

Patriarchy, Maternal Health and Spiritual Healing: Designing Maternal Health Interventions in Pakistan

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ABSTRACT

We examine the opportunities and challenges in designing for maternal health in low-income, low-resource communities in patriarchal and religious contexts. Pakistan faces a crisis in maternal health with a maternal mortality ratio of 178 deaths per 100,000 live births, as compared to the developed-country average of just 12 deaths per 100,000. Through a 6-month long qualitative, empirical study we examine the prevalent beliefs and practices around maternal health in Pakistan, the access women have to health-care, the existing religious practices that influence them and the agency they exert in their own health-care decision making. We reveal the rampant misinformation among mothers and health workers, house-hold power dynamics that impact maternal health and the deep link between maternal health and religious beliefs. We also show how current maternal health care interventions fit poorly into this context and discuss alternate design recommendations for meeting the maternal health needs of these women.

Author Keywords

Maternal Health, Patriarchy, Pakistan, HCI4D

CCS Concepts

•**Human-centered computing** → **User centered design;**
Field studies; Empirical studies in HCI;

INTRODUCTION

The risk of a woman dying as a result of pregnancy or childbirth during her lifetime is approximately 1 in 180 in developing countries as compared to 1 in 4,900 in developed countries [41]. Particularly in Asia and the Pacific region poor maternal health remains disproportionately high, with the average ratio of maternal deaths to live-births (or maternal mortality ratio) at 239 deaths per 100,000 live births, compared to the developed-country average of just 12 deaths per 100,000. In 2015, approximately 85,000 women in Asia died

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due to causes related to pregnancy or childbirth and up to 90% of these deaths were preventable through better maternal health care. Even more disturbing is that 9 out of every 10 maternal deaths in Asia-Pacific occur in just 12 countries: Afghanistan, Bangladesh, Cambodia, India, Indonesia, Laos, Myanmar, Nepal, Pakistan, Papua New Guinea, the Philippines and Timor. Although Bangladesh, Indonesia, Laos and Timor are all on track to meet the Sustainable Development [60] target of less than 70 deaths per 100,000 live births (as set by the UN), Pakistan, Myanmar and Papua New Guinea are the only countries remaining where progress has been exceedingly slow. Given the current trend with 178 per 100,000 deaths, Pakistan will not be able to meet the target for the next 26 years [1].

Studies into the causes of high maternal mortality rates in developing countries report the main direct cause to be post-partum hemorrhage which can be linked to non-attendance or late arrival in a health facility. Reasons for this delayed care include a lack of recognition of signs, symptoms, and severity of the situation, the use of traditional and unskilled birth attendants, low female literacy levels, delayed access to transport, hardships of long distance and physical terrain, delayed prompt quality emergency obstetric care and delayed care while at the hospital [29,46,52,57]. Thaddeus and Maine further elaborate that in most cases if prompt and adequate treatment is provided, adverse outcomes can be avoided [57].

In religious and patriarchal contexts like Pakistan [21, 30, 32] where women have limited agency, these risk factors are further exacerbated. Inherent attitudes of a patriarchal society, where men are superior to women combined with a religious thought process where women are to be monitored and controlled create daunting barriers for women in seeking appropriate and timely health services [34]. According to a recent UNICEF report, 1 in 12 young women (20 – 24 years) in Pakistan have given birth by the age of 18, Only 38% of deliveries among mothers with no education have a skilled attendant at birth, compared to 57% and 92% of deliveries among mothers with primary and higher education [59]. Although, in recent years there has been a concentrated effort to create mobile-phone based interventions to combat the high maternal mortality numbers for low-resource communities in developing countries like India, Kenya, Bangladesh and Ghana [3, 24, 36, 40, 44], there is little exploration of the complex structures that govern female health and well-being in

patriarchal contexts. Equally important is an understanding of the influence of religious and spiritual beliefs and traditional healing practices on maternal health care and its outcomes. Any intervention targeted towards women in developing, religious and patriarchal contexts like Pakistan must be cognizant of the specific challenges women face and at the same time engage with the traditional health and well being practices of women in these communities.

Our work lies at the intersection of HCI for development (HCI4D), mobile computing for health (mhealth) and feminist HCI. Drawing on qualitative data collected through a six month long study involving focus groups and expert interviews with 41 low-income, low-literate women we explore the complex landscape facing HCI designers that seek to create maternal health interventions in patriarchal contexts amid deeply rooted traditional health practices. Our work identifies opportunities and constraints for the design of maternal health interventions for low-literate, low-income Pakistani women.

There is little that the HCI community can do about the need for increased primary health care facilities, hospitals, transportation, skilled birth attendants and poverty levels in low-resource communities. We can however, be cognizant in our intervention designs of the unique constraints placed upon women in patriarchal cultures that have a direct impact on their health, the health of their newborns and the longevity and quality of their lives. In this work we seek to sensitize the community to these constraints and the existing religious and spiritual health practices which play an integral role in the health-related decision making of low-income Pakistani women. First, we present an in-depth description of systemic challenges that low-income, low-literate Pakistani women face, their main sources of information on maternal health and well-being, and their current health care practices (western, traditional and spiritual). Second, we explore the agency women exert in their own health-decision making and the power dynamics within a household that have a direct impact on maternal health outcomes. Third, we build upon our qualitative data to present insights into why common mobile maternal health interventions are a poor fit for these women. Fourth and lastly we present specific design guidelines for maternal health care in this context and expand the framework proposed by Sultana et al. [54] for designing within a patriarchy. The ultimate goal of our work is not to present a definitive solution to addressing the maternal mortality challenge but to discuss how HCI design and research can benefit from a deeper understanding of the nuances and politics of health and well-being within patriarchal and religious contexts.

RELATED WORK

In recent years there has been a focus within HCI on exploring technologies in relation to women's health and well-being with an emphasis on maternal healthcare [16, 26, 55, 62]. However, relatively little of it has been in the unique context of Pakistan, which is a deeply patriarchal society with restrictions on women's movement, agency and social connections.

The context: Maternal Health and Women in Pakistan

In Pakistan only 6% of women have more than a secondary school education and 78% have no education [63]. This directly impacts their maternal health and the health of their newborns, where newborns with less educated mothers are 2.4 times more likely to die during the first month compared to those born to mothers with higher education levels [59]. Pakistan also has one of the highest maternal mortality ratios in South Asia where low-income, low-literacy and pregnancies where the mother is under 20 years of age have a direct co-relation with the lack of skilled attendants at birth, the low number of ante-natal and post-natal visits and the overall ill-health of the mother [59]. To add to all this, Pakistan is deeply religious and patriarchal where women's freedoms, decision-making and agency within a household are restricted which has a direct impact on their uptake of maternal health services [19]. Studies reveal that in Pakistan, pregnancy and its associated decisions are predominantly the older women's (typically a mother in law) domain where women who have successfully claimed health care services have done so by using existing gendered structures [35]. Mumtaz et al. further reveal that the quality of a woman's personal relations, particularly with her mother-in-law and husband, are of paramount importance in accessing health care resources. Previous studies exploring the maternal health challenge in Pakistan identify low Ante-natal care (ANC) attendance due to transport challenges and unavailability of chaperones, home births assisted by unskilled attendants, unhygienic cord care, transport issues and financial constraints as important barriers to better maternal health outcomes. [22, 42, 49]. We ground our work in these studies and extend this body of work by exploring the maternal health problem in Pakistan from a feminist and technological lens with the aim to unpack the design of subversive technologies to better support pregnant women within their specific context.

Research in HCI within the Pakistani context also reveals the limited access to technology that women in low-income, low-resource settings face along with a myriad of challenges in the use of technologies including harassment, privacy and digital literacy [37, 48]. Our work explores this complex landscape in order to present meaningful guidelines for digital interventions aimed at improving maternal health outcomes for women in Pakistan. We use the framework put forward by Sultana et al. [54] in designing within patriarchal systems.

Mobile Technologies for Maternal Health

Previous research into the design and use of technology for maternal health especially in low-resource settings has relied on the wide penetration and adoption of mobile phones. The ubiquitous nature of mobile phones have the potential to transform female health and well-being at a population scale [25–27, 39, 55, 56]. Research into designing for maternal health includes educational video materials for maternal health information dissemination [26, 43], a portable ante-natal ultrasound device for use in the field [13] and phone-based messaging systems connecting health workers and rural women [27, 44, 61]. Our work builds on and extends this body of work by exploring the ground realities and constraints of women in patriarchal and religious contexts, the impact of the context on their access to and decision making around

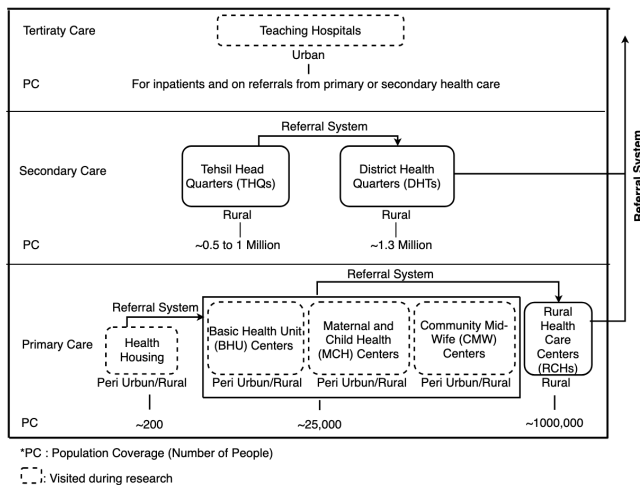


Figure 1. The three tiers of health care system in Pakistan

healthcare and by presenting specific design guidelines for effective interventions that are grounded in the lives of these women and are cognizant of their existing pregnancy related health and well-being practices. Although there has been some work in creating a pregnancy tracking application for women in Pakistan [47], it has not been based on an exploration of the existing context for low-income, low-literate women and has been targeted towards literate women (mean education level of participants was a graduate degree) with a higher income group. In recent years there has been a focus on understanding the lives of women in Pakistan and their access to and use of technologies in order to create specific design guidelines for creating digital interventions targeted to their unique contexts [37,48]. Unfortunately, the health interventions deployed for women in Pakistan do not match our understanding from these studies of their technology usage patterns or the type of constraints they face. In this study we use data from our extensive 6 month long qualitative study on understanding the maternal health landscape in Pakistan to present specific design guidelines for digital interventions for low-literate, low-income women who have little agency in the decision making process of even their own health or bodies.

Overview of the Healthcare system in Pakistan

The healthcare system in Pakistan is divided into three tiers, each adding on services from the last level (Figure 1). *Primary Healthcare*: This is the first tier of healthcare, where pregnant women have their initial interaction with the system; it provides both curative and preventive healthcare services. It includes Health Houses (HHs), Basic Health Units (BHUs) and Rural Health Centers (RHCs). Each Lady Health Worker covers a population of approximately 200 households or 1,000 people. In contrast Basic Health Units serve a population of up to 25,000. Preventive curative and referral services are provided, along with maternal and child health (MCH) services. Rural Health Centers serve a population of up to 100,000 people, where patients are provided promotive, preventive, curative, diagnostic and referral services along with inpatient services.

Secondary Healthcare: This is an intermediate level of healthcare that is concerned with the provision of technical, therapeutic and diagnostic services. It is the first point of referral serving at the district and tehsil levels.

Tertiary Healthcare: Tertiary healthcare hospitals are for specialized inpatient care. Specialized healthcare services are usually for inpatients and via referrals from primary or secondary healthcare professionals.

METHODOLOGY

This section details our IRB-approved, qualitative methods used to engage pregnant women, their family members, health experts and field workers, including semi-structured interviews, focus groups, observations and health sessions. All interviews and sessions were conducted in the local languages Urdu and Punjabi by two female researchers.

We started with a maternal health round table discussion with health experts with 6 health experts and 4 researchers. The purpose was to understand the current maternal health situation in Punjab, Pakistan. Our experts included 2 gynecologists from the largest gynecological hospital in Lahore and 4 field experts including a Lady Health Worker (LHW), Lady Health Supervisor (LHS), Community Midwife (CMW) and a Superintendent Officer (SO). Based on this discussion, we iteratively designed our interview protocol for pregnant women, their family members, health experts and field workers. The topics included high risk indications during pregnancy, current sources of information, nutritional requirements, post-delivery practices, autonomy and agency among the pregnant women, family planning, and technology access and ownership.

Over a period of 6 months we conducted semi-structured in-person interviews, focus group discussions, health information sessions and observations with pregnant women, their female family members and health personnel. The interviews were conducted at 9 health care facilities including hospitals, basic health units, maternal and child health centers, community mid wife centers and health houses (Figure. 1). Our sampling strategies included convenience, snowball and random and we determined sample sizes based on saturation. During this phase, we conducted 44 semi-structured interviews (37 pregnant women, 6 health experts and 1 family member of a pregnant woman), 2 focus groups involving 5 lady health workers, 3 health sessions with 44 participants (24 pregnant women, 11 health personnel, and 8 relatives) and 9 observation sessions (one at each health facility) (Tables 1, 3).

In-person Interviews: We conducted 37 interviews with pregnant women, one interview with a family member of a pregnant woman, and 6 interviews with health experts. The interviews with pregnant women and their family members lasted for 20 minutes on average. The discussions revolved around participants' pregnancy-related concerns and practices. We interacted with pregnant women and their family members either during their regular antenatal care visits or high-risk indication visits at the aforementioned healthcare facilities.

The interviews with health experts lasted for 130 minutes on average. The purpose of these interviews was to understand

the prevalent maternal healthcare ecosystem in the province and to locate any gaps and failure points.

Focus Group Discussions: We conducted two focus groups with lady health workers to understand their collective perspective on maternal healthcare and gain more insights into the maternal health practices revealed in our one-on-one interviews. Each focus group comprised of 2 to 3 LHWs and lasted for an average of 120 minutes.

Health Sessions: During multiple in-person interviews, the pregnant women asked our team maternal health related questions. Upon further inquiry we learnt that these women are hesitant to direct these questions to the health care providers due to their unwelcoming attitude [11]. In order to answer their queries and to get a deeper understanding of their practices, we conducted three health sessions within three different communities. We arranged these health sessions with the help of LHWs from the communities. Each session was conducted by a gynecologist in a health house, and was attended by 14 to 15 participants including pregnant women, mothers-in-law, mothers, and sisters-in-law. The gynecologist who conducted these sessions had clinical, administrative and teaching experience of more than 30 years in 5 of the largest public hospitals in Lahore. The health sessions enabled community members to interact with the health expert and discuss the health issues that they were hesitant to voice otherwise.

Observations: Besides interacting with participants and health experts in person and in groups, we conducted 9 observations sessions, one at each facility. Each sessions lasted 120 minutes on average. The goal was to observe the communication between pregnant women, their mothers-in-law and health experts.

Analysis and coding: All interviews were audio-recorded after seeking verbal informed consent from all participants and were transcribed by our team of researchers. The transcripts were coded and analyzed for patterns using a thematic analysis [92]. Themes emerged on stories about (i) family dynamics in maternal health, (ii) traditional beliefs and spiritual therapy, (iii) female agency in maternal health, (iv) timeliness (or lack there of) in seeking healthcare, (v) knowledge gaps and misinformation, (vi) pica and associated medical concerns, (vii) behavioral change practices, and (viii) technology usage.

After transcribing all the transcripts, we conducted a thematic analysis and developed categories and clustered quotations, conveying key themes from the data. Four team members created a code book based on the eight main themes identified, followed by several sub-categories, e.g. miscarriages, recurrent pregnancy loss, family planning, breast feeding, dietary instructions, fetus gender, urine infection, c-section and normal deliveries, hospital vs home births, etc.

FINDINGS

The goal of our qualitative study was to understand the prevalent practices and health seeking behaviours around maternal health among low-income, low-literate women in Pakistan. We organize our findings by the practices and influences impacting maternal health outcomes: traditional beliefs and practices, household power dynamics, access to technologies and

Age (years)	18-20: 10	21-25: 20	26-30: 20	31-35: 10
Locality	Urban: 19	Rural: 23	Dense Urban: 18	
Socio-Economic Status	Low: 23	Lower-Middle : 25	Middle:12	
Gestational Age	Max: 9 month	Min: 1 month	Mode: 9th month	
No of Kids	Min: 2	Max: 5	Median: 3	
Miscarriages	Max: 4	Min: 0	Mode: 1	
No of C-Section:	Max: 5	Min: 0	Mode: 1	

Table 1. Demographics of pregnant women (37 pregnant women from one-on-one interviews and 24 pregnant women from health sessions)

existing sources of maternal health information. We categorize traditional practices and beliefs as either being benign, where there is no active harm or danger to the pregnancy or non-benign practices which could result in adverse outcomes for maternal or child health. We also highlight the role key stakeholders play in propagating certain practices and their impact on maternal health outcomes.

We start with grounding some of our findings which support earlier work on maternal health in developing countries.

Themes Reinforcing Earlier Work

Some of our findings support earlier studies on maternal health in Pakistan. The lack of information on pregnancy-related issues like the value of routine checkups, intake of iron supplements, prenatal supplements, ultrasound appointments, high-risk indicators, and the value of hospital births among pregnant women was reported by Batool et al [11]. Similar to women in our sample, the women they interviewed also lacked awareness regarding dietary intake and healthy eating habits, eating coal, chalk, mud/soil and raw rice when nauseous. Similarly participants could not recall the date of their last menstrual period (LMP) and were unaware of it's importance. In our study, we explored these points in greater detail with our experts and found that most women from low-literate households who visit the hospitals are unaware of their last menstrual period date and a large percentage have had no ultrasounds. This makes it almost impossible for the doctors to accurately determine their expected date of delivery. Even the ones who have had ultrasounds are usually not aware of the need for the ultrasound during the first 12 weeks of pregnancy for the calculation of an accurate due date. This results in a large number of preterm deliveries - something that can be prevented by simply remembering or recording the date of the last LMP. As one doctor explained:

Expected date of delivery (EDD) can be calculated only through a scan of the first 3 months and not after that.

Phone Ownership:	Smart: 15, Feature: 13, Unknown: 9
Phone Ownership	Personal: 16, Shared: 13, Unknown: 8
Internet Usage	Users: 7, Non-users: 30

Table 2. Technology usage of 37 pregnant women from One-on-One Interviews

We cannot rely on later ultrasounds to define the dates, i.e. when to deliver the baby. When we ask them about their LMP, they say doctor please do an ultrasound and check it yourself. **-(HP1, Hospital, Exp: 8 Years)**

In addition to the types of misinformation previously identified our study also reveals more prevalent myths. For example it is believed that eating certain things could lead to a miscarriage, intake of medicine could change the gender of the baby. Cesarean-births are not considered time-sensitive and can happen any time after 9 months. An Ultrasound is commonly believed to reveal everything including exact date of delivery, gender, last menstrual period, and baby’s health. The colostrum (first breastfeed) is considered dangerous.

Traditional Practices and Beliefs

Our data reveals that in Pakistan, one of the most prevalent and widely practiced form of non-western maternal health treatment is religious or spiritual therapy based on the Islamic faith. The belief in the efficacy of these practices is not limited to particular families or pregnant women. We found that with the exception of hospital doctors, most health workers, midwives and gynaecologists at the community level health units recommend the use of various forms of religious therapy for better maternal health outcomes. In addition Islam places a great deal of emphasis on the virtues of accepting pain with patience and fortitude [5]. This impacts the way and the urgency with which treatment is sought. We reveal that the way Muslims view and cope with health care in light of their beliefs is of paramount importance for maternal health outcomes.

Benign Religious Therapies and Spiritual Practices

The maternal health doctors from our study reveal that most of the spiritual and religious therapies are benign and lead to a placebo effect when practiced in parallel with modern medicine and antenatal visits to health clinics. We observed that lady health workers, midwives and gynaecologists allow and even leverage such practices to motivate pregnant women to continue returning to health clinics to seek medical advice and care. Religious therapy involves going to a spiritual practitioner, called a ‘pir’(an aged male or female, whereby age reflects experience) who recites Islamic religious verses on water, jaggery (brown sugar) or on black pepper, and gives it to the pregnant woman to eat or drink. Often a ‘taveez’ (amulet), containing verses from the Quran, is also given to the pregnant woman to wear till delivery which is then passed on to the newborn. Follow up visits are also involved as the amulet needs to be periodically replaced (e.g. every month).

Expert Category	Participants	Experience (In years)
Gynecologist	2	30,8
Medical Officer	2	12,7
Superintendent Officer	1	20
Lady Health Visitor	2	20,8
Lady Health Supervisor	2	24,12
Lady Health Worker	5	22,15,14,14,5
Community Midwife	2	10,9

Table 3. Demographics of Experts

We found that participants consider religious therapy as important as antenatal care (ANC) visits, while some participants ranked religious therapy above ANC visits. They believe that wearing such amulets keeps them away from all evils, ensures a smooth pregnancy, an easy delivery, a healthy baby and a male child (male children are preferred over females as they are considered eventual bread winners while a female child is considered a burden). One pregnant woman explains:

I go for spiritual therapy every month and Baba ji (religious therapist) gives me an amulet every month. I have to transfer the last amulet to my baby. This therapy keeps me fit. (EM1, Age:28, Gestational Age:9th Month, Hospital)

Our data also reveals specific religious therapies for issues like miscarriages, the ‘evil eye’ and infertility.

A “pregnancy loss” is defined as a clinically-recognized pregnancy involuntarily ending before 20 weeks. 35% of the women we interviewed had experienced at least one miscarriage in their gestational history with 11% had experienced Recurrent Pregnancy Loss (RPL) involving at least two miscarriages. Our interview participants referred to a miscarriage as “Athra”,and firmly believed this requires religious therapy. A pregnant woman who had a miscarriage in the past told us:

During my first pregnancy, I had a miscarriage after a month of conceiving and I came to know that I am suffering from Athra. Therefore, in the next pregnancy, I regularly went for religious therapy for 9 months and also took medicine from the clinical doctor, after which I had a healthy baby. The religious therapist told me that I am suffering from Athra, so religious therapy is a must. My midwife from the clinic also told me that I have Athra so I was regular in my ANC visits and I also got injections to prevent against Athra.(EM38, Age:24, Gestational Age:6th Month, Basic health Unit)

In this context these women refer to Athra as infertility or other related issues that cause congruent child mortality and are perceived as an “evil sickness” to be cured by religious healing.

The Role of Mothers-in-law in Propagating Spiritual Therapy

Family members including mothers-in-law and sisters usually consider even one miscarriage a recurrent pregnancy loss or Athra and take their pregnant daughters-in-law for religious therapy. Athra is considered a transferable condition as in some cases, when one daughter-in-law faces a miscarriage, the mother-in-law assumes that Athra has spread through her entire household, and takes every married woman in her house for religious therapy regardless of whether they have experienced any miscarriages. Moreover, if mothers-in-law hear of any woman in the neighborhood suffering from Athra, they forbid their daughters and daughters-in-law to go to that house or to even step across the open sewer lines of that house. A mother-in-law told us:

My neighbors daughter-in-law had Athra and while she was taking a bath, my daughter-in-law happened to step across the open sewer lines of their house and also got

affected. Then I took her for religious therapy and strictly instructed her to not go anywhere until she delivers her baby. (IL3, Age: 54, BHU)

The Role of Health Workers in Propagating Spiritual Therapy Not only do pregnant women and their family members believe in the efficacy of spiritual healing, Community Midwives (CMWs) and health workers also practice such therapies. While talking about her religious therapy, a community midwife told us:

I had this very unusual pain during my first pregnancy in the third month. I got the requisite injections but all in vain. My supervisor said that this conception is going to waste and it will be a miscarriage... A religious therapist told me that I am suffering from Athra in my third month. He gave me a bottle of water and instructed me to drink it in small sips until next morning and my pain will go away. I drank it overnight and within 3 to 4 hours I was relieved. I went back to him in the morning and he gave me some more water and a taveez. When my baby was born, he did not initially cry, but when I put the same taveez around his neck, he started crying. This means my son too had Athra when he was born and was immediately relieved after putting the taveez around his neck. (HP16, MCH Center, Exp: 10 Years)

The Role of Spiritual Therapy to Promote Adherence to Healthcare Health workers exhibit a deep understanding of the prevalent religious beliefs and their importance in the community. In order to gain the trust of the pregnant women, the health workers encourage and leverage these belief systems and spiritual practices to ensure timely antenatal visits and a continuation of western medicines. As one worker explained:

When people come to us and say that they have Athra and they need religious therapy, we never say no to them because if we stop them from their religious practices, they will never come to us and listen to us. We tell them to definitely go for religious therapy, but do come to the clinic and get medicines as well, as this will speed up the recovery process. When they have a healthy pregnancy, they say this is because of that religious therapy and their belief gets stronger. We don't care about this because for us the only thing that matters is their good health and well-being. All these spiritual healers recite verses either on water or on fruits and neither of these are at all harmful things to have during pregnancy

Traditional Practices with Non-Benign Outcomes

Numerous themes have emerged where specific practices can be linked directly to adverse outcomes for mother and child. Such themes include a belief in the prohibition of c-sections, a complete reliance on traditional birthing assistants, and patriarchal family setups that diminish the autonomy and agency of the pregnant woman. We explore these themes further in the following sections.

Religious Beliefs with Adverse Outcomes For Maternal Health The refusal to use contraceptives due to religious reasons was a recurring theme reported by 68% of our partici-

pants. While talking about family planning and birth spacing, a woman explained:

I will go for natural birth spacing after two sons but will not go for ligation because it's a sin. I have heard that all our prayers go in vain after ligation. I have heard from religious scholars that it is prohibited in Islam to stop birth procedure permanently because Allah will get offended. I have heard the same thing in my Islamic classes as well. (EM29, Age:25, Gestational Age:9th Month, Hospital)

One participant also tried to rationalize why, in her opinion, the use of copper-T might be prohibited in Islam:

It is prohibited to use Copper-T in Islam because menstrual cycle (period) blood clots stick to it and you will no longer have a completely clean body to perform any prayer. (EM33, Age:23, Gestational Age:7th Month, MCH Center)

The women also had reservations regarding the religious prohibition of c-sections. A woman with six previous births in the high risk hospital ward told us:

I had six normal deliveries but this time, the doctors are saying they will operate on me. I'll go back and opt for a normal delivery as I have heard that C-Section is prohibited in Islam; we all (me and my family) don't want to do anything against Islamic beliefs so I will leave this place soon. (EM1, Age:35, Gestational Age:7th Month, Hospital)

Non-Traditional Birthing Assistants We found that 30% of the participants and their family members relied on non-registered Traditional Birthing Assistants (*Daai*). This is partly because the midwives, in addition to traditional services, also provide religious therapy. 16% of our participants reported their religious affiliation with a *Daai* and one further explained:

I prefer a daai over these doctors. If it is going to be a normal delivery, I'll ask my midwife to do it because she not only does deliveries, but also visits me regularly for parhai (recitation of Quranic verses) and gives taveez (amulet) for both me and my baby. (EM2, Age:22, Gestational Age:7th Month, Hospital)

Such practices are potentially hazardous as the *daai*'s are not professionally trained or registered with any health organizations in Pakistan. Previous studies have also elaborated on the use of unhygienic practices by traditional birthing assistants, like cutting the chord with unclean instruments and application of 'ghee' (oil) on the cut chord, that can complicate a delivery and increase risk of an infection [22].

Family Dynamics Impacting Maternal Health

Our data reveals that women in Pakistan exercise little to no agency in decisions pertaining to their own well-being particularly regarding their reproductive health. The family dynamics of low- and middle-income communities in Pakistan revolve around either the mothers-in-law or the husbands, and the women themselves have little to no autonomy in making

health-related decisions. This includes decisions about delivery in hospitals vs at home, dietary needs, and the use of contraceptives. From our sample 67% of women reported not using contraceptives due to pressure from husbands and mothers-in-law and as a consequence 30% reported dealing with unwanted pregnancies. This is particularly true for young and first-time mothers who are considered naïve and ignorant and therefore all of their decisions are made by others on their behalf. Mothers of one to two children enjoy comparatively more autonomy. However, going out of the house is something that is only decided by the husband or the mother-in-law. Women can only go out accompanied by their mothers-in-law, some trusted females of the house (usually husband's sister or an elder daughter-in-law) or the husbands. The women also reported that it is decided by husbands and mothers-in-law if and when they should become pregnant. The women themselves have little say in this matter. Similarly the decision to use contraceptives and the choice of family-planning methods is also determined by the husband or the in-laws. A pregnant woman explained:

I wanted to go for an operation (ligation) after my fourth delivery but couldn't because my husband was not in the hospital and my mother-in-law refused to sign the consent form as my husband has the decision power. Now I'll do it after this (fifth) delivery and hopefully my husband will be here.-(EM3, Age:32, Gestational Age:9th Month, Hospital)

Mothers-in-law not only exercise control regarding methods of family planning and delivery, but they even have a controlling influence on the sex life of the couple. One mother-in-law told us:

My daughter-in-law was childless so I took her for religious therapy. He (religious therapist) recited some Quranic verses on water and an apple and gave it to her. Then he told me to ask the couple to have intercourse that very night; they will be granted with a baby by God's will. She is pregnant now and I know that this is all because of that religious therapist.(IL1, Age:45, BHU)

Mothers-in-law also have the power to decide the place (home or hospital) and mode (normal or c-section) of delivery. One woman explained:

I gave birth to a baby at home and he died. My mother-in-law had a daai handle my case. At the time of delivery, we went to her home but there was no electricity, so we came back to our house with the daai and all her equipment. The entire experience was very painful for me. I was screaming with pain all night and delivered around 7:00 am but the baby died. I think, if my mother-in-law had chosen a hospital for my delivery, the baby would have survived.(EM12, Age:27, Gestational Age:9th Month, Hospital)

During our observation sessions, we learnt that the influence of mothers-in-law is not just limited to important decisions; they also insist upon interacting with doctors during antenatal checkups of their daughters-in-law. They accompany pregnant women for their antenatal care visits even though their

presence is troublesome for doctors who then have a difficult time focusing on the issues of the mother. The mothers-in-law keep interrupting the conversation, and the daughters-in-law hold back from sharing everything with the doctor. This leads to the doctors asking the mothers-in-law to leave the room and wait outside (which is obviously met with resistance from them). We also observed this with lady health workers during their visits to the pregnant women at their homes for counselling. Mothers-in-law either do not allow them to come in or remain present for the entire duration of the visit. A lady health visitor at a basic health unit told us how she used a placebo method to handle mothers-in-law who accompany their daughters-in-law:

They (mothers-in-law) usually accompany pregnant women at BHU and don't let them speak during checkup. Instead, they speak on their (pregnant women's) behalf. ...it is hard to get an idea about how the pregnant woman is feeling. When I ask them why they are there with the pregnant women, they say that they have a headache or pain in joints. So I give them paracetamol and send them out of the room, or I tell them that it is restricted by the government to have two members inside the antenatal care room so they should wait outside. They have to agree because I am using the word government. They would never accept if I were to say that I don't want them accompanying their daughters-in-law during their antenatal visits because they hesitate to speak in front of you.(HP3, BHU, Exp: 20 Years)

The absolute control mothers-in-law exert also made it challenging for us to access and interview the pregnant women. We worked around this by having one researcher engage the mothers-in-law while another researcher engaged the pregnant woman.

Interestingly as Sultana et al. [54] found in their study, our female participants also engage in subversive behaviors to carve out a little autonomy for themselves. Typically to go out for shopping and gossiping, pregnant woman pair with other women from the neighborhood or from their own homes (usually husband's sisters or elder daughters-in-law) and claim to be visiting the health centers. During our focus group discussion with health workers, they reported that some women use the health centers as an excuse to go shopping:

I went to her home during my rotation and her mother-in-law asked me if she visited the health center the other day and I knew that she went out for shopping before visiting the health center so I said yes she came to the center and everything is fine(HP13, BHU, Exp:5 Years)

Delay in Seeking Healthcare

In our sample, 45% of pregnant women could not recognize the symptoms that warranted immediate medical attention. Pregnant women do not show up for any antenatal care visits until the time of delivery and are unaware that certain pre-existing diseases need to be highlighted during early trimesters. Conditions like high blood pressure, diabetes and blood deficiencies which eventually lead to miscarriages in 38% of our participants. As women do not show up for antenatal visits,

they have little to no information regarding the progress of their pregnancy. Their primary source of information is usually the mother-in-law, who takes things lightly by saying that she has been through all this and there is no need to go to the hospital. While talking about her miscarriage, one woman told us:

I had a miscarriage in the third month of my previous pregnancy. I am diabetic and came to know of this only at that point. Because I am diabetic, my baby did not grow properly and I had a miscarriage. I never knew that I was suffering from diabetes. I do not have such a family history, and I did not go for any antenatal care visit in my last pregnancy. (EM1, Age:28, Gestational Age:9th Month, Hospital)

Our data further reveals that besides being unaware, some pregnant women were indifferent towards their own health even after experiencing complications. They let things take their normal course even after facing serious repercussions including miscarriage, and neonatal death. A woman who had had 4 miscarriages and 2 neonatal deaths told us :

I have had 6 pregnancies and not one survived. 4 died in the womb and 2 were born and died within two days. Both who were born were premature. We asked doctors about these miscarriages and neonatal deaths and every time they said that my 'bacha dani' (womb) is defective and I might get stitches in my next pregnancy, but I never got any. This time they are keeping me under observation in high risk ward because they say we (me and my baby) won't survive if I go home. (EM4, Age:26, Gestational Age:8th Month, Hospital)

We also found evidence through 54% of our participants that serious consequences lead to a shift in attitudes of some households. If the lack of awareness of a certain symptom leads to serious consequences like a miscarriage, stillbirth or neonatal death, women take it seriously in their subsequent pregnancies to ensure their own safety and that of their babies.

Misinformation among Healthcare Providers

In contrast to the findings reported by Batool et al. [11], our data reveals rampant misinformation among maternal healthcare providers which is then propagated among the communities they service. Some observations are as follows:

- *Sanitary pads could lead to growth of bacteria:* During our observations, we found health workers dismissing sanitary pads. They believed that the pads contain a layer of polythene that is not breathable and leads to bacterial growth and recommended using cloth.
- *Breastfeeding at night is a method of contraception* While counselling her community, a health worker claimed that breastfeeding at night, meant the women would most likely not conceive soon.

These misconceptions propagate unhygienic practices within the community and can have adverse consequences for mother and child health. These misconceptions were most frequently observed among the community health workers and midwives including the lady health workers that visit homes and have the

most face-time and influence on the pregnant mothers. During the focus group discussions with the lady health workers similar misconceptions around female anatomy changes during pregnancy, dietary requirements, supplements and new born care were observed.

Questions Asked by Pregnant Women During Health Session

We conducted three health sessions where a gynaecologist was present to better understand the concerns of pregnant women. During these sessions, most pregnant women asked questions around urine infections, nausea, restlessness, burning and swelling, iron and calcium intake, baby's development, blood pressure, breast feeding vs. formula milk, c-section repercussions, nutritional requirements, vaginal discharge, low-lying placenta, miscarriage reasons, back pain and stretch marks. The gynecologist provided detailed answers and suggestions to the queries and instructed them to ask these and similar concerns to their respective doctors. During regular visits the doctors are overwhelmed with patients and have a limited amount of time to spend with each pregnant woman and restrict their interaction to immediate issues and concerns. As a result these women do not have access to medically sound sources of information.

Technology Access and Use

From our participants 43% had direct access to mobile phones (Table.2). The rest had indirect access to phones through their in-laws and husbands. They primarily used phones to receive and make calls, and for a small percentage, use the internet to gather pregnancy-related information. 5% of our participants shared serious repercussions of following online information blindly (Table. 2). Most women in our sample watched TV but also said they did not have much time for it between house work, prayers and taking care of their children. Only one woman had a social media profile and she used it in her free time. Mothers-in-law and husbands used their phones for calls only, as reported by the women in our study. 5% of our participants reported believing any information they readily found online. One woman explained that she searched for content on YouTube using roman Urdu queries. Another said that her husband had not permitted her to use the internet but he downloaded videos for her. One pregnant woman, who had a miscarriage, told us:

I have high Blood Pressure (BP) and I read on the internet that papaya is good for BP patients so I ate it a lot. When I suffered a miscarriage, I told the doctor that I had a lot of papaya and he said that it is not recommended to have anything in excess, especially papaya, so now I refrain from eating too much. (EM1, Age:28, Gestational Age:9th Month, Hospital)

Another pregnant woman told us how she verified what her doctor (non-registered medical practitioner) said via the internet :

The doctor told me that your baby in the womb has some white stuff in his kidney during my fifth month of pregnancy, but it will clear up by the seventh month. I then checked for this online and found out that the doctor

was right. (EM2, Age:22, Gestational Age:7th Month, Hospital)

DISCUSSION

We extend the existing understanding of the maternal health landscape in Pakistan beyond the exploration of the lack of agency women have, limited resources at hospitals, the lack of knowledge among pregnant women and their lack of mobility [11, 26, 37, 48] to reveal the deep impact Islamic spiritual and religious beliefs have on the perception and practice of maternal healthcare in Pakistan. Muslims regard their religion not just as a belief system but as a way of life and Islam strongly influences a Muslim's perception of and interaction with health-related issues and as our study reveals plays a vital role in maternal healthcare. Reverting to Islamic literature, we find that medicine and prayer for well-being hold key significance. Islam views Muslims as caretakers and safe-keepers of their physical and spiritual existence, each of which is prone to disease and harm. Among the duties of Muslims is to protect themselves from harm and actively seek a cure for all ailments. Muslims do not consider their actions as the sole determiner of health outcomes. So, while Muslims are obligated to resort to the best medical treatment in their capacity in case of a disease, they are also instructed to pray to God to seek cure and healing [4, 6].

We reveal this in our work and highlight the importance of spiritual healers and religious practices, belief in whom is also leveraged by the community care-givers to encourage ante-natal visits and a continuation of western medicine. We advocate the need for HCI researchers and practitioners designing for Muslim populations globally to understand those aspects of Islamic beliefs which influence maternal health outcomes. For example, an understanding and incorporation of the Islamic belief that emphasizes the safeguarding of the body as a Muslim duty into digital interventions targeted at maternal health stakeholders could have a deeper impact in shifting perceptions around maternal health than non-religious messaging. Similarly, Islam considers pregnancy and child bearing as signs of the divine existence of God [28], and interventions that link messaging and attitude changes with Islamic beliefs and practices are more likely to be persuasive and adopted [45]. We further argue, based on Bidwell's work [12] that designing for compatibility with the spiritual healers and 'Dais' in this context can help to *digitally enfranchise* the targeted communities.

The existing understanding of maternal health care infrastructures and most current maternal health applications (e.g. May-May in Myanmar, MAMA in Bangladesh, South Africa, India and Nigeria, Mobile Midwife in Ghana and Safe Pregnancy and Birth for developing countries) lack an understanding of the importance of stakeholders like the mothers-in-law and husbands in birthing outcomes. These members of the household have supreme authority not only over all health related decisions for the pregnant women, but also control their intimate sexual and reproductive lives. They are also the main sources of information for pregnant mothers. Previous research in Pakistan and the Global South on female agency and reproductive health outcomes has focused on physical auton-

omy, i.e. a woman's ability to travel alone to a health center as an important factor in determining a woman's reproductive health [10, 14, 17, 38, 42, 50]. In contrast we reveal more complex challenges, such as the total lack of control a woman has over her reproductive and sexual body (outside of ability to travel alone), due to conservative and patriarchal practices and stark power dynamics with in-laws, all of which adversely affect maternal health. Similarly, in contrast to previous public health studies in Pakistan and elsewhere exploring the maternal health problem which take a macro-level policy view based on quantitative data, we adopt a micro-level view that is relevant for technology design [18, 33]. Designing to include stake holders who do have control over a woman's body is likely to have a direct impact on her reproductive health.

The women themselves have the least amount of agency among all the birth stake holders and have few sources of information outside of their mothers-in-law, sisters-in-law and mothers. Unfortunately, these sources of information including the lady health workers that visit their homes and the community midwives at the health clinics themselves propagate misinformation and feed into myths and misconceptions within the communities. The doctors at hospitals are over-worked and have little time to dispel the misconceptions that are prevalent. The few women in our sample who were able to navigate online sources of information (using roman Urdu to search Youtube videos) inherently trusted any information available online which they then followed to the letter. An interesting insight for us leading from the lack of knowledge women have, has been the taboo nature of certain aspects of maternal healthcare as it relates to intimate care involving parts of the body that are linked with sexuality. We add to a small body of work in HCI which explores how a lack in knowledge and understanding of the body, which in Pakistan and the Global South is bound together with shame and taboo and not to be discussed, create conditions which lead to diminished reproductive health outcomes [7, 8, 58].

Outside of the impact of our findings on maternal health there are design implications for other areas within HCI. There is a growing body of work, particularly within sustainable HCI which explores the integration of design with local history, culture and environments [15, 23, 53], which may benefit the practice of religious therapies in this context. Similarly, our work also adds to the postcolonial computing movement within HCI and ICT4D [2, 20, 31] which explores the historic marginalization and suppression of colonized knowledge, particularly with reference to local health practices [9]. We add to this body by revealing how existing HCI knowledge and practice lacks indigenous understandings of health practices around maternal health in the Global South.

Design Recommendations for Maternal Health Interventions

In this section we present our insights for the design of maternal health applications for women within this context using the framework proposed by Sultana et al. [54]. We argue that the design of any maternal health intervention design within this context must leverage the existing assets within the society. These we define as the existing spiritual and religious

beliefs that maternal health decisions draw from, leveraging the authority of the mother-in-laws to allow for better decision making with regards to maternal health outcomes (subversively supporting the women in their struggle for healthy birthing outcomes, better spacing between children, more frequent visits to medical professionals, encouraging hospital births etc). In our guidelines we advocate for *subversively disruptive technologies* that leverage the existing mechanisms within the community (religious figures, mothers-in-law, husbands, community workers) to change attitudes towards specifically maternal healthcare but broadly intimate female health.

Empower Within, Not Against

One of the key insights from our study has been the absence of trusted sources of medically sound information for the pregnant mother, the mothers-in-law and the husbands. One severe consequence of this has been the lack of understanding amongst households of the urgency in seeking health care for specific symptoms. For example visiting a clinic or doctor for early signs of gestational diabetes, pre-eclampsia or gestational hypertension. Most narratives of miscarriages and Recurrent Pregnancy Loss (RPL) in our study revolve around the delay in understanding symptoms and their urgency and the subsequent delay in seeking help. Our participants had great trust and faith in the hospital doctors and to a lesser extent the lady health workers. Designing interventions that leverage the authority of the hospital or the ‘government’ would be more likely to be acceptable within the community and would also have a more significant impact on the seriousness with which a recommendation is followed. Currently, the reach and influence of doctors is severely limited due to the sheer number of patients they see everyday. An intervention that leverages the hospital’s authority and pings mothers based on their specific gestational week regarding what normal changes might be expected and when a specific symptom requires urgent help might be taken more seriously within the home than a complaint from the pregnant woman herself. Similarly, to dispel widely held beliefs and myths that are also propagated by the community health workers it is essential to leverage the authority and trust of doctors’ from the countries larger hospitals. These recommendations would have further impact if they were sent to the mothers-in-law who hold the most power within households, allowing them to feel respected and having their authority recognized. This is a delicate balance because by further enabling the power structures within the homes we run the danger of propagating patriarchal frameworks.

Enable Situated Tactics

We also reveal a deep link between maternal healthcare in Pakistan and spiritual healing practices. Most of our participants believed in the efficacy of religious therapy and ‘taveez’ (amulet) while health workers further report this to be the case for a large percentage of the communities they work with. The community midwives and lady health workers strategically piggyback on these existing religious practices to promote better maternal health care and western treatments. Similarly, effective health applications for maternal health need to leverage these beliefs to increase adoption and promote medically sound maternal health treatments. Incorporating these belief systems and practices is also an important design element

from Sultana et al’s. [54] frame work for using and leveraging existing practices within the communities. Currently, none of the existing health care applications like Baby+ in Pakistan, MomConnect in Africa [47, 51] or Projecting health in India [26] leverage or incorporate local spiritual beliefs or traditional health practices. One potential way to incorporate these belief systems in technology design is to create digital ‘taveez’ (amulets) that might also include reminder to mothers regarding check-ups or medications. Equally valuable is designing for and with the faith healers (‘babji’) who wield great authority and power and who pregnant women visit almost monthly for the renewal of the ‘taveez’. Not only could designing for them create a valuable channel for disseminating information to women but also a point of contact for monthly antenatal checks.

Designing Beyond the User

We reveal that the power within homes in low-income, low-literate families in Pakistan lies with either the mothers-in-law or husbands. These members of the household play a powerful role in deciding the access to and level of maternal health care services a pregnant woman might receive. Mothers-in-law, being the primary source of information for pregnant women, override the voices of women in deciding everything from conception to antenatal care, from delivery mode (normal or C-section) to initial baby care. Given this power differential any maternal health or female reproductive health application must also be designed for and targeted towards husbands and mothers-in-law. Existing maternal health applications are designed for individual women and do not include or target key household members. We would argue for designing to include all maternal health stakeholders including religious healers, community health workers, the community gynaecologists and the traditional birth attendants (‘Daai’s’) bringing all stakeholders onto the same platform. Engaging all stakeholders that interact not only with one specific pregnant mother at any given time but influence and interact with a large number of pregnant women (e.g. faith healers, ‘dais’) and members of their households has the potential to remove information black holes and create impact at the community level as opposed to individual household levels.

CONCLUSION

Our work unpacks opportunities and identifies challenges in designing maternal health technologies for low-income, low-literate pregnant women in Pakistan. Our ethnography reveals systemic challenges pregnant women face particularly with regards to a lack of agency over their own bodies, a lack of authentic sources of information and controlled access to technologies. Moving forward we propose specific guidelines for designing meaningful interventions that engage all maternal health stakeholders and leverage existing spiritual and religious practices within the community.

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