only see and listen to them, and the heart is not perplexing. But here on the computer when we know that we also have to speak then the heart must be perplexed with the thinking what should I say. We should not say anything wrong… so I was feeling like this.”

The interviews revealed that after some experience using the telemedicine system, women compared communicating during the consultations with the same ease as the face-to-face
interviews. This was unexpected and surprising given the reports of dropped consultations and the audio/video issues from the RHPs operating the TPCs. Difficulties in communication because of technical issues in audio/video quality and format during consultations specifically were probed, but the communication issues women brought forth during the interviews were all related to consultations with providers and not with the telemedicine technology itself. For some, interviewed women had issues with understanding providers’ regional accents or medical jargon. Terminology for illnesses, symptoms, and physiology differed in rural villages, and patients heavily relied on telemedicine RHPs as mediators for describing their medical problems, answering and asking questions, and receiving instructions from telemedicine doctors.

*Fear of being judged by doctors*

“Fear is... I don't know what she will think of me when I speak to her, what type of doctors are they on computer. But now I won't be frightened as now I understand how to talk and what type of doctors are they. Now I would speak to them much.”

– Patient 18 who suffered from continuous menstrual bleeding but did not consult anywhere for 6 months in hopes it would stop by itself.

In addition to a fear of speaking through the telemedicine system, a second theme of fear emerged. The interviews revealed a fear of speaking to doctors that was unrelated to telemedicine but to the patient-provider interactions during the consultations. Many knew that the telemedicine doctors were from Delhi, and they were frightened by the uncertainty of what type of questions would be asked by the “big” or “city” doctors. Patients described a fear of being judged by doctors which stemmed from their feeling ashamed of their health problems, particularly by those consulting with reproductive health problems. A patient with pelvic inflammatory disease and another with a miscarriage described their family’s reluctance to allow them to consult with any provider and not just at TPCs for concern about what others would say. In part, the interviews also revealed that some fears of consulting with any medical provider alone and a need travel with a male relative accompanying them was associated with a fear of being “rebuked” by the doctor. These fears were also present regardless of their doctor’s gender. Although greater than a third of those interviewed had consultations with male telemedicine doctors, they described being afraid enroute to their consultations before knowing who their doctors would be. Similar to their unfamiliarity with computers and telemedicine, their feeling fear of being judged by the telemedicine doctors resided after the actual telemedicine consultation. Patient 15 recalls the RHP operating the TPC repeatedly encouraging her to speak “openly” since the telemedicine doctors are “human beings just like you and me,” which encouraged her to speak.

On the other hand, interviews revealed that women also adopted a much more confident, practical stance when interacting with the telemedicine doctors. Despite some self-describing themselves as “shy,” they were unafraid to discuss their illnesses openly to providers particularly
in times of emergencies which they considered their health problems to be. In contrast to other women, they felt unashamed to discuss their health issues. If they did not speak up and fully share everything about their issues, then doctors would be incapable of making accurate diagnoses and prescribing effective medicines. This was depicted by Patient 3 who also was unafraid of speaking through the computer and telemedicine equipment:

“No, if [a health] problem is there then I can talk anywhere. When we can talk on the phone then in the same way we can speak on the computer and talk like we’re talking now. She [the telemedicine doctor] was sitting there on the computer and here I was sitting on the computer and then I had a talk with her.”

[patient later continues]
“If she was trying to solve my problem, asking me questions then couldn’t I say anything to her? Like you are asking me my problem then shouldn’t I tell you my problem either by phone [microphone] or by mouth? I was using the phone to talk to her and she was speaking like you without the phone so I have spoken like this only.”

TPCs were deemed to have an appropriate environment for medical care for women. While “female problems” that she discussed with telemedicine doctors could be misconstrued by strange males, but others were confident that they could ask any strange males to leave the consultation room.

**Telemedicine and good medical care**

“I have told to everyone that we spend so much conveyance for consulting a doctor in a city but here the doctor has done the same check-up like others by checking eyes, face and I felt everything like you and me are sitting here. She [telemedicine doctor] was asking me my problem, checking me, understanding everything when the problem happened to me, how it happened… my heart was very satisfied listening to her and seeing her. I thought that how nicely they are asking the questions and then understanding them, she is a Delhi doctor also and cheap also because farmers work on loss [meaning she loses wages by taking time to consult].”

- Patient 13

Interviews probed about what good medical care meant to the women and how did their experiences at TPCs compare. A wide range of attributes of good medical care were given, but some common themes emerged. Clearly there was an expectation that good medical care would cost money. Women described their families having to take loans and mortgaging land to pay off their exorbitant healthcare costs. Common wording used and its variants were that “there is no value to money” when describing the costs relative to the value associated with their health. This
phrasing did not mean that financial considerations when seeking healthcare were trivial, but rather it was used to emphasize the expensive lengths that they would through in paying for good healthcare as a need. “Health is everything” was commonly repeated like a mantra. Still though, the cost for good medical care was an important consideration. Women cited the advantages of saving on travel time and costs by consulting at a TPC locally instead of other more distant healthcare facilities. They felt that consulting at the TPC, despite the fee, was actually cheaper and provided the same check-up as other healthcare facilities. For others, the issues of pharmaceutical supply and testing availability, both unrelated to telemedicine itself, were important factors in their perception of the benefits of consulting at TPCs. If prescribed medicines were unavailable in their village or if they had to travel to a nearby town for laboratory tests, they felt frustrated that the TPCs did not save them on time or travel costs.

In regards to the consultations with telemedicine doctors, one such theme that emerged was that the women wanted them to speak “nicely.” From their perspective, this meant having telemedicine physicians speaking clearly, encouraging them to respond, and taking case histories. Wording such as “slowly-slowly” was used during interviews; they used repetition in Hindi for added emphasis. In this context, “slow” referred not only to the speaking speed to better understand the questions and responses but also a thorough case history that was not rushed as well. Women wanted to feel that their problems were well understood and that they clearly understood the doctors. However, the interviews also revealed another experience of female patients regarding case histories. Doctors asking questions while taking case histories were of less importance to some women who also preferred an immediate diagnosis without physical touch.

Women vastly differed on the importance they assigned to physical touch by providers. Some felt that the importance depended on the type of medical condition they sought care for and that telemedicine physicians directing the TPC RHPs to use the telemedicine equipment on them were an adequate substitute. One patient deemed any physical interaction between her and any male provider to be highly suspicious in motive and preferred not to be touched altogether. Others wondered how a check-up would be performed through machines, and some were indifferent to the physical touch by a physician. The voicing of either strong support for or against the importance of physical touch by telemedicine providers, however, was directly linked to whether or not they experienced relief from their consultations. Those who did not experience relief felt slighted by consulting at TPCs because of the inability of the telemedicine doctor to physically “feel” their disease. This was captured by Patient 22, the wife of a RHP operating the TPC who was very upset with the outcome of her telemedicine consultation as well as the lack of patients at her TPC as a business-

“She [the telemedicine doctor] has told me by not touching that it [her medical condition] was worse, everybody else [other doctors] has touched it. She has told me just by seeing the report, then it means she was just like a fake doctor. I was very hurt at that time, and I told her that you are sitting there uselessly.”

In contrast, some women likewise preferred a lack of physical interaction because this was an indication of the clinical superiority of the physician. If a doctor knew immediately what health
condition they suffered from immediately, then this doctor was an omniscient expert. This perspective was best represented by Patient 2-

“Because who else is much better than them [doctors] as they are telling about the disease without touching it. That doctor is not worthwhile who is telling everything after asking us about the disease. In this way, anyone can get the medicine by telling the symptoms and get it by just sitting ideally at home. Any doctor can give the medicines in this way but a good doctor is the one who can tell the disease without touching it.”

Upon asking a general question about “good” medical care at TPCs, interviewed women without hesitation equated “good” medical care with “good” medicines- a clear indication of the importance assigned to medications in seeking healthcare by these patients. “Good” medicines were those providing the much needed relief that they were seeking. Preferences for medicine “type” were based on their perceptions of the intensity of pain suffered, type of relief given, the possibility of side effects, and the length of time the medication would take to have an effect. The themes of health being needed for responsibilities and the seeking of permanent relief likewise factored into women’s’ preferences for medicine types.

Some women preferred “English” or allopathic medicines for their apparent ability to give instant relief to their medical problems, often those that were described as being “big” or serious. A patient who described her migraine attack as “6-6 people pressing on my head” wanted allopathic medicines for instant relief to her serious health condition that led to her losing consciousness. By some, allopathic medicines also were deemed to be unhealthy. In their adjectives used to describe allopathic medicines, women referred to them as being “strong,” “hot,” and “harmful” because of their potential for side effects like nausea, drowsiness, and swelling. These were viewed both positively, because it indicated that the medicine was having an impact, and negatively, which was far more common, since it could interfere with the ability to work. The side effects of allopathic medications were often equated with the “creating” of another disease leading some patients to question the futility of taking medication for one problem only to cause another. In contrast, “Desi” or ayurvedic medicines were perceived to be “weak” and to work “slowly-slowly” which meant that they didn’t have side effects, and they were taken for longer durations. Most importantly, ayurvedic medicines were thought to cure problems “from the root,” a highly desired outcome, and the same expression that was used to describe the permanent relief that they sought.

Despite stating having preferences, medicines, and by extension medical care, at TPCs were judged to be “good” if they had provided the women with relief. “All that matters is relief” was repeated throughout interviews. TPCs were yet another medical resource available among a spectrum of options in their community, and seeking healthcare there meant trying a different medicine to the interviewed women. Although telemedicine doctors were allopathic physicians, RHPs were not necessarily invested in one system of medicine or another. Drugs of varying quality and types were widely available in rural villages, and RHPs typically sold medications as well. A wide range of outcomes were reported, and female patients felt satisfaction with the telemedicine consultations if they experienced the relief that they sought.
Conclusion:

As a new technology, it was unclear how acceptable telemedicine would be for women in rural UP: a conservative environment with low levels of households owning computers and televisions. Previous published reports have described the implementation of telemedicine projects and patient descriptions in developing countries such as India. However, they lacked a crucial perspective- the experiences of telemedicine patients. WHP’s telemedicine project specifically targeted reproductive age women, a population that faces cultural and geographic barriers to health services. In order to provide family planning, however, TPC services had to be acceptable to rural women. If the TPCs had a reputation of being unacceptable for women to seek healthcare at in conservative Uttar Pradesh communities, they wouldn’t have been able to attract clients for family planning services. Although telemedicine research on patient experiences is lacking, ample research has investigated the health seeking behavior of rural RA Indian women. Under this framework, this study attempted to gain insight into their experiences at TPCs and how they related to women’s perceptions of good medical care.

This research has revealed that women consulted at TPCs in search of permanent relief to their health problems, some of which they have suffered from for extended lengths of time. To these women, good health was absolutely essential not just for them as individuals but more critically, for their household responsibilities as well as for their roles within their extended families. Although these themes were strongly expressed during telemedicine patient interviews, public health research on the health seeking behavior for rural Indian women has not thoroughly delved into this area. A study of 3000 households in rural areas of 5 states including UP found that “key indicators of sickness were an inability to move and work and loss of appetite or interest in surroundings” which influenced provider choice and health seeking behavior (Chirmulay 1997). Rohde and Viswanathan wrote of “rural discussions where people speak of the fact that they could not carry out their normal activities and that pain or weakness was disrupting their work” as a cue to seek medical care (Rohde and Viswanathan 1995). In a book examining Indian women, work, and their health, it was concluded that women sought healthcare not for themselves as individuals, but as a “means to preserve and sustain their capacity to work” (Swaminathan 2005). The results of these qualitative interviews with RA female telemedicine patients reaffirm that their perspectives on their need for good health is a key factor in their health seeking behavior. The extent of this phenomenon, whether or not it persists in populations who did not seek healthcare from TPCs is unknown and is a future research area to explore.

While being new and unfamiliar, this research also revealed that interviewed RA women were concerned less with the telemedicine technology itself, but more with the greater context of it functioning as a local healthcare resource. In regards to “good” medical care, issues of medicine and laboratory testing availability and healthcare costs were brought up as were the advantages of savings on travel time and consultations with “city” doctors. TPCs, however, were judged by the only criterion that ultimately mattered- if the women had effective relief. While the services and procedures at TPCs may have conformed to their expectations, their perspectives on TPCs as a health resource were decidedly practical; the telemedicine consultations either worked or they did not. In conclusion, future telemedicine projects must consider that it’s not the technology itself, but the underlying context in which it is implemented in that will be the instrumental factor in determining success.
Tables and Figures:

Figure 1: Telemedicine consultation and ReMeDi equipment

Table 1: Characteristics of interviewed reproductive age women, Uttar Pradesh, India

<table>
<thead>
<tr>
<th>Patient Interview</th>
<th>TPC utilization</th>
<th>Age</th>
<th>Religion</th>
<th>Number of children</th>
<th>Occupation</th>
<th>Education</th>
<th>Main medical condition</th>
<th>Length of time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>middle</td>
<td>45</td>
<td>Muslim</td>
<td>&gt;3</td>
<td>Laborer</td>
<td>no education</td>
<td>allergies</td>
<td>1 year</td>
</tr>
<tr>
<td>2</td>
<td>middle</td>
<td>30</td>
<td>Muslim</td>
<td>&gt;3</td>
<td>Contractor</td>
<td>Koranic only</td>
<td>antenatal, fever, neuromuscular pain</td>
<td>3 months</td>
</tr>
<tr>
<td>3</td>
<td>low</td>
<td>40</td>
<td>Hindu</td>
<td>&gt;3</td>
<td>Laborer</td>
<td>no education</td>
<td>fever</td>
<td>seasonal over years</td>
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<tr>
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<td>low</td>
<td>45</td>
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<td>&gt;3</td>
<td>Laborer</td>
<td>no education</td>
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<td>6 years</td>
</tr>
<tr>
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<td>40</td>
<td>Hindu</td>
<td>3</td>
<td>Agriculture</td>
<td>no education</td>
<td>neuromuscular pain</td>
<td>3 months</td>
</tr>
<tr>
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<td>middle</td>
<td>25</td>
<td>Muslim</td>
<td>2</td>
<td>Housewife</td>
<td>no education</td>
<td>dizziness, headache</td>
<td>15 days</td>
</tr>
<tr>
<td>7</td>
<td>high</td>
<td>27</td>
<td>Hindu</td>
<td>3</td>
<td>Housewife</td>
<td>primary</td>
<td>TB</td>
<td>2 years</td>
</tr>
<tr>
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<td>35</td>
<td>Muslim</td>
<td>&gt;3</td>
<td>Housewife</td>
<td>Koranic only</td>
<td>reproductive health</td>
<td>3 years</td>
</tr>
<tr>
<td>9</td>
<td>middle</td>
<td>35</td>
<td>Hindu</td>
<td>3</td>
<td>Housewife</td>
<td>some secondary</td>
<td>ear condition</td>
<td>15 years</td>
</tr>
<tr>
<td>10</td>
<td>high</td>
<td>30</td>
<td>Hindu</td>
<td>2</td>
<td>Housewife</td>
<td>some secondary</td>
<td>helminthiasis/neuromuscular pain</td>
<td>3 months/3 years</td>
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<td>11</td>
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<td>38</td>
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<td>antenatal, reproductive health</td>
<td>1 year</td>
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<td>no education</td>
<td>allergies, bronchitis</td>
<td>12 years</td>
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<td>22</td>
<td>Hindu</td>
<td>0</td>
<td>Housewife</td>
<td>secondary</td>
<td>antenatal, reproductive health</td>
<td>4 months</td>
</tr>
<tr>
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<td>middle</td>
<td>30</td>
<td>Muslim</td>
<td>2</td>
<td>Housewife</td>
<td>no education</td>
<td>reproductive health, TB</td>
<td>2 months</td>
</tr>
<tr>
<td>18</td>
<td>high</td>
<td>35</td>
<td>Muslim</td>
<td>&gt;3</td>
<td>Housewife</td>
<td>no education</td>
<td>reproductive health</td>
<td>6 months</td>
</tr>
<tr>
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<td>30</td>
<td>Muslim</td>
<td>1</td>
<td>Housewife</td>
<td>no education</td>
<td>neuromuscular pain</td>
<td>10 years</td>
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<td>0</td>
<td>Laborer</td>
<td>primary</td>
<td>infertility</td>
<td>13 years</td>
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<tr>
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<td>30</td>
<td>Hindu</td>
<td>1</td>
<td>Agriculture</td>
<td>higher secondary</td>
<td>migraine, anxiety</td>
<td>2 years</td>
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<td>low</td>
<td>22</td>
<td>Hindu</td>
<td>0</td>
<td>RHP</td>
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<td>reproductive health</td>
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References:


Conclusion

While this telemedicine and family planning social franchising project lacked a formal quantitative impact evaluation: namely a population-based baseline, follow-up surveys and a comparison group, several inferences can be made from the research presented in this dissertation. First and foremost is the proof of concept of WHP’s social franchise model. The profits generated from telemedicine consultations and drug/family planning product sales can be used to leverage local resources to provide healthcare services and family planning on scale in rural Uttar Pradesh communities. This project succeeded in building a programmatic structure to deliver modern family planning using private, informal rural health providers in a region lacking such services. This social franchise project was the first of its kind and involved a project area of over 1300 villages and an estimated population in excess of 6 million: a substantial size for a “pilot” project.

While telemedicine consultations have steadily declined among the centers from their start date, the driving force behind this trend is unclear. This decrease may be due to the actions of the rural entrepreneurs as they are health providers in rural communities themselves. The telemedicine system serves both to attract clients as well as a potential competitor for patient services. Despite the decreasing consultations (and therefore revenue generated for entrepreneurs), the family planning targets were still achieved. In theory, this should have removed the leverage that WHP had on rural entrepreneurs to provide family planning services. Financial profit may have not have been the only motivation of rural health providers, however. In interviews, rural health providers suggested that increased community prestige and affiliation with a larger organization gave them an appearance of legitimacy as healthcare providers. Another possibility is that the rural health providers learned how to treat patients from observing the consultations with qualified MBBS telemedicine doctors and convinced patients to bypass the telemedicine system altogether. Patient interviews as well as past research (Rohde and Viswanathan 1995) have shown that the rural health providers are held in high regard in rural communities and have significant influence on patient consultations. To better understand their motivations and patient clientele, further exploration of rural health providers is warranted.

On the otherhand, there is a possibility of decreased patient demand for health services from TPCs. As a new medical resource in rural communities, patients may have explored telemedicine as part of their “healer shopping,” the seeking of healthcare from multiple sources either serially or concurrently. From the qualitative interviews with rural women, it is apparent that many were testing telemedicine as a new healthcare resource for long-term chronic conditions. Some expressed dissatisfaction of the healthcare provided since it didn’t provide the permanent relief to their conditions that they were looking for. Without a formal impact evaluation or regular client satisfaction surveys, however, it is not possible to thoroughly assess the perceived quality of care at telemedicine provision centers or patient satisfaction over time.

Overall, telemedicine provision centers were highly successful in attracting female patients as 56% of those who consulted were women. In rural Uttar Pradesh, reproductive age women are a population in need of critical services and face substantial barriers to healthcare. Women are especially sensitive to lengthy travel distances, and they are a population that would greatly benefit from the availability of local health services through telemedicine. The travel distance from a patient’s residence to telemedicine facility has an enormous impact on their utilization. Spatial analyses reveal, however, that the placement of TPCs was sub-optimal. The
90% catchment area for TPCs for reproductive age women was 4.9 kms. TPCs were initially established and spaced according to an assumption of 10 kms, a distance over twice that of the actual catchment area for female patients. Location-allocation models demonstrate that there were likely villages in the project area that could have benefited from having telemedicine facilities geographically closer to them. In other words, there were villages in the project area that were not adequately being serviced. Whether or not a shorter distance to TPCs would have led to an increase in family planning for the project, however, is unclear. The relationship between geographical distance and the utilization of family planning has not been clearly defined in past research and is a matter of debate.

From the qualitative patient interviews, healthcare through telemedicine was acceptable to rural women in culturally conservative Uttar Pradesh, a population with limited previous familiarity with computers and Internet technologies. Although many experienced an initial fear of the computers and speaking with an unfamiliar doctor, these subsided with experience. For the most part, the consultations and services provided at telemedicine provision centers corresponded with their expectations of good healthcare. The importance of a physician’s physical touch for diagnosis, however, differed among the interviewed women with some preferring to be touched and others preferring to be told what was wrong with them without any questions or being touched. Overall, the only thing that was held in utmost importance for these women were to experience relief, and it was on this basis that the telemedicine provision centers were ultimately judged.
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