# Supporting Family Planning Needs of Pregnant and Postpartum Women through Smartphone-based Solutions in Rural Northern India

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submitted in partial fulfillment
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**Doctor of Philosophy**

*by*

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## Certificate

This is to certify that the thesis titled as "**Supporting Family Planning Needs of Pregnant and Postpartum Women through Smartphone-based Solutions in Rural Northern India**" submitted by Jasmeet Kaur to the *Indraprastha Institute of Information Technology Delhi*, for the award of the degree of *Doctor of Philosophy*, is an original research work carried out by her under my supervision. In my opinion, the thesis has reached the standard fulfilling the requirements of the regulations relating to the degree.

The results contained in this thesis have not been submitted in part or full to any other university or institute for the award of any degree or diploma.

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To all the women, especially those raised by a single parent, who took a stand for their education, fought generational curses to fulfill their dreams and decided to change the narrative for the next generation of women.

## Abstract

The United Nations Sustainable Development Goal 3.7 promotes universal access to sexual and reproductive healthcare services, including family planning, information, and education. India has a dedicated National Programme for Family Planning, which offers family planning services in rural areas. Despite government services, rural women have a high unmet need for family planning and spacing. Further, women in rural areas face varied challenges in accessing healthcare, such as limited access to authentic health information, low agency, societal norms, and personal beliefs, which deepen further family planning given the associated stigma in rural India. Lack of authentic knowledge, rather misinformation, on contraception has been found to be a significant factor resulting in poor uptake of family planning.

In HCI, family planning, specifically contraception use, within the sociocultural context of the Global South has been under-explored. Research has focused on other stigmatized topics like mental health and explored pregnancy and postpartum ecology; however, the family planning aspect of sexual and reproductive health needs further investigation. In this dissertation, we engage pregnant and postpartum women in a contextual inquiry to unpack how they practice family planning amid the stigma associated with it and identify their support needs. We follow the inquiry with an exploration of smartphone-based interventions to address the family planning needs of pregnant and postpartum women. First, we study how pregnant and postpartum women perceive and practice family planning, and further uncover the sociocultural nuances in their practice, and investigate their support needs. Second, we study how pregnant and postpartum women use a peer support group to discuss family planning despite the topic being stigmatized, even in close social circles. Third, we investigate how pregnant and postpartum women use ChatGPT to learn about family planning methods and how they fit/do not fit into women's support networks. This dissertation adds to the HCI4D research by shifting focus to the family planning needs of

pregnant and postpartum women residing in resource-constrained settings and unpacking the potential of smartphone-based interventions for addressing family planning needs.

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Jasmeet Kaur

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# Chapter 1

# Introduction

With a focus on improving health outcomes, the United Nations Sustainable Development Goals 3.1 and 3.2 emphasize ensuring healthy lives and well-being for all, with special attention to reducing maternal, neonatal, and under-5 mortality rates. Though maternal mortality rates have declined over the last decade both globally and in India, the rates are still high in rural areas of India [1]. With inequality in healthcare access in India, women in rural areas suffer from limited access to healthcare as compared to those in urban areas. These women face varied challenges, including limited access to authentic health information sources, inability to act on health information, and mobility issues with traveling long distances to healthcare centers [2, 3, 4]. In addition to the said barriers, there are societal and personal barriers such as fear of shame, shyness, and familial pressure to access information as an outcome to which women rely on non-health professionals such as husbands, mothers, mothers-in-law for health information, which can lead to health-related misconceptions and health issues [5, 6]. These barriers further worsen for family planning, which is a stigmatized topic in rural India. In India, sex is a taboo, which in turn makes contraception a taboo [7]. Stigma is around holding discussions on contraception with partners, having conversations on safe sex, and also stigma with buying contraceptives [7]. Lack of authentic information and exposure to misinformation on contraception has been found to be a major factor resulting in poor uptake of family planning [7, 8, 9].

The World Health Organisation defines family planning as a means of empowering people to attain their desired number of children, if any, and to determine the healthy spacing of pregnancies through the means of contraceptive usage and infertility treatment [1]. With a focus on improving health outcomes and fostering women's empowerment, the United

[1] https://www.who.int/health-topics/contraception/#tab=tab_1

Nations Sustainable Development Goal 3.7 promotes universal access to sexual and reproductive healthcare services, including family planning, information, and education. However, as of 2019, an estimated 270 million women lack access to safe and effective family planning measures [2]. Out of all the unwanted pregnancies that happen annually worldwide, more than one in seven occur in India [10]. Further, WHO recommends keeping a gap of at least two to three years between births to reduce the risk of adverse maternal and child health outcomes [11]. However, in India, the average birth spacing is 22 months [12]. India has a dedicated National Programme for Family Planning, under which it offers family planning services such as providing contraceptive methods [13]. In addition to these services, ASHA workers [3] are also trained to counsel rural women on family planning and help women decide a method appropriate for them. Despite government services, rural women have a higher unmet need for family planning (9.9%) and spacing (4.3% ) compared to urban women in India. Married women do not adopt contraception due to fear of side effects, infrequent sex, and objection from contraception by self or others [8, 9]. The adoption is further shaped by the family members [9, 14, 15]. Mothers-in-law influence the number of sons their daughters-in-law must have and the timing and use of contraceptive methods [16]. Further, husbands' understanding of contraceptives and discussion with their friends shape the couple's adoption of family planning [14]. Thus, women in India are not the sole decision-makers regarding their health, even though the patriarchal structure of Indian society puts the burden of family planning on women [17].

In HCI, though research has focused on stigmatized health topics such as mental health [18, 19, 20, 21, 22] but family planning in the Global South is understudied. HCI researchers have studied maternal and child health-related support needs of women in different phases of pregnancy and postpartum, and offer design recommendations for techno-

[2]https://www.who.int/teams/sexual-and-reproductive-health-and-research-(srh)/areas-of-work/family-planning-and-contraception

[3]ASHA ( Accredited Social Health Activists) workers are frontline health workers employed by the Ministry of Health and Family Welfare, India. They are responsible for connecting the rural population with the state health system. Their responsibilities include counseling women on birth preparedness, safe delivery, nutrition, breastfeeding, immunization, contraception, prevention of common infections, and childcare.

logical interventions [23, 24, 25, 26, 27, 28]. Recently, there has been an emerging focus on highlighting the rich sociocultural subtexts overarching maternal health, including religion, gendered spaces, and household power dynamics [29, 30]; however, limited work has been done on fertility tracking for conception and responsibility sharing for birth control pills that too with a focus outside of Global South [31, 32, 33, 34]. Overall, in HCI, family planning, specifically contraception use, within the sociocultural context has been under-explored, especially in the Global South context.

In this dissertation, I examine family planning practices among pregnant and postpartum women in rural India, contributing to the HCI literature by exploring their support needs and the role of smartphone-based interventions in addressing those needs within stigmatized health contexts. I investigate how sociocultural norms, personal beliefs, and relational dynamics influence women's perceptions, access, and use of family planning. The dissertation highlights how structural barriers, family expectations, and social stigma limit women's autonomy in making reproductive health decisions. Additionally, I explore the types of support women find valuable, including both informational and emotional resources, and examine how smartphone-based tools — specifically chatbots for private, individualized support and peer-support groups for shared learning and solidarity — can help bridge knowledge gaps, foster trust, and enhance agency. This research offers practical insights for designing culturally sensitive, privacy-preserving, and contextually grounded digital health interventions to support marginalized women in resource-constrained settings.

### 1.1 Research Context

In this dissertation, we have engaged with pregnant and postpartum women residing in rural and sub-urban areas of Haryana in Northern India. These women are mostly housewives who live in joint families with their in-laws family. They generally fall in the age bracket of 25-35 years. Their highest qualification is generally at most graduation. Almost all

the women have no more than two children. The majority have their own personal smartphones, which are at times also accessed by their children and other family members, and have internet access available. However, these women have limited digital literacy. Further, these women experience health-related decisions at the intersection of their own needs and desires, patriarchy, and limited agency. They are not the sole decision-makers about their health and, hence, navigate their health in accordance with the decisions of their husbands, mothers-in-law, and society at large.

The women we engaged with throughout this thesis are connected with our collaborator NGO, called SWACH [4], which operates in Northern India. SWACH has been actively working in the field of maternal and child health since 1988, implementing various initiatives aimed at improving childbirth and newborn care practices in primary health centers. Their work includes capacity building of ASHAs, supporting high-risk pregnancy cases and birth defects, and conducting awareness programs on maternal health. SWACH collaborates closely with government systems, engaging with frontline workers like ASHAs and ANMs, as well as healthcare professionals up to the district hospital level, to strengthen the implementation of public health programs. On the other hand, SWACH engages with pregnant and postpartum women through WhatsApp groups and Zoom meetings to offer health information and regularly trains old and new group members on using these platforms. Hence, members have become familiar with WhatsApp and Zoom over time. The organization operates across approximately 100 villages, covering a population of 1.5 million people in the Ambala and Yamuna Nagar districts, with 1,650 ASHAs associated. In this work, the NGO was solely responsible for connecting us with women.

## 1.2 Positionality

I acknowledge that having closely observed how patriarchy, society, and family shape women's health-related practices, it has shaped the collection and analysis of data pre-

[4] https://www.swach.org/who-we-are.php

sented in this dissertation. Even though I was born and raised in urban areas, I am sensitive to the challenges experienced by rural women in accessing basic healthcare. As a woman, I feel sympathetic toward the struggles of my fellow women, which in turn motivates me to continue working to make healthcare accessible to these women and beyond. To minimize potential bias in data analysis, I followed two practices: frequently going back to the data and discussions with my co-authors. During the analysis, I revisited the data quite often to check if the data actually represents the codes and themes. Further, I discussed the analysis with my co-authors to get their perspective on the data. Both strategies helped identify cases of over-representation of data, which were resolved with discussions. Also, with the sympathy I had for my participants, I was able to offer a safe space to them during data collection, which helped build a connection.

Further, while the dissertation incorporates work from collaborative publications, I was the primary researcher responsible for the conceptualization, design, execution, and analysis of the studies presented. In all key studies included in the dissertation, I served as the first author. My independent contributions encompassed identifying research gaps, formulating research questions, designing methodological approaches, developing data collection instruments, leading fieldwork activities, performing data analysis, and driving the interpretation of results. I also took primary responsibility for drafting and revising the manuscripts for publication.

The use of "we" throughout the dissertation is to acknowledge the support and contributions of co-authors and supervisors. However, the core research activities and theoretical framing were independently conducted and led by me.

### 1.3 Research Questions

We have followed the research approach of conducting a contextual inquiry followed by field experiments. We understood pregnant and postpartum women's current practices and needs around family planning. Next, we experimented with smartphone-based interven-

tions at both individual and group levels to address those needs. We study the use of AI-based conversational agents and WhatsApp-based peer support groups to bridge the knowledge gap and understand how they fit into the existing support network of pregnant and postpartum women. Overall, we aim to address the following research question -

- RQ1: What sociocultural and personal factors influence how women perceive, access, and practice family planning amidst social stigma in rural contexts?
- RQ2: What forms of support do women perceive as most helpful in navigating family planning decisions amidst stigma and low agency?
- RQ3: How can socio-technical systems foster trust, protect privacy, and promote informed decision-making around family planning among women in marginalized communities?

Broadly, this dissertation explores how sociocultural norms, stigma, and personal circumstances shape women's perceptions, access, and practices around family planning in rural, marginalized settings. It seeks to understand what forms of support women value most when navigating sensitive reproductive decisions amidst social pressures and limited agency. Building on these insights, the research investigates how socio-technical systems can be designed to foster trust, protect privacy, and empower informed decision-making. Overall, it aims to inform the design of context-sensitive, equitable technologies for family planning support.

### 1.4 Contributions

This dissertation makes contributions to HCI, CSCW, and health informatics by critically examining how marginalized women navigate family planning in contexts shaped by stigma, social barriers, and infrastructural constraints. Moving beyond isolated interventions, this dissertation conceptualizes family planning support as a layered ecosystem

of information, peer exchange, and AI augmentation within the socio-cultural context of women. Overall, this work makes the following contributions:

- *Reframing Access to Sensitive Health Information* The dissertation contributes to HCI4D and critical HCI by revealing that barriers to family planning are not merely about lack of information but are shaped by social stigma, cultural expectations, and restricted help-seeking behaviors. It highlights the need for technology designs that acknowledge hesitations in seeking knowledge and the complexity of sharing personal health concerns within constrained social environments.

- *Extending Peer-Support Frameworks in CSCW* Through the investigation of WhatsApp-based peer groups, this work broadens CSCW's understanding of informal care systems, demonstrating how community-driven digital spaces enable emotional reassurance, experience-sharing, and access to locally grounded knowledge in contexts where formal healthcare support is limited.

- *Contextualizing AI for Health Equity* By studying conversational AI (ChatGPT) in low-literacy, stigmatized contexts, the dissertation enriches responsible AI discussions, offering critical insights into the constraints of generic AI systems in culturally specific and sensitive health scenarios. It informs the design of context-aware, privacy-respecting conversational technologies.

- *Advancing Ecological Approaches to Responsible Health Technology Design* This dissertation uses Bronfenbrenner's ecological systems theory [35] to examine how family planning practices among pregnant and postpartum women in rural India are shaped by intersecting influences, from personal beliefs to societal norms. Moving beyond a descriptive application, it offers an explanatory and generative contribution to HCI and CSCW by showing how stigma, power dynamics, and limited autonomy affect women's decisions, and how smartphone-based interventions, such as chatbots and peer-support groups, can introduce alternative, private support networks. Guided

by Halverson's framework of effective theory - descriptive, explanatory, predictive, and generative [36], the research highlights both the challenges and design opportunities for responsible, context-aware technologies in stigmatized, low-resource settings. It ultimately advances theoretical discourse by demonstrating how technology can reconfigure traditional support systems, contributing to more situated and relational design practices, particularly in the Global South.

Pregnant and postpartum women in low-resource settings often face limited access to health information and decision-making opportunities, with these challenges becoming more pronounced around family planning due to prevailing sociocultural norms and stigma. Given the sensitivity of this topic in rural India, this dissertation focuses directly on understanding the perspectives and experiences of pregnant and postpartum women, rather than approaching the issue through intermediaries such as community health workers.

## 1.5 Dissertation Outline

We divide our dissertation work into chapters, beginning with the related literature, where we highlight the research gaps. The rest of the dissertation is divided into three parts, starting with an understanding of the informational needs of pregnant and postpartum women, followed by studies exploring the potential of smartphone-based interventions to address those needs.

1. **Understanding Practices and Information Needs of Pregnant and Postpartum Women around Family Planning**. In Chapter 3, we investigate pregnant and postpartum women's current awareness and usage of family planning methods. We study how personal beliefs and sociocultural context shape women's family planning practices. We conducted three FGDs, surveys, and twenty interviews to explore rural Indian women's practices relating to contraceptive awareness, usage, and adoption, support received within and outside of the family, factors influencing decision-

making, and aspirations from technology to meet their needs. Our findings highlight the knowledge gap about contraception among women, which is further increased with insufficient counseling support from families and healthcare workers, and uncover sociocultural nuances that hinder the adoption of family planning by women. Further, our findings show how women desire technology to bridge the knowledge gap in the context of stigma associated with family planning.

2. **Understanding the Potential of Peer Support Groups for Offering Informational and Experiential Support around Family Planning**. In Chapter 4, we explore the potential of digital peer support for family planning, given its high feasibility and acceptability for managing health conditions such as mental health illnesses and HIV. We conducted surveys, interviews, and a three-week field experiment with 30 pregnant and postpartum women to understand their engagement in a WhatsApp-based peer support group. Given the limited support within the family and from doctors and community health workers, we found the group to augment the informational and emotional support through peers. The peers shared a similar sociocultural context, which fostered a deeper connection and served as a way to locate local resources.

3. **Understanding the Potential of AI-based Conversational Agents for Addressing Informational Needs around Family Planning**. Prior studies have explored ChatGPT's potential in managing certain health conditions and supporting clinicians in their practice but with a focus outside the Global South. In Chapter 5, we aim to fill this gap by investigating how ChatGPT supports the informational needs of pregnant and postpartum women around family planning. We conducted Zoom sessions with eight postpartum women to study their engagement with ChatGPT using screen-sharing. We observed how ChatGPT could/ could not adapt to women's language considerations, given their limited literacy levels. We studied women's experiences with framing questions to ChatGPT and identified their strategies for evaluating the

correctness of ChatGPT's answers. Further, we observed women's struggles with the voice-conversation feature of ChatGPT, a feature traditionally seen as a way of bridging the literacy gap.

# Chapter 2

# Background and Literature Review

In this chapter, we first present the family planning background in India and how the family planning landscape has evolved in India since the National Programme for Family Planning in 1952. Next, we situate our research in the literature on technology-mediated support interventions in healthcare, with special attention to family planning.

## 2.1 Family Planning in Rural India

In 1952, India launched its National Programme for Family Planning. This program offers services to support family planning adoption, such as free contraceptive methods, training ASHAs to offer counseling support in rural areas, and running mass-media campaigns to create awareness and demand for contraceptives [13]. The program provides two types of contraceptive methods - short-term and long-term. Short-term methods include condoms, Intrauterine contraceptive devices (IUCD/IUD), oral pills, and injectibles, while long-term methods include male and female sterilization. Moreover, those who adopt long-term methods and IUCD are compensated. ASHA workers are also trained to counsel women on family planning. Their responsibilities include counseling women to help them decide the most suitable contraceptive method. They are compensated for ensuring the spacing of children and administration of long-term methods.

Mass media campaigns are also run nationwide to create awareness and increase the adoption of family planning. One of the TV campaigns was launched in 2006 targeted to break the taboo and promote condoms in a humorous way [37]. Different campaigns with slogans such as *'Hum do Humare do'* (We are two, will have two children) and *'Chota parivar sukhi parivar'* (Small family is happy family) were advertised widely through TV, Radio, and posters insisting people to have fewer children. In 1971, during a political

emergency in India, the government forced women and men into sterilization.

This resulted in putting family planning in a bad light. The family planning program's reputation was rebranded in the late 1980s with the fear of HIV/Aids in India when campaigns were run to promote contraception, namely condoms, for protection from HIV/Aids. Thus, with its services and campaigns, the National Programme for Family Planning has managed to reduce the fertility rate from 2.2 (2015-16) to 2.0 (2019-21) [1].

With different contraceptive methods available, the National Health Family Survey observed female sterilization to be the most used method among women in India, across rural and urban settings, while male sterilization has a negligible usage [2]. 38.7% women use female sterilization in rural areas as compared to 0.3% use of male sterilization. With the patriarchal structure of Indian society, the burden of family planning falls on women [17], which might be contributing to female sterilization being the most used method. Condoms are used by 7.6% of rural women as compared to 13.6% of urban women. IUDs, pills, and injectibles have low adoption among urban and rural women.

Rural women (9.9% and 4.3%) in India also have higher unmet needs for family planning and spacing as compared to urban women (8.4% and 3.6%). With the history of family planning in India, where contraception uptake is promoted, we observe the unmet needs of rural women as an opportunity to investigate the factors that inhibit the adoption of family planning in rural settings.

Moreover, a recent study conducted in Uttar Pradesh in India has shown that women avoid family planning either to conform to social norms of having a child soon after marriage, having a male child, or due to low-risk perception of their current method or due to fear of side-effects or out of shame to discuss family planning [14]. The study revealed that despite needing to avoid pregnancy, women have low intention to use contraceptives and even lower actual use of contraceptives. A similar trend of low usage was observed in another study by Ghike et al. [15]. Among a sample of 1,000 rural Indian women, the

[1] http://rchiips.org/nfhs/NFHS-5_FCTS/India.pdf

[2] https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf

authors observed a gap between awareness and actual use of contraception. Studies have reported that married women did not adopt contraception due to fear of side effects, infrequent sex, and objection from contraception by self or others [8, 9]. Moreover, in India, family members have been found to influence family planning choices [9, 14, 15]. It has been reported that mothers-in-law influence the number of sons their daughters-in-law have and the timing and use of contraceptive methods [16]. Further, husbands' understanding of contraceptives and discussion with their friends shape the couple's adoption of family planning [14]. Thus, women are not the sole decision-makers regarding their health and, hence, their bodies. Overall, prior research shows statistical trends and surface-level barriers, such as fear of side effects, social pressure to have children early, preference for male offspring, and family resistance to contraception. However, this body of work does not address how these factors operate in everyday life, influencing women's perceptions, access, and use of family planning services, and what support women desire to practice family planning amidst these factors?. We attempt to answer this in response to our first and second research questions as discussed in Chapter 1.

## 2.2 Technology-mediated Interventions in Healthcare

We begin with interventions that offer informational support for maternal health in resource-constrained settings. We highlight the shortcomings of such interventions and present the case for transitioning to smartphone-based interventions in resource-constrained settings. Next, we present the literature on chatbots and peer support groups in healthcare and highlight the gaps our research aims to fill. Finally, we present the research on technological interventions for family planning, which is largely studied in the medical domain and has limited literature in the HCI domain.

### 2.2.1 Technology-mediated Interventions for Maternal Health in Resource-constrained Settings

Prior research has focused on interventions that offer informational support to pregnant and postpartum women through IVR (Interactive Voice Response), SMS, videos, and messaging platforms. Interventions compatible with feature phones have been developed to offer information on maternal and child health topics. These interventions targeted improving health behaviors such as adopting medicines and family planning practices, frequency of antenatal clinic visits, and immunization rates [38, 39]. Other interventions involving health-related information dissemination through messages include Wazazi Nipendeni in Tanzania [40], MomConnect in South Africa [41], and Aponjon in Bangladesh [42]. These interventions attempted to bridge the healthcare access gap by offering maternal and child-related health information and have shown positive results towards behavioral change in pregnant and postpartum women around antenatal visits, institutional deliveries, and HIV testing. However, SMS-based systems face the limitation of drafting messages with a certain word limit and put the cost of the service on both the implementation team and the end users. A hybrid model has also been tested to understand its effectiveness in imparting informational support to pregnant women [38]. SMS model with a human in the loop has been evaluated to address the health queries of pregnant women in Kenya. SMS was used to provide health information, while human support in the form of a nurse addressed pregnant women's queries, which were either unstructured or used a mix of languages. Such hybrid systems face scalability issues due to human involvement.

IVR systems have also been developed to disseminate healthcare information. Studies have studied the impact of IVR-based automated calls on medical adherence among pregnant women by providing weekly reminders encouraging women to take iron supplements [43]. These IVR-based systems disseminate information on topics such as diet, antenatal visits, complementary feeding, and ultrasound tests [44, 45]. These studies describe user experience and the slow adoption process of such interventions in low-resource areas. Ra-

dio chat shows based on IVR have been found to have the potential to offer information on maternal health-related topics in resource-constrained areas [46].

In resource-constrained settings, SMS- and IVR-based interventions have been effective in offering informational support, especially to users with limited literacy levels. However, these interventions are limited in their modality and the amount of information that can be provided at a time. SMS allows sending only a limited amount of information in a message, and with IVR, sending a large amount of information may pose retention issues. On the other hand, smartphones offer a more interactive and engaging experience. Users can take advantage of multimedia and have the flexibility to send and receive any amount of information in a go. Smartphones open up new avenues of information delivery in the form of chatbots, peer groups, and mobile apps. Thus, smartphones can be explored to deliver information directly to pregnant and postpartum women and connect them to their peers while still being mindful of their limited literacy and instead adding more tools to their information network.

### 2.2.2 Chatbots in Healthcare

In recent years, chatbots have been deployed for various purposes such as railway ticket reservation [3], banking [4], and as an empathetic AI friend [5] to name a few. Among several categorizations, chatbots can be task-oriented or data-driven [47]. Task-oriented chatbots perform well-defined tasks and have structured conversations with users through automated responses [47]. Chatbots used for ordering food [6] are examples of task-driven chatbots. On the other hand, data-driven chatbots interact with users by understanding and responding to their queries in a context-aware manner. These chatbots learn user behavior over time and offer personalization to users [47]. Alexa and Siri are examples of data-driven chatbots. Task-based chatbots do not offer support for unstructured conversations but keep the

[3] https://www.irctc.co.in/nget/train-search
[4] https://v1.hdfcbank.com/htdocs/onChat/index.html
[5] https://replika.com/
[6] https://www.chatbotguide.org/dominospizza-bot

conversation focused on the designated task and avoid providing incorrect information using the pre-defined rules. While data-driven chatbots allow more free-form conversations, they must be mindful of interpreting user queries correctly, which is of prime importance in healthcare.

In healthcare, chatbots play varied roles, such as psychotherapists, nurses, and medicine consultants. For example, Comendador et al. [48] designed a medicine consultant chatbot to offer information on generic medicines for children. Chatbots have also been developed to assist people with mental health issues, such as chatbots offering cognitive behavioral therapy for depression[7], and chatbots for building resilience and reducing stress in adolescent and young cancer survivors [8]. Chatbots have been investigated to deliver information on healthcare topics such as obstetric and mental health care, breastfeeding, sexual and reproductive health, and COVID-19 vaccination. Chung et al. [49] studied the efficacy of a text-based chatbot in delivering information to perinatal women and their partners on obstetric and mental health care. The results suggested updating datasets with user queries over time for user retention and building comprehensive datasets inclusive of males' perspectives on health conditions for higher usage and impact. However, the study pilot tested the chatbot with a small sample with an uneven sex ratio. Yadav et al. [50] followed a wizard-of-oz approach to study the potential of chatbots in providing breastfeeding-related information to postpartum women residing in urban slum areas in northern India. A doctor as a wizard provided answers to queries of postpartum women on behalf of the chatbot. Another study by Rahman et al. [51] prototyped a chatbot for answering sexual and reproductive health-related queries of adolescents in Bangladesh. Both studies were conducted in controlled settings and showed positive results towards feasibility and acceptance of the chatbot and discussed the ethical concerns related to the chatbots around user trust in the chatbot and privacy around shared phones. Baal et al. developed a chatbot, CORY, to offer information on COVID, tackle misconceptions around its growth rate, and deliver behav-

[7] https://woebothealth.com/

[8] https://hopelab.org/product/vivibot/

ioral intervention to encourage people to practice COVID-related safety guidelines [52], however, it has not been tested for its efficacy. These initial studies showed the potential of chatbots to deliver health information; however, these studies tested mainly chatbot prototypes and not actual chatbots, and thus they set the basis for further investigating the scope of chatbots in healthcare. We build on this observation of chatbot prototypes' positive feasibility and acceptability to investigate the use of AI-based chatbots as an informational tool in the context of family planning. In this dissertation, we aim to extend the literature on chatbots in healthcare by studying the use of an existing chatbot, ChatGPT, for the specific purpose of providing information on family planning to pregnant and postpartum women.

ChatGPT has found applications in varied domains such as education [53, 54, 55, 56], finance [57, 58, 59], counselling [60, 61] and healthcare [62, 63]. In healthcare, ChatGPT has been investigated to support certain health conditions, write clinical patient letters, and understand patient experience in hospital settings. Purohit et al. explored the potential of ChatGPT to support people with aphasia, a language disorder that affects a person's ability to communicate. [64]. The authors used ChatGPT on real-world data and reported ChatGPT to be accurate in retrieving words intended by an individual with aphasia while adopting a polite stance in its reply. However, the authors should have incorporated the user feedback in evaluating ChatGPT. Ali et al. evaluated the readability, factual correctness, and humanness of ChatGPT-generated clinical letters to patients in the context of skin cancer [65]. The authors created different clinician communication scenarios and found ChatGPT to generate clinical letters with high scores of correctness and humanness. Moreover, the authors emphasized involving humans in the loop for early adoption of ChatGPT in healthcare to mitigate the risks of incorrect reporting or interpretation and other errors that could have serious health consequences for users. Chatelan et al. investigated the potential of ChatGPT to offer nutritional guidance to individuals with certain health conditions such as Type-2 diabetes [66]. Though ChatGPT's responses were understandable, they were found to be inaccurate and poorly referenced according to clinical reasoning.

Wang et al., through an ongoing study, have reported the human-centered design approach in designing a ChatGPT-based chatbot in hospital settings to improve user experience [67]. We aim to extend knowledge on the scope of ChatGPT in healthcare by evaluating its potential to support the informational needs of pregnant and postpartum women with a focus on a stigmatized health topic. Overall, we contribute to the use of AI among marginalized populations.

### 2.2.3 Peer Support-based Interventions in Healthcare

In HCI, chat-based peer support has been investigated in the context of health conditions such as mental health illnesses, diabetes, and HIV within and outside hospital settings. O'Leary et al. explored the design of peer support chat systems to help people suffering from mental health illnesses [68]. They used Google Docs as a chat platform to experiment with two chat types: guided and non-guided. They reported that the guided chat helped participants figure out solutions for their issues, while the unguided chat was found to be easier and smoother. Another difference reported between the two chat types included guided chat shifting the focus toward troubles, while unguided chat shifted the focus away from troubles. The authors recommended enabling peer conversations over multiple sessions to foster higher engagement. Their work provided initial insights for designing peer support systems. However, their chat system did not offer participants a chat interface, which might have influenced their perception of the overall system. We learned from their findings and designed the chat system over WhatsApp group to offer a chat interface and enable participants to have conversations beyond a single session. Our chat style lay midway between guided and non-guided style, with the moderator sending only discussion prompts with minimal intervention to allow space for participants.

Howard et al. investigated the use of unplatformed design to create a peer support system for individuals undergoing extreme weight loss as a part of diabetes management in Barbados [69]. They presented the positive relationship between participants, peer sup-

port, and WhatsApp and recommended using an unplatformed design for peer support in other contexts. Another work that explored the unplatformed design for digital support groups was conducted by Yadav et al. [70]. They studied the engagement of rural Indian women and health professionals in a WhatsApp group run by an NGO to support women's pregnancy and postpartum needs. They reported the nature of informational and emotional support sought by women, the limitations of WhatsApp for running support groups, and the experiences of health professionals running the group. They opened the discussion for adopting an unplatformed design vs a bespoke model for designing support groups. Learning from these studies, we adopted the unplatformed design to create our peer support group, considering the technology usage of our target population.

Another line of work investigating chat for peer support is in the context of patient-provider communication in hospital settings. Wang et al. studied the use of WeChat for creating nurse-facilitated patient groups to offer medical help and peer support around IVF in China [71]. They reported the use of groups for asking medication-related questions, getting opinions on medical test reports, and exchanging emotional support. The authors suggest design solutions to make nurses' work easier and more effective through changes to WeChat. Haldar et al. explored the opportunities for peer support for hospitalized pediatric patients [72]. The authors reported that patients exchange informational and emotional support and ways to manage time in the hospital. They suggested design considerations for hospital-based peer support systems. Though we aim to investigate designing peer support systems outside of hospital settings, we learned about the engagement patterns of individuals around healthcare.

Overall, the prior studies have mostly focused on creating peer support groups around a health condition and for individuals who have reasonable digital literacy and agency around their health. In this dissertation, we offer an understanding of peer support groups of pregnant and postpartum women who are not suffering from a health condition but need sustained support for managing their sexual and reproductive health. We contribute to

the literature on peer support among a marginalized population in the context of family planning.

### 2.2.4 Interventions for Family Planning

Prior research has investigated family planning interventions that focus on counseling and informational support. Technological interventions for family planning include SMS-based interventions, mobile applications, and chatbots. SMS-based interventions primarily aimed at offering informational support to women [73, 74]. Ashcroft et al. implemented CycleTel Family Advice, an SMS-based service in India that provided information on reproductive health topics such as menstrual cycle, fertility, and family planning. They reported the SMS-based service as insufficient in a stand-alone manner for user retention over long periods and suggested that behavior change requires other supporting systems. In the HCI domain, Perrier et al. experimented with SMS-based intervention to involve male partners in family planning conversations in Kenya [75]. They developed an automated SMS-based system that also involved personalized replies from healthcare workers on a need basis. They reported that SMS-based interventions involving male partners could positively influence the family planning practices of women while leaving the engagement of females with the intervention undisturbed. However, the system was not evaluated for its effectiveness in influencing contraception uptake and poses scalability issues with the involvement of healthcare workers. These studies highlight that SMS-based interventions are either insufficient or unscalable; hence, other types of interventions, especially automated ones, are needed.

Braun et al. evaluated a mobile application developed to support community health workers in Tanzania in counseling clients on family planning [76]. They reported the app to have positive acceptability, and provide better quality information to community health workers. Gilliam et al. developed and evaluated an IOS-based mobile app to offer information on Long-acting reversible contraceptives (LARC) to US patients waiting in the clinic

for their turn to visit a doctor [77]. The authors reported that the app increased patients' knowledge about LARC and their interest in discussing LARC with their doctor. Thus, apps were also found to be useful in family planning counseling. Further, a chatbot has been explored for its feasibility of offering counseling on family planning [78]. Hussain et al. developed and evaluated a rule-based chatbot to offer information on family planning methods. The chatbot was evaluated using the Unified Theory of Acceptance and Technology [79] with 52 individuals of reproductive age living in the US and found to perform well on parameters such as acceptability and self-efficacy. Mobile apps and chatbots have been investigated, but the investigation is in the nascent stages, and further research is needed to determine their use as informational tools for family planning, especially in the Global South context.

Overall, prior research has mostly explored the acceptability and the potential of the interventions to affect the likelihood of contraceptive uptake in women. However, these interventions have been developed with the aim of providing access to information without taking into account how the provided information will operate in the sociocultural context of the women. Moreover, the HCI literature is limited on the understanding of how pregnant and postpartum women, in resource-constrained settings, navigate family planning and how smartphone-based interventions can best support their family planning needs. Thus, we aim to fill this gap by studying pregnant and postpartum women's family planning context and consequently experimenting with interventions to meet their support needs.

In summary, this dissertation focuses on the pressing need to explore smartphone-based interventions as a means to support pregnant and postpartum women in rural and semi-urban India, where traditional healthcare services often fail to address information gaps, social stigma, and agency limitations around family planning. While existing technological interventions, such as SMS and IVR systems, have prioritized information delivery, they often lack the capacity to offer personalized, private, and engaging support for women navigating sensitive reproductive decisions.

This work identifies a critical gap in the HCI literature, where the everyday lived experiences and support needs of women in low-resource, high-stigma environments remain underexplored. By examining how chatbots and peer-support groups, accessible through widely used smartphones, can enhance informational, emotional, and decision-making support, this dissertation addresses the third research question and contributes new insights into designing culturally sensitive, privacy-preserving, and socially aware technologies.

Overall, this dissertation extends the boundaries of HCI and CSCW by foregrounding the complex sociocultural realities of family planning in the Global South, offering pathways for more inclusive and responsible technology design in stigmatized health domains.

# Chapter 3

# Understanding Family Planning Practices and Needs of Pregnant and Postpartum Women

India has its National Programme for Family Planning, under which it offers family planning services such as providing contraceptive methods [13]. In addition to these services, ASHA workers [1] are also trained to counsel rural women on family planning and help women decide a method appropriate for them. Despite government services, rural women have a higher unmet need for family planning (9.9%) and spacing (4.3% ) compared to urban women in India. Moreover, out of all the unwanted pregnancies that happen annually worldwide, more than one in seven occur in India [10]. WHO recommends keeping a gap of at least two to three years between births to reduce the risk of adverse maternal and child health outcomes [11]. However, in India, the average birth spacing is 22 months [12].

Prior work in the medical field reported low awareness and even lower actual usage of contraceptives in women due to fear of side effects, infrequent sex, and limited agency [14, 15]. Prior research, also primarily in the medical domain, has offered different individual-level support interventions for family planning [80, 81, 82, 73, 75, 76, 78]. SMS-based interventions and mobile applications have been designed to offer contraception-related information and have been evaluated with women, male partners, and community health workers. These interventions were found to be feasible and acceptable. However, these interventions do not consider the nature of support, depth, and cultural relevance of information, and the information dissemination mechanisms as desired by different stakeholders.

In HCI and CSCW, family planning is an understudied topic. Though CSCW research

[1] ASHA ( Accredited Social Health Activists) workers are frontline health workers employed by the Ministry of Health and Family Welfare, India. They are responsible for connecting the rural population with the state health system. Their responsibilities include counseling women on birth preparedness, safe delivery, nutrition, breastfeeding, immunization, contraception, prevention of common infections, and childcare.

has focused on other stigmatized health topics such as mental health in general population [18, 19, 20, 21, 22] but a limited focus has been placed on family planning, with prior studies examining hormonal contraception through speculative design [83]and relationship dynamics around contraception use[84]. Moreover, in HCI, pregnancy ecology has been studied to understand maternal and child health-related support needs of women in different phases of pregnancy and offer design recommendations for technological interventions [23, 38, 24, 85, 33, 86, 87, 25, 88, 89]. Further, recently, there has been an emerging focus on highlighting the social, cultural, and intangible facets that are entangled in pregnancy care practices [30, 34, 29]. However, the ecology understanding remains confined to pregnancy and does not move beyond to the postpartum phase. In CSCW, postpartum depression and parenting aspect of postpartum ecology has been given attention [26, 27, 90], but, the aspect of family planning, specifically contraception use, has been under-explored. We aim to understand the postpartum ecology with a focus on family planning through a sample of low-resource women who desire contraception after having given birth or about to give birth to at least one child. We wanted to understand what is the perception of women around family planning, what is the support network women have within and outside of the family, what factors influence women's contraceptive choices, and what support women expect from a technological intervention.

Thus, to widen our understanding of postpartum ecology with a focus on family planning, we started with understanding women's support needs and aspirations around technology to meet their family planning needs. We conducted three focus group discussions (FGDs), 20 telephonic interviews, and an online survey with pregnant and postpartum women. We began with FGDs among pregnant and postpartum women and a healthcare expert to get insights into women's concerns around family planning. Then, the interviews provided us with deep insights into women's experiences with family planning and the support desired from a technological intervention. The survey highlighted the sources of information on contraceptives along with the methods' awareness and actual usage on a

Table 3.1: Demographics of interview participants

| **Demographic** | **Interviews (20)** |
|---|---|
| Category | Postpartum(17), Pregnant(3) |
| Age | 18-24 (4), 25-34 (14), 35-44 (2) |
| Highest Education | Class 12th and below (3), Graduation (13), Post-graduation (3), Nursing (1) |
| Employment | Self-employed (1), Unemployed (19) |
| Parity | One child (10), Two children (8), Delivery due (2) |

large scale, aiding data triangulation. Overall, we aim to address the following research questions,

- RQ1: What are women's support needs around family planning in resource-constrained settings?
- RQ2: What are women's aspirations from a technological intervention to meet their family planning needs?

By identifying women's needs and technology-related aspirations, we intend to offer recommendations for designing future mHealth interventions for family planning support in resource-constrained settings. We plan to contribute to women's health literature to extend HCI knowledge in the context of family planning where there is a dearth of investigation. Further, we urge to move beyond the pregnancy ecology towards postpartum ecology with a focus on contraception by drawing attention to family planning experiences of women, highlighting the challenges and influences on contraception use, and further, opportunities for technology design.

## 3.1 Methodology

We started with understanding the concerns of pregnant and postpartum women residing in rural areas around family planning. Some of the pregnant women included in our study

Table 3.2: Demographics of survey responders

| **Demographic** | **Pregnant women (96)** |
|---|---|
| Age | 18-24 (22), 25-34 (72), 35-44 (5) |
| Highest Education | Class 12th and below (33), Graduation (32), Post-graduation (34) |
| Parity | Two children (24), Delivery due (75) |
| Geographical area | Rural (63), Semi-urban (33) |

had a prior experience of postpartum phase while some were about to have their first delivery. We included those without prior experience to widening our understanding on family planning doubts and experiences. However, our focus has been largely on women with postpartum experience across the entire methodological process. We analyzed three focus-group discussions (FGD) involving pregnant and postpartum women and a healthcare expert as participants. We followed the discussions with 20 semi-structured interviews to dig deep into the women's perceptions, experiences, and aspirations around family planning. We also conducted a short survey to identify adoption and barriers to contraception among pregnant and postpartum women.

### 3.1.1 Participants

For our study, we recruited pregnant and postpartum women as participants. We connected with participants through collaboration with an NGO located in northern India. Since December 2018, the NGO has been running WhatsApp-based groups of pregnant and postpartum women, primarily residing in low-resource areas of Northern India, to deliver information and address queries on maternal and child health-related topics. With the onset of COVID-19, the NGO started expanding its set of digital tools to provide support. The NGO staff started conducting Zoom meetings with women to share informative material

with them and answer queries. The staff regularly trains old and new members on how to join a Zoom meeting through a link and how to mute and unmute themselves, which makes it possible for the women to attend discussions. Hence, over time, members have become familiar with both WhatsApp and Zoom. We leveraged this familiarity and used the same set of tools as the NGO.

From the pool of women in the WhatsApp groups, we conducted three FGDs with around 30 women on average in an FGD and invited 20 participants for semi-structured interviews. We interviewed primarily postpartum women who had delivered a baby within the last six months to better capture the family planning practices spanning the pregnancy and postpartum phases. Though postpartum ecology generally refers to the phase up to one year after childbirth, extending this ecology up to three years helped understand how women's family planning needs change over time and how their practices evolve as they move ahead. The demographics of interview participants are listed in table 3.1. For the survey, we circulated the survey link in the WhatsApp groups seeking participation from group members. We managed to receive 327 survey responses. The demographics of survey responders are listed in tables 3.2 and 3.3. The demographic parameters listed in the table exclude the contact numbers we collected for unique entries. With the help of the NGO, which has a long-standing presence among the women, we managed to interview women regarding their family planning practices, building on the women's trust in the NGO.

### 3.1.2 Data Collection

We, along with our collaborator NGO, conducted three FGDs with pregnant and postpartum women over Zoom. Due to the geographical spread and time constraints of participants, it was quite challenging to gather all the participants for an in-person discussion. Hence, an online discussion was conducted. The discussions were meant to gain insights into women's concerns around family planning to understand the type of queries they had

Table 3.3: Demographics of survey responders

| **Demographic** | **Postpartum women (106)** | **Mothers (125)** |
|---|---|---|
| Age | 18-24 (23), 25-34 (72), 35-44 (11) | 18-24 (8), 25-34 (116), 35-44 (1) |
| Highest Education | Class 12th and below (20), Graduation (44), Post-graduation (42) | Class 12th and below (32), Graduation (38), Post-graduation (55) |
| Parity | One child (68), Two children (38) | One child (86), Two children (36), Three children (2), Four children (1) |
| Geographical area | Rural (74), Semi-urban (32) | Rural (88), Semi-urban (37) |

regarding contraceptive methods. These concerns also helped us frame our interview questions so that we could further probe participants on their concerns and discern how those concerns stem. Prior to the discussion, the group members were informed about the study objective of understanding their concerns around family planning to offer appropriate support and a brief of the research team was also shared. They were also informed that the discussion would be recorded, and the recording would be analyzed by the research team and would be kept confidential by storing it privately. The members were invited to join the discussion only if they were comfortable being recorded, and hence, they participated accordingly. The staff shared the Zoom discussion link in the groups. On average, 30 women participated in each discussion, and each discussion lasted 35 minutes on average. In each discussion, roughly 10-12 women were generally active, with the rest being passive listeners. At the start of every discussion, an informative video was played stating the different contraception methods, their benefits, and side effects. The video was followed by the health expert sharing his views on family planning. The expert then opened the stage for the women to ask their doubts and share experiences around family planning.

We followed the FGDs with semi-structured interviews via telephone calls. We could not conduct the face-to-face interviews due to the vast geographic spread and varying avail-

ability of the participants. The NGO staff contacted the women in the groups via calls and informed them about the interview objective of understanding participants' family planning experiences. They were informed that their interview would be recorded and analyzed by the research team, and everything they expressed would be kept confidential between them and the research team. Participants were further informed that their interview would be shared only with the research team and that their personal details, such as contact numbers, will not be shared with anyone outside. A participant was recruited only if they volunteered to share their experiences and provided verbal consent for their participation. Finally, the staff provided contact numbers and availability of the women who consented to participate. Interviews were conducted by the first author, who identifies as female. The interviews were conducted to get deep insights into what family planning meant to women, what were women's experiences with practicing family planning, what were the challenges, what were the facilitators, what type of support was desired, and what was the role of technology in meeting women's needs. Prior literature has shown the feasibility and acceptability of technological interventions for providing informational support in resource-constrained areas, and hence, we believed technology-mediated support to be a viable option for building a support network outside of their existing support network of only human actors. The interviews started by building rapport with the participants by discussing their health and association with the NGO and slowly shifting to informing them about the reason behind the interview. Once rapport building was completed, the participants' verbal consent to record the interviews was obtained again. All the participants consented to have the interviews recorded. The interview included questions such as, "How do you decide on the contraceptive method?", "What advice did the doctor give you regarding family planning?", "What kind of support around family planning do you desire to receive via your phone?".

After conducting interviews, we conducted a survey using Google Forms to identify contraceptive methods used by women, the purpose of using contraceptives, factors influencing the adoption of a method, barriers to contraception, and sources of information

on contraception. The NGO staff informed us that the group members are well-versed in Google Forms; hence, we decided to use Google Forms for our survey. The survey was conducted to gain an understanding of contraception awareness and usage on a larger scale as compared to interviews. The interviews provided an understanding of the different factors shaping the use of contraception, while the survey provided statistics on the usage of contraception, which helped in the triangulation of data. The survey was conducted in Hindi, considering the literacy levels of the pregnant and postpartum women connected with the NGO. The survey helped better capture contraceptive methods' popularity and other related parameters, such as adoption and barriers among a larger population as compared to the interviews. The survey included 16 questions in total - 10 questions on family planning practices and six questions on demographics, including the question on enquiring whether a responder was a pregnant or postpartum woman or a mother. The survey objective was provided as an introduction text, and the first question asked for consent to participate. If the responder did not consent, they were directed to the thank you page, and no data was collected for them. Other survey questions included, for instance, "Which contraceptive methods have you used so far?", "What factors do you consider while choosing a contraceptive method?" and "From where do you get information on contraceptives?". The survey received 327 responses, with 96 responses from pregnant women and 106 responses from women with children up to one year, which we label as postpartum women, and 125 responses from women with children of age between one to three years, which we label as mothers.

### 3.1.3 Data Analysis

The FGDs and interviews were conducted in Hindi. We started the analysis by translating and transcribing the FGDs and interviews into English. We used the inductive thematic approach for further analysis [91]. The first two authors individually developed codes from randomly selected five interviews and then discussed the codes between themselves

to come to a common understanding. Once codes were mutually agreed upon, the first two authors coded the remaining interviews and developed the final codebook. Similarly, both authors individually coded the FGDs and added the codes to the codebook. The final codebook was then discussed with the third author over multiple sessions to draw the set of themes and tackle any conflicts and biases in coding. For instance, codes such as 'Fear and unawareness of Copper T procedure hinders its adoption' and 'Fear of disease hinders Copper T adoption' contributed to the theme 'Factors affecting Copper T adoption'. Other themes include the 'Role of mother-in-law,' 'Motivation for spacing,' and 'Women's informational needs.' During our analysis, we did not compute the inter-rater reliability on account of it not being congruent to the thematic analysis approach and, moreover, not an appropriate criteria to judge the qualitative work [92, 93].

The survey responses were a mix of open and close-end responses. The open-ended responses were analyzed using the same approach of translation, transcription, and inductive thematic analysis as used for FGDs and interviews. At the same time, the closed-ended responses from the survey were counted against the total number of responses received for that closed-ended question.

## 3.2 Findings

In this section, we report women's perceptions around family planning, the nature of support available to women for family planning, and factors influencing the adoption and usage of contraceptive methods. We also report women's aspirations around family planning interventions.

### 3.2.1 Perception around Family Planning

Almost all our participants entered their marriage with the expectation of getting pregnant within the first year of marriage, which is a prevalent social norm in India [94]. Women viewed conception as a responsibility and burden to be carried as part of their duties as a

wife. A participant shared,

> "It's good I got it over with having a baby. I won't have to listen to taunts anymore." (P08)

We noticed from the interviews that the participants held family planning synonymous with birth spacing and viewed family planning as a means of maintaining a gap of at least 2-3 years between their children after their first child. Participants would keep this gap between children for multiple reasons. These included circumstances like childcare concerns and financial concerns.

However, participants routinely disregarded their health as a significant factor influencing their decisions about family planning. A participant shared,

> "As for health, based on the diet, health will be well on its own." (P03)

It was only in severe cases involving miscarriages or surgeries that participants would be concerned about their health. Even then, intrinsic, societal, and familial expectations would lead to conception and childbirth, overshadowing participant's health concerns. A participant shared,

> 'I had a miscarriage a year back in June 2022. After the miscarriage, the doctor suggested keeping a gap of 6 months before conceiving again. Then, in November, I thought that I should conceive again, and I did." (P10)

Overall, participants perceived family planning as using contraception to ensure spacing between their children. They did not consider their own health as a factor contributing to spacing but rather held only childcare as a primary factor. With pressure to prove their fertility and intrinsic desires, contraception came into participants' lives after their first child.

### 3.2.2 Nature of Support Within Family

For most women, they were provided little information regarding contraception and conception before marriage. Instead, women hesitated to talk about these matters openly. Thus, Their husbands would act as their primary source of information regarding these topics. However, husbands themselves would have limited knowledge. A participant shared how she shared information she gained from the NGO's WhatsApp group with her husband,

> "My husband did not know about these things at all. Actually, I told my husband about all of those copper T and injections, and he said oh, these things are also available? He did not know about these things " (P02)

Participants reported their husbands playing a supportive and compassionate role in their family planning decisions as well as being mindful of the participant's health as an important factor influencing family planning decisions. A participant mentioned

> "Whatever I ask my husband to use, my husband uses that. He follows what I ask him." (P10)

However, a few participants mentioned that their husbands would put the burden of contraception upon them and insist upon using certain contraceptive methods, sometimes due to fear of side effects. A participant shared,

> "I knew about condoms; however, my husband wouldn't agree to use them." (P04)

Overall, husbands played a significant role in the family planning decisions made by participants. However, in the context of an Indian family unit, it was noted that the mother-in-law oversaw the family planning decisions of their daughters-in-law. Thus, the husband's support was mostly in private spaces.

When it came to the mother-in-law(MIL), the MILs often imposed choices about the use of contraception as well as how many kids to have. In many instances, MILs would be accompanied in this by the sister-in-law (SIL). MILs and SILs would thus aim to impose complete control over a couple's family planning decisions. A participant shared,

> "My husband told me that you should get the Copper T inserted. Actually, MIL and SIL are more in control, so they were saying that you can use condoms and don't get a Copper T since it creates problems later." (P08)

This control imposed by MILs and SILs led many participants to lie to their MILs and SILs about using contraceptives. MILs would keep a check on the period schedule of their daughters-in-law and even their spending habits. Participants would accordingly have to negotiate access to contraceptives because they were under constant surveillance by the MIL. A participant shared,

> "My MIL told me not to take contraceptive pills, no contraceptives after the first child, whenever the next baby has to happen, it will happen ... I could use the free contraceptives provided by ASHAs, but I have to make sure my MIL doesn't get to know about it" (P12)

Another participant mentioned,

> "After my first child, I didn't tell anyone I was abstaining. We didn't tell anyone we're keeping a gap on our own, so whenever ladies would get together, they would tell us to have another baby" (P15)

Many participants also reported being pressured by their MIL and SILs to get pregnant. MILs would also pressure women to have more kids to ensure a male child. A participant mentioned,

> "Even now, [MIL] says that she wants another baby, but I don't want another because I already have two kids. I want to raise them well." (P04)

Participants would often be pressured by neighbors to have children. A participant mentioned,

> "In the village, soon after marriage, the women in the neighborhood start commenting that you should have a baby. They used to visit my MIL and tell her that it has been a year so she could provide me medication from here and there so that I could conceive." (P09)

Society would also pressure participants to have more babies in the name of having a male child since it's the male child that takes forward the family's name. A girl child is considered to be a temporary part of the family that will eventually be married off.

Thus, participants undergo complicated dynamics with their husbands, MILs, and society, which shape their decisions around family planning.

### 3.2.3 Nature of Support from Doctors and ASHA workers

Participants conveyed a sense of trust in the information received through a doctor compared to alternate information channels. A participant shared,

> "The best way to get information is to talk to a doctor directly because their recommendations are based on experience, and they have guided many people already." (P15)

However, at the same time, participants reported insufficient access to support from doctors and shared disappointment over the lack of counseling available to them. Participants felt that despite access to doctors, their role was insufficient in meeting their requirements for support. This leads to negative sentiments towards their relationships with doctors. A participant shared,

> "I am not able to receive complete knowledge from doctors. As you know, we might go to any doctor, but doctors don't have enough time to talk to us prop-

erly. Doctors just want the patients to keep coming, and they keep prescribing medicines; they won't completely listen to our problems." (P04)

Most of the participants reported that they did not receive counseling of any kind from the hospital staff after delivery. A participant noted,

"In my case, it was not like the doctor asked me if I wanted to get injections or if I wanted to use a Copper T or if I wanted another baby, nothing like that" (P06)

Some instances were noted where doctors provided certain support and advice to women regarding family planning practices. Doctors would inform participants regarding the gap in conception after a miscarriage as well as between children. Some doctors also enquired about or advised inserting a copper T after delivery for contraceptive purposes. However, in a lot of cases, doctors would insert a copper T without the prior consent of the participant. The doctors wouldn't inform the participants after the insertion procedure either, and the participants would then have to rely on alternate methods to ascertain whether a copper T was implanted after their delivery. Participants would find out about the Copper T later by noticing heavy bleeding or Copper T threads, or going for an ultrasound. A participant shared,

"At the place I had my delivery, they didn't inform me whether they had inserted a Copper T or not. When we asked about it, they said that they would give us a file and it would be written in the file, but even the file did not contain whether a Copper T was inserted or not. We asked as well, but the hospital staff said that they don't reveal this information openly. Now we will get an ultrasound, and then we will know whether a copper T was inserted or not." (P09)

A similar trend was noticed among the ASHA workers. In our survey, we observed similar trends in the counseling support received from ASHA workers across pregnant and

postpartum women and mothers. Very few of the pregnant survey responders (6%), postpartum survey responders (6%), and mothers (4%) reported hearing about family planning for the first time from an ASHA worker. Most of the participants noted the role of ASHAs as visiting to take note of the baby's health but not providing any guidance or counseling around family planning, while a few participants reported not having any visit from an ASHA worker. At the same time, a few participants reported extended support from the ASHA workers regarding providing free condoms, providing advice about injectables and copper T, and offering to help with conducting sterilization procedures. Moreover, a participant shared receiving folic acid tablets from an ASHA worker just three days after her marriage, thereby reinforcing the notion of getting pregnant soon after marriage. Overall, the participants had a sentiment that ASHA workers had a very limited role in family planning counseling. A participant shared,

> "ASHA comes only to collect information about baby such as weight but does not provide any additional information." (P13)

Thus, participants received limited support from their healthcare providers, which heavily shaped their family planning practices.

### 3.2.4 Factors Influencing Contraception Usage

The survey showed similar trends in awareness and adoption of contraceptives across pregnant and postpartum women and mothers. The most known contraceptive method among pregnant women (76%), postpartum women (87%), and mothers (85.6%) were male condoms. At the same time, condoms were also the most used method by pregnant women (52.1%), postpartum women (72.2%), and mothers (74.4 %). Other known methods include female sterilization and Copper T. The contraceptive method with the minimal possibility of side effects is prioritized by pregnant women (65.3%), postpartum women (75.2%), and mothers (79%). Moreover, almost all the survey responders reported fear of side effects as a barrier to contraception.

Table 3.4: Concerns of participants regarding contraceptive methods

| Method | Example of concern |
|---|---|
| Copper-T | "If a woman has a C-section delivery, then when can she get Copper T after one month?" |
| Oral Pills | "If a mother is breastfeeding and taking pills also, will it have any side effects on the baby?" |
| Injections | "I want to know about contraceptive injections. I have heard about an injection that lasts for three months. Are there any other injections that last longer?" |
| Male Sterilisation | "Men can also get operated. Is it safe for them? They doubt that after operation, will they have any problems in the future in having sex?" |
| Female Sterilisation | "It is going to be three months to my delivery. Can I get the sterilization? I have a son and a daughter of three months." |

In the focus group discussions, women raised their doubts, which showed their lack of information about the timing of using the different methods and their side effects. Instances of doubts raised by women are listed in table 3.4. In the interviews, participants shared being aware of condoms, Copper T, injectibles, oral pills, and female sterilization but lacked proper knowledge of these methods. However, when it came to usage, participants mostly used condoms.

There were certain factors that shaped the adoption of contraceptive methods among participants.

*Limited Knowledge:* A few participants expressed having limited knowledge of the methods, which resulted in no usage of contraceptives and, at times, further in unwanted pregnancy. A participant shared how she had no idea of contraceptives, which ended up in her being pregnant,

> "It is my first pregnancy. I did not know anything about methods such as *Antara* [2] injection and Copper T. I did not know what they are, what happens

[2] An intramuscular hormonal contraceptive method for women that provides three months of protection with a single dose.

with them, why do we use them." (P02)

Further, a participant shared her lack of knowledge that male sterilization exists,

> "I thought only females could get the sterilization. I did not even know that males can also get sterilization" (P06)

*Fear of infertility post miscarriage:* A few participants had experienced multiple miscarriages earlier and, out of fear of infertility, were desperate to get pregnant and hence avoided contraception. A participant shared,

> "I had a miscarriage soon after marriage. Then, I was afraid that I would have a problem conceiving. There is a woman in my neighborhood who conceived after six years of miscarriage. So my husband and I thought that we should conceive." (P12)

*Fear of side-effects:* Some participants expressed relying on natural methods such as abstinence to avoid unwanted pregnancy and side-effects of contraceptive methods. A participant shared how she avoided pregnancy without any contraceptive by adopting a simple technique informed by her female relatives,

> "My mother and brother's wife told me that I always pee after having sex so that any sperm that goes inside gets out of the body. They said that this method is better than taking any medicines." (P12)

This brings to notice a deeper issue regarding women's health in rural India. Women lack sufficient knowledge regarding the physiology of conception itself.

A few participants were informed of ovulation days by their female relatives and practiced abstinence on those days.

*Fear of embarrassment:* For some participants, fear of embarrassment hindered the use of condoms. Most of the participants lived together with their in-laws and were afraid of shame if their condom use was exposed. A participant shared,

> "I was afraid that if we use it and somebody sees it in the dustbin, then what will happen? So, we never bought it and used it." (P12)

*Misinformation:* Almost all the participants shared their fear of using Copper T, which mostly stemmed from the negative experiences of other women. Participants shared that they have heard of women having health issues such as heavy bleeding, pain, and infertility due to Copper T, which hindered them from using it. A participant shared,

> "I was thinking of getting Copper T inserted, but my sister-in-law told me not to do so. She said that she got it inserted, but then she experienced heavy bleeding and faced health problems, so I should not get it." (P04)

Oral pills and injectibles also suffered the same fate as Copper T. Participants feared that these methods had to be consumed and may cause infertility or some diseases such as cancer. A participant shared,

> "There is a woman in our neighborhood who took pills. My mother-in-law told me that it has been seven or eight years since she has not been able to conceive. So my mother-in-law feels that one should not take it." (P12)

Aside from the lack of knowledge and health concerns around contraceptives, there were other logistical, financial, and agency-related factors associated with contraception that affected its usage.

*Convenience:* In interviews, participants found using condoms as a convenient option since they did not have to visit a health center to get it, unlike injectibles or Copper T.

*Lack of finances and agency:* With participants whose mothers-in-law controlled the household finances, it was difficult to use contraception since they had to be accountable for the money spent on contraception. Since condoms, injectibles, and pills required frequent dosage, they could not cover for such expenses in front of their mothers-in-law. A participant shared,

> "I live in a joint family, and my mother-in-law keeps a check on every penny spent, so we cannot spend any penny without giving her complete details." (P12)

Participants could not even take advantage of the free contraceptives provided by the primary health centers due to their unawareness of the services or objections from their families.

Overall, participants faced a lack of information, misinformation, fear of infertility, side effects, and embarrassment, which guided their contraception usage. Convenience and agency-related issues further shaped the usage.

### 3.2.5 Aspirations around Technological Intervention

Participants admitted having limited information about contraceptive methods, and they could not fill their knowledge gap through their poor support network comprising of family, ASHA workers, and doctors. Participants shared further experiences of limited agency at the hands of their families. Thus, they aspired informational support outside of their support network. Understanding our participants' understanding and interest in using technology as a tool for informational support was important, and hence, we probed them regarding their existing technology use and desire for future use of technology for family planning. We observed that our participants were well-versed with WhatsApp due to certain reasons. First, they were already a part of NGO's WhatsApp groups offering informational support on maternal and child health topics. Second, they also use WhatsApp for personal use, apart from health needs. All the participants use WhatsApp heavily, while usage of other social media platforms such as Telegram, Instagram, Facebook, and Snapchat is minimal. Firstly, participants lack the literacy to use these social media platforms all by themselves without relying on another individual. Secondly, participants expressed that they were facing agency issues as their husbands objected to using different social media platforms. WhatsApp is deemed the best and safest platform for socialization by husbands, and hence, its usage remains

high among our participants. Participants expressed being able to send, delete, and forward messages of text and audio nature. They could block a contact. Further, they were familiar with viewing and uploading stories on WhatsApp. Apart from WhatsApp, YouTube was also used by participants for recreational purposes such as watching videos/shorts and liking/disliking videos/shorts. Using WhatsApp and YouTube had developed a basic understanding of mobile applications among our participants. Some participants also expressed their interest in using Google search, either to translate text from English to Hindi or to search for information regarding health and other issues. Interestingly, some participants were also aware of chatbots. They expressed learning about chatbots during COVID times when the Indian Government introduced a WhatsApp-based chatbot called MyGov Corona Helpdesk in English and Hindi to disseminate information about COVID-19 [95]. They had a basic understanding of chatbots as computer systems that provide answers to questions provided as menu options. Overall, their usage and awareness of these technology-based platforms helped them visualize the use of technology for fulfilling their family planning support needs when their human infrastructures failed to offer the desired support.

Enquiring about their usage of Google search or any existing apps or chatbot for family planning needs, all the participants unanimously confirmed of no usage except for Internet search. Participants expressed lacking awareness of any app or chatbot for family planning. While some participants used the Internet for health-related queries to cover up for their lack of information, they had concerns over information accuracy. Participants felt that internet searches did not provide them with accurate and personalized information. A participant shared,

> "The Internet has unnecessary information also. The Internet also does not know our history, what we can use, and our current health condition." (P07)

Moreover, with limited guidance available from doctors and ASHA workers, participants expressed the desire to receive experiential knowledge from fellow women going through similar life phases. The participants desired to know what contraception other

women were using and how it was working for them.

Participants were inclined towards using a group-based intervention where other women could also join and share their experiences of using family planning. Participants felt that when other women share their thoughts and experiences, their scope of knowledge gets widened, and they are better able to decide on contraception for themselves. A participant shared,

> ”In a group, women have similar problems, and each will tell their experiences. We will be able to get not one but many messages where women would tell which method has what impact and which method has what side-effect on them, and we will be able to take benefit from that.” (P12)

However, participants also desired a certain level of privacy in such a group-based intervention. Participants shared being hesitant to discuss family planning in the presence of men and women they know, for example, women from the neighborhood. Some participants hid their contraceptive use from their mothers-in-law, and they feared that if they discussed it with known women, their mother-in-law would come to know about it, and they would have to face the repercussions. A participant shared a similar experience where she discussed a contraceptive method with her neighbor, who in turn informed her mother-in-law,

> “My neighbor asked me about contraception, so I told her about the contraception I was using and suggested she try it out. She later told my mother-in-law I was using contraception, and then hell broke loose for me.” (P04)

Participants wished for women unknown to them to be a part of group-based support intervention to discuss family planning without any fear and judgment.

Moreover, participants desired to complement the group-based support with individual-level support. They expressed interest in using mobile applications and chatbots to receive

detailed information on contraception methods, such as their types and side effects. A participant shared,

> "If there is a special app for family planning, then it will guide us better. In group, women will tell what they have used, but the app will tell about all the methods, their benefits, their side-effects." (P12)

Some participants felt that if they were unable to ask some personal questions in a group, then they could ask them from the chatbot.

Participants felt that with the app and chatbot, they would be able to gain information according to their routine, such as at night after completing all the chores.

Overall, participants desired a blend of both types of support as described by a participant,

> "Both the types have their own positives and negatives. In the group, we all are members of the same phase. Some have either delivered a baby or are about to deliver a baby. Wherever there is a phase, the level of discussion is very different. Someone would reply to a question, and somebody might put up a question on that reply, and this is how the conversation goes in different directions. We get elaborate information. If there is no group, then I will have direct information. I am asking, and I am getting the answer. So, both types are okay with me. For me, both are in my comfort zone. (P07)

Participants desired group-based support for experiential knowledge and individual-level support for fundamental knowledge about contraceptives. This is quite contradictory to the prior technological interventions, which have focused on providing individual-level support.

## 3.3 Discussion

Learning from our findings, we discuss the need to adopt an ecological approach to family planning. We further present design implications for developing support interventions for family planning.

### 3.3.1 Ecological Approach towards Family Planning

Contraceptive adoption has been found to be low in rural areas. The adoption is affected by the level of awareness and intention, which in turn translates into usage. The usage is further shaped by the extent of agency women have regarding decision-making about their health and well-being.

The first step is the knowledge about family planning among women. As observed in our study, women in resource-constrained areas receive limited knowledge about contraceptive methods from their families. Moreover, with ASHA workers focusing mainly on childcare and overlooking family planning and doctors also providing limited guidance on family planning, participants' knowledge about contraceptive methods is adversely affected. In our study, we found condoms to be the most known method. This could be attributed to the mass media campaigns focusing mainly on condoms and also to other factors such as ease of convenience of use and access. Thus, the perception of condoms is good, and concerns are less compared to other methods among our participants.

The intention is the next step in the adoption pipeline. Intention is also determined by the knowledge level of participants and, moreover, by the extent of fears and misinformation surrounding women. In India, a woman is defined by her fertility and is considered worthless if she fails to give birth [17]. In our study, we observed a similar emotion; women shared having a fear of the side effects of methods, with the fear of infertility being the most prevalent. A participant shared being called infertile when she had multiple miscarriages even though she eventually conceived. With the fear of becoming infertile, the intention

to use contraceptives remains low, especially for contraceptive methods apart from condoms. With limited informational support from family, ASHA workers, and doctors, the fear of side effects and misinformation is quite prevalent. Thus, the intention for using contraceptive methods, in general, is adversely affected.

Another factor that shapes women's use of family planning methods is the agency around decision-making about their health. As observed in prior studies and our study, women are not the sole decision-makers around contraception [9, 14, 15]. Husband, mother-in-law, sister-in-law, and society influence a woman's decision-making. In our study, we observed that women who have to bear the pressure of getting pregnant from these different actors either succumb to that pressure and do not use contraception or take a stand for themselves and use contraception. Those who take a stand devise strategies to use contraceptives, such as keeping it hidden from the family. Moreover, our findings highlight the mothers-in-law's influence on a granular level, such as determining the use of method, type of method, timing of method, and controlling finances to further hinder the agency of women. At times, husbands also object to the use of certain methods due to fear of infertility and fear of adverse health effects. Thus, knowledge and perception of mothers-in-law and husbands influence the adoption of methods.

Prior studies focused on counseling women and, at most, husbands along with women; however, mothers-in-law were rarely included in the ecology of individuals receiving counseling. Thus, we urge the inclusion of a wider ecology of stakeholders that influence family planning practices.

Building on Bronfenbrenner's ecological systems theory [35], we describe the different stakeholders influencing a woman's autonomy around family planning at different levels.

- At the core center is the woman.
- The microsystem consists of the husband, family, friends, and neighbors.
- The exosystem consists of extended family, society, healthcare institutions, and work-

ers.

- The macrosystem consists of social norms, beliefs, and culture.

For women, informational interventions offering education and experiences around family planning are needed. For the microsystem, educational interventions grounded in the macrosystem need to be delivered to address age-old beliefs and provide accurate information. The exosystem, particularly healthcare workers, need to be routinely assessed for their family planning counseling in the field and involved in interventions that increase the outreach of their counseling.

Apart from pregnant and postpartum women specific to our study population, there could be samples of women having quite different needs around family planning. Some women may desire to delay pregnancy despite having no children, while some women may face problems in conception despite their wish to conceive. We believe the ecological approach and our recommendations can also be extended to these different samples of women. The sample of women wishing to delay pregnancy needs informational interventions focusing heavily on contraception. On the other hand, the sample of women facing problems in conception needs interventions providing informational as well as experiential support. Women can share experiences, discussing the issues they face and the treatments they undertake related to conception. The other levels of the ecosystem need educational interventions with a particular focus on addressing the beliefs around associating a woman's worth with fertility.

Our findings demonstrate the deeply entangled values and cultural systems that impact decisions regarding conception, contraceptive use, and healthy spacing right from the beginning of marriage. However, as of now, the postpartum ecology hardly focuses on the family planning aspect. Taking a delineated approach might lead to neglect of the pre-existing complex structures that exist between multiple pregnancies. Targeting the different layers of the ecological system could detangle the complexities on the intra- and inter-level in these layers. This detangle could improve the knowledge of different stakeholders about

family planning, which could support women in practicing family planning.

### 3.3.2 Implications for designing Technology-mediated Support Interventions for Family Planning Needs of Women

**Implication 1 - Incorporate Peer Support:** Prior technological interventions around family planning have provided informational support primarily on the individual level. However, the impact of these interventions on knowledge gain and behavior change has not been studied. Moreover, these interventions have not been developed by understanding what women want but rather with the assumption that women desire one-on-one interaction, while in our study, we observed a contradiction. We found that participants, in addition to individual-level support, desire support that offers them experiential knowledge about family planning. They want to know what methods other women use, how the method affects them in real life, what the possible side effects of the methods are, and how women mitigate those effects. Participants wish to use others' experiences to figure out a method that suits them best.

Peer support has been primarily investigated for health conditions such as maternal and child health, mental health illnesses, HIV, and diabetes within and outside hospital settings [68, 69, 70, 71, 72]. These studies have reported the nature of people's informational and emotional exchanges with each other in peer support systems. As seen in works such as by Karusala et al. [96], Yadav et al. [70], Yang et al.[97], and Hu et al. [98] group-based support creates a sense of community among the group members and supports members' knowledge through each others health queries and experience sharing. These studies highlight the potential of peer support, and we believe a similar peer support group could fit into our context. However, parameters such as the nature of information exchange, notions of privacy, and group dynamics could be different for our study population, given the unique characteristics of their context. Prior works have dealt with populations having literacy, knowledge, and agency around their bodies. On the other hand, women in our study

context have low literacy levels along with limited awareness and knowledge about their health. They hesitate to discuss family planning even with women in their own households and lack the decision-making power around their bodies. Their notion of privacy is also limited in scope, given their low exposure to technology. Hence, a group-based support tailored to our study population is needed.

Further, some studies have highlighted the unplatformed design process towards developing peer support systems [68, 70], which gives insights into the platform design of peer support groups. Few studies have also uncovered how peer support systems could fit into hospital settings to expand the capacity of healthcare professionals in helping patients [71, 72].

A recent study by Naseem et al. investigated the use of IVR-based hotlines for extending maternal and child health-related support for low-income expectant fathers [99]. The hotline offered options such as asking queries that were answered by doctors, listening to peers' health queries and answers, and also sharing health experiences with peers. This system showed positive results in user acquisition; however, we believe a similar intervention would not fit our context. Firstly, the scope of users was kept for husbands without targeting the primary stakeholder - women, their limited agency. Though women have limited agency in our settings, keeping them on the peripheries makes it seem like they are further comprising their agency. Moreover, the IVR-based hotline support would not offer experiential exchange as effectively as a peer support group over the text-based interface.

Overall, in HCI, the use of a peer support system to support the unmet needs of low-resource populations in terms of family planning is under-explored. Learning from the findings of prior literature on peer support, an initial peer support group for exploration can be designed. We now offer recommendations for designing peer support group.

*Who should be Involved?:* The peer support group should be comprised of women from a similar socio-cultural context. Such women would be aware of the social norms and the barriers to family planning in their context and would be able to support each other better.

The women would themselves have experienced those barriers and, thus, could offer other women ways of navigating them.

Further, women in different phases could be involved, such as women not pregnant and needing contraception, pregnant women needing family planning knowledge after delivery, women with one child, and women having achieved a desirable number of children so that they could seek and provide support to each other with diverse experiences.

In our study, participants had desires to keep their family members at the peripheries to avoid judgment and interference from them. Participants were comfortable sharing their family planning practices and concerns with women unknown to them so that their family planning practices were kept hidden from the family. They wanted a private space from their family but a safe space with women unknown to them. Thus, the group should have members who are unrelated to each other for open discussion.

*What should be the Platform?:* Considering the technology level literacy of women, peer support should be deployed over a platform convenient for them. As for our study participants, a WhatsApp-based support group is a feasible option, given their high familiarity with WhatsApp. Similarly, for women in other contexts, understanding the technology used by women to decide on a peer support platform is crucial. For instance, for some women, social media platforms like Facebook could be a better option for peer support where they could engage even as a closed peer support group. Prior studies have already explored the role of Facebook groups for the population residing in high-income countries [100, 101, 102]. Overall, adopting a platform impacts the usage of peer support and, hence, should be designed with careful consideration of the technology used by the target population.

*What should be the Group Dynamics?:* As seen in prior studies involving peer support groups [96, 70], the group includes a moderator for sending prompts for discussion among members and for providing answers to members' queries. Discussion prompts have been found to foster engagement in the group. We suggest building on these dynamics to design a peer support group in the initial stage. We recommend keeping a moderator's role passive

with minimal involvement in the peer support group initially to offer members space to engage more independently and for researchers to observe how the group engagement flows naturally. Over time, the moderators can learn of engagement patterns and adopt their roles accordingly.

**Implication 2 - Incorporate Health Expertise:** Participants desire to involve a healthcare expert in the intervention who can share accurate information and provide replies to their queries. At times, women share different views on methods for which they feel the need for a healthcare expert to provide the right information. However, with a poor doctor-to-patient ratio in India, this seems an infeasible option. One workaround is to share the doctors' workload through digital tools such as chatbots. As seen in work by Yadav et al. [50], chatbots have the potential to answer the healthcare queries of users. The chatbot could be used to answer basic queries requiring factual information, while only complex queries could be directed to the doctor. This would provide access to doctors without overburdening them.

In healthcare, chatbots have been found to have different use cases, such as psychotherapists, nurses, and medicine consultants. For example, Comendador et al. [48] designed a medicine consultant chatbot to offer information on generic medicines for children. Chatbots have also been developed to support people with mental health issues, such as chatbots providing cognitive behavioral therapy for depression[3], and chatbots for building resilience and reducing stress in adolescent and young cancer survivors [4]. Chatbots have been investigated to offer informational support on healthcare topics such as obstetric and mental health care, breastfeeding, and sexual and reproductive health. Chung et al. [49] studied the efficacy of a text-based chatbot in delivering information to perinatal women and their partners on obstetric and mental health care. Yadav et al. [103] performed a wizard-of-oz experiment to study the potential of chatbots in providing breastfeeding-related information to postpartum women residing in urban slum areas in northern India. A doctor as a wizard

[3] https://woebothealth.com/

[4] https://hopelab.org/product/vivibot/

provided answers to queries of postpartum women on behalf of the chatbot. Another study by Rahman et al. [51] prototyped a chatbot for answering sexual and reproductive health-related queries of adolescents in Bangladesh. Both studies were conducted in controlled settings and showed positive results regarding the feasibility and acceptance of the chatbot. They also discussed the ethical concerns related to the chatbots, such as user trust in the chatbot and privacy around shared phones. Kaur et al. explored the role of chatbots in tackling COVID-19 vaccine hesitancy among low-resource women on a large scale in rural India and reported chatbots being useful in developing intention for behavior change [104]. Overall, chatbots have a high potential for information dissemination, even among low-resource populations. Building on this line of work, we suggest leveraging the potential of chatbots for a taboo topic - family planning in low-resource settings.

Given the context of our study population and the taboo nature of the family planning topic, we suggest making the following considerations -

*Interaction Style:* The chatbot should interact in a manner compatible with the literacy level of the users. Kaur et al. reported high compatibility of rule-based chatbots for low-resource women, given the limited literacy of their target population[104]. We believe a rule-based chatbot would also fit in our context, given similar participant demographics. A question-answering-based chatbot is another interaction style. However, it would have to be investigated whether our participants can frame health queries with minimal cognitive overload and also interpret the chatbot's answers correctly. Prior studies have explored question-answering chatbots but in controlled settings [50, 51]; hence, exploration in real-world settings is needed.

*Nature of Chatbot:* The chatbot should be designed in a culturally sensitive manner considering the contextual social norms, myths, and misconceptions. Addressing these socio-cultural factors is important for extending support in an effective manner, given their prevalence in women's family planning practices. For instance, the chatbot's database should have information on common family planning practices prevalent in the community

so that the queries are answered with localized actionable information.

*Scope of Chatbot:* The chatbot should cover information ranging from contraception methods to local resources for family planning. Information on contraceptive methods should include details of different temporary and permanent methods along with the natural methods to cater to the varying needs of women. The chatbot could also inform of the local resources available for family planning and details of how to access them to further support the usage of family planning.

The chatbot should not substitute a healthcare expert but rather share their workload. The chatbot should direct the user to a health expert if needed.

## 3.4 Limitations

The involvement of our participants in existing WhatsApp groups run by NGOs shaped their understanding of technology use for healthcare. With poor exposure to other social media platforms and existing digital health tools, the participants' views about technology remained mainly confined to WhatsApp-based groups. With wider exposure, the notion of health technology would have been different.

## 3.5 Building on Current Findings

With the understanding of family planning needs and practices of pregnant and postpartum women, along with their aspirations for technology support for family planning, two forms of needs for support interventions emerge - experiential support and fundamental knowledge around contraception. Women desire experiential support through a group-level support, while they expect fundamental knowledge from an individual-level support. Thus, we have investigated both types of support to understand how they would operate in the context of pregnant and postpartum women. Chapter 4 investigates group-level support in the form of a WhatsApp-based peer support group, and Chapter 5 investigates individual-level support in the form of ChatGPT.

# Chapter 4

# Understanding the Potential of Peer Support Groups for Offering Informational and Experiential Support around Family Planning

In HCI, peer support has been primarily investigated for health conditions such as mental health illnesses, HIV, and diabetes within and outside hospital settings [68, 69, 70, 71, 72]. These studies have reported the nature of people's informational and emotional exchanges with each other in peer support systems. These studies highlighted the unplatformed design process towards developing peer support systems [68, 70]. Few studies have uncovered how peer support systems could fit into hospital settings to expand the capacity of healthcare professionals in helping patients [71, 72]. However, the potential of peer support for practicing fundamental human rights, such as sexual and reproductive rights, and for life phenomenon that prevents health conditions in the first place has been understudied in HCI and CSCW. We believe exploring the potential of peer support as a preventative step towards health is equally important to using peer support as a cure and management step towards health, as seen in prior literature. Thus, we learn from the insights of the prior studies and investigate the potential of peer support systems for extending family planning support to women residing in resource-constrained settings in India. These women have been found to have low knowledge and limited agency around family planning and also experience family pressure for conception [15, 17]. Additionally, they receive limited counseling support from community health workers. Given their context, we plan to explore the potential of peer support groups where women can support each other. We adopt a chat-based model of peer support over WhatsApp, given our participants' high familiarity with WhatsApp and their limited technological literacy, which hinders the use of online platforms for information-seeking. We have conducted a three-week field experiment where we run a WhatsApp-based support group of 30 married and non-sterilized women residing

in rural areas of Haryana in Northern India. As a first step, we conducted a survey to collect demographics and family planning practices of the 30 women participants. Then, we ran a WhatsApp group of 30 participants for three weeks. During the field experiment, we also conducted a short survey to gauge the participants' feedback on counseling provided by community health workers. Finally, we conducted semi-structured interviews with 10 participants to understand their experiences with the group.

In this study, we uncovered the nature of informational and experiential support sought by our participants and how the group served as an emotional space for managing stress. We also observed the moderation strategies employed by our participants for the smooth running of the support group. Further, we identified the value added by the group for our participants amidst their poor support network. Finally, we highlighted participants' aspirations with the design of a peer support system for family planning support.

In this paper, we uncover how women, who are marginalized in terms of knowledge and agency, use a support group and how the group should be designed to cater to the population's needs around family planning. We intend to contribute to HCI, CSCW, and social computing literature with an understanding of peer support systems for family planning, a topic that in itself is understudied in these domains. Overall, we aim to make the following contributions -

- Providing an empirical understanding of support needs of women around family planning, not met by support within family and in hospital settings
- Providing an understanding of how low-resource women engage in a peer support group for healthcare needs around family planning
- Identifying design implications for a peer support system in resource-constrained settings for women

Table 4.1: Demographics of Study Participants

| **Demographic** | **Study Participants (30)** |
|---|---|
| Category | Postpartum(18), Pregnant(12) |
| Age | 18-24 (5), 25-34 (24), 35-44 (1) |
| Highest Education | Class 12th and below (15), Graduation (8), Post-graduation (7) |
| Employment | Employed (1), Unemployed (29) |
| Parity | One child (16), Two children (8), Delivery due (6) |
| Smartphone Ownership | Own (28), Shared (2) |

## 4.1 Methodology

We started with the objective of understanding how women would engage in peer support for their family planning needs. We began by conducting a survey to collect our participants' demographics and family planning practices. We then conducted a three-week field experiment with 30 women participants to observe their engagement in a WhatsApp-based support group. We also conducted a short survey to obtain participants' feedback on family planning counseling provided by ASHA workers. We followed the experiment with semi-structured interviews with 10 participants to get deeper insights into their experiences with the support group.

### 4.1.1 Participants

For our study, we recruited pregnant and postpartum women as participants. We connected with participants through collaboration with an NGO located in northern India. The NGO runs WhatsApp-based groups of pregnant and postpartum women, primarily residing in low-resource areas of Haryana in Northern India, to deliver information and address queries on maternal and child health-related topics. The existing WhatsApp groups were focused on maternal and child health in general. There was no existing group focused primarily on the family planning needs of women. Thus, we had to create a separate group to investigate

the scope of peer support specifically for family planning, a topic considered taboo in comparison to general maternal and child health-related topics.

From the pool of women in the WhatsApp groups, we aimed to engage with 40 women in our study. The NGO staff helped us recruit our participants. The staff approached active members of the groups who participated in discussions, asked questions frequently, and expressed having family planning needs. Active members were approached to ensure that the study group had participants who would participate willingly in discussions. Selecting passive members of the existing WhatsApp groups had chances of members being passive even on the topic of family planning, which would have defeated the purpose of understanding the design of the peer support group. Such passive members would have needed more efforts over the long run to foster their participation, and understanding the nature of such efforts and their impact on passive members related to a taboo topic was not the focus of the current work. Hence, we attempted to recruit as many active participants as possible to have a rich engagement during the time interval of the current study. These active members were then shared the link to an initial survey we discuss below, and finally, those who provided consent to participate were further involved in the study. With the help of the NGO, which has a long-standing presence among the women, we managed to engage women regarding their family planning practices, building on the women's trust in the NGO.

### 4.1.2 Data Collection

*Survey:*

In order to know our participants better, we conducted an initial survey using Google Forms with our participants to capture their demographics, such as age and parity, and their family planning practices, such as contraception usage, the purpose of using contraception, and barriers to family planning. The survey provided an overview of our participants' family planning practices, which helped design the discussion prompts for the field experiment.

Table 4.2: Family Planning Practices of Study Participants

| **Parameter** | **Participants (30)** |
|---|---|
| Awareness of contraception | Male condoms(26), Copper T (23), Female sterilisation(22), Male sterilisation(21), Injectibles(18), Emergency pills(17), Female condoms(10) |
| Usage of contraception | Male condoms(23), Copper T (4), Emergency pills(3), Natural method(3), No method (5) |
| Motivation for using contraception | To get pregnant as per wish/Avoid unwanted pregnancy(24), Spacing between children(21), Avoid STI/STD (13) |
| Deciding a method | Easy and convenient to use(23), Minimal side-effects(22), Easy availability(13), Inexpensive(2), As instructed by husband(2) |
| Motivation for spacing | Take good care of children(29), Maintain good health of self(24), Maintain financial stability(13) |
| Barrier to contraception | No barrier(20), Fear of side-effects(10), Objection from husband(2), Objection from family(2) |

The demographics of study participants are listed in table 5.1. At the same time, the family planning practices of participants are shown in table 4.2. For certain survey questions, multiple responses were allowed, and thus, the numbers do not necessarily total up to the number of participants. The NGO staff informed us that the group members are familiar with Google Forms and use the forms to conduct surveys in their groups; hence, we decided to use Google Forms for our survey. The survey was conducted in Hindi, considering the literacy levels of pregnant and postpartum women connected with the NGO. The survey included questions such as, ”Which contraceptive methods have you used so far?”, ”What motivates you to use contraception?” and ”From where do you get information on contraceptives?”.

Through the survey, participants were informed that the current study focuses on understanding their engagement in a WhatsApp group where they could interact with fellow women regarding their family planning needs. They were further informed that their survey and interview responses, along with group chat, would be collected and analyzed by

the research team, and they were asked to participate in the study accordingly. The survey started with a question seeking consent from participants regarding their participation in the study and the collection of their chat logs. If any participant objected to their data being collected and analyzed, they were not included in the study and were directly transitioned to the thank you page of the survey without collecting any data from them. Our collaborator NGO did not persuade any participant to participate in the study and did not play a role in seeking participant consent, which was purely voluntary.

*Field Experiment:*

After the survey, we created a WhatsApp-based group comprising 30 participants. WhatsApp was chosen as the group platform, considering our participants' high familiarity with it. The group also involved the first author and one NGO staff. The first author was responsible for sharing discussion prompts in the group daily, except on Sundays. The prompts included questions such as, "How do you choose a contraception method?", "How do you use ovulation days?", "What are your fears with modern contraceptive methods?", and "Do you experience any stress with family planning?". Meanwhile, the NGO staff cleared any misinformation and answered participants' queries. Since the participants were already a part of the NGO's other WhatsApp groups, they had an intrinsic desire to gain information related to their health, which helped foster discussion on family planning in our study. Moreover, we leveraged participants' trust in the NGO, which led them to have open discussions without any fear. Moreover, privacy was not a challenge for our participants as they were comfortable if their husbands wanted to see their chats in the group. Thus, the group was run for three weeks, and we collected chat logs of participants in the group. The collected chat logs were shared only with the NGO head and the NGO staff member involved in the study, apart from the research team. The collected chat logs were stored in a drive folder with strict access rights to ensure participants' privacy.

During the field experiment, we identified the lack of support from ASHA workers to-

wards our participants, which made us curious to understand our participants' interaction with their ASHA workers. Thus, we conducted a short survey to gauge participants' feedback on the guidance provided by ASHA workers about family planning. The survey was designed as a Google Form in Hindi. The survey was based on the Interpersonal Quality of Family Planning(IQFP) scale, which measures the interpersonal quality of contraceptive counseling between women and their healthcare providers. The scale has been primarily validated in the United States but has been found reliable and valid in Indian rural settings [105]. The survey captures participants' responses on a Likert scale ranging from 1(poor) to 5(excellent) against parameters evaluating guidance provided by ASHA workers.

*Semi-structured Interviews:*

After three weeks, we wanted to understand group members' experience with the group, so we conducted ten post-intervention telephonic interviews. We could not conduct the face-to-face interviews due to the vast geographic spread and varying availability of the participants. The first author conducted the interviews in Hindi and started them by building rapport with the participants by discussing their health and association with the NGO and slowly shifting to the main topic. Once rapport building was completed, the participants' verbal consent to record the interviews was obtained. All the participants consented to have the interviews recorded. The objective of the interviews was to understand the participants' experiences in the group. We wanted to understand how women engage with each other to seek support around family planning and what value such a group adds to their information-seeking around their health. We intended to identify whether running such support groups in the future is crucial and, if so, how such groups need to be designed. The interview included questions such as, "What value does this group add to your family planning practices?", "What did you find missing in the group?", "Did you have any privacy concerns with your contact number being visible to group members?".

### 4.1.3 Data Analysis

The survey responses were a mix of open and close-end responses. The open-ended responses were analyzed using the approach of translation, transcription, and inductive thematic analysis [91]. At the same time, the closed-ended responses from the survey were counted against the total number of responses received for that closed-ended question.

The chat logs were in Hinglish, Hindi written using English alphabets. The chat logs were analyzed using inductive thematic analysis to draw themes. The authors developed codes such as 'Seeking help on chances of pregnancy till no periods after delivery' and 'Unclarity about the quantity of menstrual flow post delivery', contributing to the theme 'Insufficient knowledge about menstrual flow pattern after delivery.'

The interviews were conducted in Hindi. We started the analysis by translating and transcribing them into English. We used the inductive thematic approach for further analysis. The authors developed codes from the interviews and discussed them to identify themes. For instance, codes such as. 'Number visibility fosters help-seeking and personal connection' and 'Help-seeking on 1:1 adversely affected with hiding numbers' contributed to the sub-theme 'Downside of offering privacy by hiding numbers', forming the theme 'Privacy levels desired by participants'.

## 4.2 Findings

In this section, we report findings from the engagement of the participants in the group-based support intervention and the follow-up interviews to understand participants' experiences with the intervention.

### 4.2.1 Engagement in the Group

In the group, participants sought informational support and experiences from fellow group members. Participants also shared their suggestions, such as the timing of the use of con-

traceptive methods and conception. Further, participants used the group to vent their emotions to relieve stress. Moreover, we observed participants' devised ways of moderating the group for irrelevant content.

*Seek Informational Support and Experiences:*

Participants shared having insufficient knowledge about family planning. They expressed unawareness about different contraceptive methods, their side effects, timing of use, and how to get them. Participants messaged the group asking for information on which method to use and others' experiences with the method. For instance, a participant shared her doubt about adopting a permanent or temporary method after achieving a desirable family size,

> "My family is complete. We have two children. But doubt remains: What should I do? Should I get an injection after every three months or get sterilization? Because my husband and I do not want to take any risks." (P15)

Participants shared messages in the group asking about their experiences using the methods so that they could better decide for themselves. For instance, a participant sought experiences of using injectibles,

> "I have not used any injection or medicine. My husband only uses protection. I do not know about injections. When other members share their experiences regarding injections, I will definitely read them. I would try to learn about the benefits and drawbacks of injections." (P19)

Further, members felt that the group provided an understanding of the dos and don'ts of family planning and, at the same time, cleared myths about certain methods. For instance, to clear a myth around Copper-T in the group, a participant shared,

> "Sister, infection happens due to several reasons. Infection happens for other reasons, and women blame Copper T. We also get infections but do not have Copper T inserted. " (P18)

Members also shared learning about the importance of spacing from the experiences shared by fellow group members. For instance, a participant expressed her wish to guide others about spacing due to her own experiences of failing to keep a gap between her children, as a result of which she feels guilty about being unable to look after her children properly.

One of the major concerns raised in the group included understanding menstruation post-delivery and the effect of different methods on menstrual flow. Participants sought help in understanding menstrual flow patterns post-delivery since a lack of knowledge of the flow contributed to the stress of unwanted pregnancy in participants. For instance, a participant shared,

> ”I got my periods after one month of delivery. I had a normal delivery. Is it a thing to worry? I am afraid of getting pregnant, so I do not have sex. My daughter is two months old, and I am tensed that I might get pregnant since I got my period soon after delivery. Please, sister, give me advice so that I do not get pregnant. What should I do to have sex? Please reply.” (P14)

In response to participants' requests for information and prompts shared by a moderator, group members shared their concerns, knowledge, and experiences. For instance, in response to a discussion prompt, a group member shared detailed information on injections to use,

> ”Let us discuss today's topic. If the injection is taken on time, then it could be very effective ... The side-effects of injections are ... After taking injections, you may experience mood swings, food cravings, stress, etc. ” (P15)

Moreover, group members sought help in finding ways to hold ASHA accountable for offering limited guidance and services on family planning. For instance, a group member expressed her disappointment with ASHA,

> ”Let me tell you one thing. The government provides everything. It is the ASHA workers who just collect our government ID card and then do not need us. They receive iron, calcium, and other supplies from the government, but they never give us. They must be showing fake entries for delivery of these medicines and other supplies.” (P22)

Additionally, members asked for ways of holding doctors who insert Copper-T on their own accord to be held accountable. A member asked,

> ”Can we file a case against the doctor if they insert Copper-T without our permission?” (P18)

We observed the concerns raised by participants in the group to be repetitive. The concerns were generally basic and needed factual knowledge. At the same time, the experiences were quite detailed and also appreciated by fellow group members.

Further, we observed very limited use of emojis in the support group. Members used only certain emojis such as flowers, rising sun, hearts, and chocolates, and these were used only in greeting messages such as to greet good morning. However, there was no use of voice notes, memos, or GIFs for conversation. With such minimal usage, we did not feel the need for moderation of the use of emojis.

Given the peer support group over WhatsApp, the learning curve for members to adapt to the group was negligible. Since members were already a part of other WhatsApp-based groups, they were highly familiar with using WhatsApp for peer chat. The use of any other platform, such as Telegram, would have had a higher learning curve, and members would have had to adapt to a new platform altogether. WhatsApp provided ease of communication, given members' prior experience, which allowed the members to engage with each other easily. The members already had an idea of how a group operates over WhatsApp, which helped set realistic expectations in their minds beforehand regarding the possibilities of WhatsApp for peer support. Overall, WhatsApp-based peer support offered minimal adaptation at the members' end and provided ease of engagement.

*Share Suggestions and Local Resources:*

Participants shared suggestions on methods to use based on their own experiences or those of others. They shared suggestions on the timing of contraceptive use and conception. Participants also shared information on local resources to help others in the same geographical area.

In a general discussion about Copper-T, few participants suggested others adopt Copper-T based on self-positive experience, while few suggested against it due to negative experiences by self. Some suggested getting Copper-T from a health expert to avoid any problems afterward. For instance, a participant suggested against Copper-T,

> ”It happened to me. Due to Copper-T, my periods did not stop for six months. It used to be okay for 2-3 days and then start again. My complexion got dark, and I got weak. I got okay when I got the Copper-T removed. ” (P23)

Further, group members shared their suggestions for the ideal family size, which was two children for almost all the members. Members also shared their suggestions for planning the timing of children and the choice of the contraceptive method before or early in marriage to avoid unwanted pregnancy. We observed that group members thought of abortion as immoral and, hence, were keen on avoiding unwanted pregnancy. Members also suggested planning a second child before the delivery of the first child. Moreover, members exchanged their perception of ideal spacing with each other, which was mostly a minimum of three years.

Apart from suggestions, members shared local resources such as family planning services offered by the government, services available at local hospitals, and experiences of getting services at local hospitals. For instance, a member informed another member of free contraception provided by the government,

> ”Sister, you do not need to spend money when the government provides condoms free of cost. You can collect it from ASHA whenever you want.” (P18)

Members supported each other in all the ways they could, from offering suggestions like a sister to educating others about the family planning services available at the nearest health center.

*Encourage Adoption of Family Planning:*

Members encouraged fellow members to adopt family planning by sharing the benefits of planning and spacing. Members shared that they gained the liberty to have children when they desired with the help of planning. Members further encouraged the use of contraceptives by sharing being relieved of the stress of waiting for periods every month by using contraceptives. Among the reasons for spacing, members highly emphasized keeping a gap to gain the privilege of taking better care of children and offering good future opportunities, which was the motivation of most of the members for spacing. Moreover, members motivated others to use family planning to avoid sexually transmitted infections such as HIV/AIDS.

*Vent emotions:*

Members used the group as a space for venting out emotions of disappointment on receiving limited to no support from family. The nature of support members desired rather than needed from their family ranged from emotional to informational to instrumental. However, their needs were not satisfied, which left them stressed. Moreover, with limited agency, they felt further helpless. With no space for relieving stress, the members used the group as a space to speak up and express their frustrations.

Members shared being pressured by MILs to get pregnant soon after marriage, which is a social norm in India, and also for facing complications in pregnancy. For instance, a group member shared,

> ”Yes, in my in-laws’ house, my mother-in-law and aunt-in-law all used to tell me that when will you have a second baby, it is not okay to have only one child.

> But no one at my mother's house ever forced me to have another baby; they used to say that God should save his life." (P07)

Members had to repeatedly face the question of having a child from their family members. Even after having their first child, the question did not stop and shifted to the birth of a second child. The participants expressed having different opinions about spacing from their family members and eventually experiencing stress due to opinion clashes. Thus, these participants used the study group as a space to express their frustrations with their family members since, in reality, they felt a lack of agency to take any action.

Moreover, members felt their MILs had inadequate information on family planning and practiced age-old beliefs, which the MILs enforced on them despite their wishes. A group member expressed in the group,

> "My MIL used to say all the time that during our time, we used to work, and we didn't even realize when we had kids, you just lie down all day." (P01)

Another member shared,

> "My mother-in-law doesn't know much, but she says that once you have two children, then don't have a baby again." (P07)

Members shared that their MILs were aware of the birth practices prevalent at the time they were pregnant. However, they did not adapt to the changing norms and practices over time and, hence, believed only the age-old practices to be correct. Due to such limited knowledge, members had to listen to their MIL's taunts, which contributed to stress. With no escape from such taunts, these members turned to the group to voice their discomfort. Moreover, members desired to impart knowledge to MILs to prevent emotional turbulence. For instance, a member shared,

> "Mam, I feel that first of all, we should have knowledge of family planning, both husband and wife. It is also very important for the mother-in-law to have

> knowledge of family planning because, in our households, our adults have more power over decision-making than we couples. A daughter-in-law has to ask her mother-in-law for permission. Therefore, the mother-in-law should know when family planning should be done and what the gap should be for the second baby. If she has all the knowledge, then she will not force her daughter-in-law to do family planning, and the daughter-in-law will not suffer from any depression" (P18)

Members shared that they were overburdened with household chores and childcare and had no family support. A member shared,

> "The doctor had advised me bed rest, but if I don't work, my MIL rebukes and taunts me." (P01)

Such a lack of disregard for doctors' advice and members' health not only disturbed members' physical health but also their mental health. They expressed feeling helpless with limited power of decision-making about their health, which was further increased with limited knowledge about family planning.

Despite the lack of emotional and instrumental support, members did not share their feelings in the hope of figuring out ways to negotiate with their families. They primarily used the group to voice their disappointment so they would feel heard and relieve themselves of stress. In their family, members expressed lacking agency to voice their own opinions about practicing family planning. Thus, to cover up for their frustration with the limited agency, members made it an affordance of the peer support group by using it as a space for emotional outlet.

*Moderate Group:*

Members devised ways to moderate the group for irrelevant and inappropriate content. At times, when some members started chatting on a topic unrelated to family planning, others

themselves asked them to stop drifting from the topic. Though members greeted each other daily and wished each other's birthdays and anniversaries, members did not encourage holding personal chats in groups. Members further moderated the group for content they found inappropriate. When a few group members talked about condoms jokingly, others found it inappropriate and requested the members to delete the messages to avoid making the group uncomfortable. Thus, the members were active not only in sharing experiences and concerns but also in the smooth running of the group.

### 4.2.2 Feedback on Support Group

We interviewed group members to understand their experiences with the group and seek their thoughts on improving the group. Group members found the group highly beneficial in improving their knowledge of family planning and shared the value the group added to their support-seeking.

*Value added by Peer Support:*

Participants shared the value the group added to their support-seeking despite having other avenues for support-seeking, such as doctors, ASHA workers, family, friends, and neighborhood. Participants expressed their disappointment with the lack of guidance from doctors and ASHA workers. Members shared that they did not receive proper counseling on contraceptive methods and help in deciding a method based on their condition. Members could have limited time with their doctors due to the doctors' busy schedules, and their doubts could not be resolved. ASHA workers also focused on childcare, with limited to no attention on counseling members on family planning. Across chats in the group and interviews, members expressed disappointment with ASHA workers offering limited to no support for family planning counseling and service provision. Moreover, as a result of their disappointment, they sought information on holding ASHA workers accountable for improper disposal of their duties. This is in line with the feedback of the participants on the

Table 4.3: Feedback of Study Participants on ASHA on a Likert Scale ranging from 1 (poor) to 5 (excellent)

| **Parameter** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| ASHA respects me as a person | 5 | 7 | 6 | 6 | 3 |
| ASHA shows care and compassion | 9 | 3 | 7 | 5 | 3 |
| ASHA lets me say what matters to me about my birth control method | 11 | 5 | 4 | 5 | 2 |
| ASHA gives me an opportunity to ask questions | 7 | 6 | 5 | 4 | 5 |
| ASHA takes my preferences about my birth control seriously | 12 | 4 | 4 | 4 | 3 |
| ASHA considers my personal situation when advising me about birth control | 10 | 4 | 5 | 5 | 3 |
| ASHA works out a plan for my birth control with me | 12 | 2 | 7 | 5 | 1 |
| ASHA gives me enough information to make the best decision about my birth control method | 12 | 3 | 4 | 4 | 4 |
| ASHA tells me how to take or use my birth control method most effectively | 13 | 3 | 4 | 5 | 2 |
| ASHA tells me the risks and benefits of the birth control method I chose | 12 | 3 | 5 | 4 | 3 |
| ASHA answers all my questions | 10 | 3 | 6 | 4 | 4 |

guidance received from ASHA in the table, which we gauged via survey 4.3. As evident from the table, with the majority of the participants choosing 1(poor) on the Likert scale, it is clear that the participants found the ASHA workers to provide inadequate services across different parameters of guidance around family planning. Neither the ASHA workers took into consideration participants' family planning-related needs and preferences for guiding contraception, nor did they provide sufficient information for aiding the decision-making of participants.

Members expressed their husbands' lack of knowledge about family planning, which further left them unaware. Though the husbands supported members in family planning, their lack of knowledge distorted the support system of these members, given the husbands were generally their primary source of information. MILs were thought to have age-old beliefs, which the members found to be not always true in today's world as well as in their condition. Moreover, with pressure from MIL for children, the possibility of receiving guidance within the family is reduced to a minimum for the members. Members also found it inappropriate to discuss family planning with women in their neighborhoods and friends out of fear of judgment and the chances of their shared information reaching their MIL in a twisted manner. For instance, a participant shared hesitation in discussing her concerns with neighborhood women,

> "We have some personal things which we can easily talk to someone when we do not know. If we talk to someone known, then there is a fear that if we share our personal things, those things will reach back to our home." (P16)

Thus, with limited support from the different stakeholders, members found it both convenient and appropriate to seek support from a group of unknown women where they could get access to varied experiences, escape judgment, and also get immediate responses without any mobility issues.

Further, we sought feedback on improving the group and overall support for family planning.

*Emphasis on Experience-sharing:*

Members emphasized the need to have more experience sharing in the group so that they can have much richer engagement. Members suggested adding women of different phases and conditions to the group in order to exchange guidance with each other. Members proposed to add women early in pregnancy and even before when they are just married so that they can learn ways to prevent infections and have planned pregnancies. Another suggestion was to add women who have multiple pregnancies in the hope of a boy child so that they can be guided to stop neglecting their health. Overall, members suggested adding more members for a richer engagement.

*Design of Discussion Prompts:*

We observed that on days when the moderator did not share discussion prompts, the engagement just revolved around greetings. Members shared that having prompts is necessary to start a discussion. Members felt that the family planning topics were limited, so prompts could be shared once in two days with a higher focus on experience sharing. Further, members suggested designing short discussion prompts. Members found it more convenient to answer short prompts than long prompts. They believed long prompts required long responses, which are inconvenient to type. Even though the option was available to send messages as audio, members used the group primarily as a text.

*Role of Moderator:*

Members expressed different aspects of a moderator's role. They deemed it important to have a moderator to run the group on a topic for which they needed support. Members visualized a moderator to adopt a range of responsibilities for running the group. The responsibilities include aiding practical understanding of certain types of family planning concepts, aiding information retention, tackling information conflict, supporting knowledge gain, and fostering active engagement.

Members needed a practical understanding of certain family planning concepts. They found certain topics to be better understood with multimedia content. For instance, topics such as the insertion of Copper-T would be better understood via video. Members desired the moderator to send not only text-based discussion prompts and informative messages but also informative material in audio and video form. Theoretical textual information seems insufficient in some topics, and hence, multimedia content would help cover it up.

Further, members suggested ways of aiding information retention. Members felt that discussions throughout the day made it difficult to recall the important information points discussed in the day. Thus, they suggested the moderator share a summary of the discussion points every night for a quick revision of the discussed topic. They felt summaries would help them remember the important points over the long run.

Another responsibility visualized by members is to tackle information conflict. Sometimes, group members shared different opinions and contrasting experiences on a topic, which left the remaining members confused. For instance, a few members in the group shared positive experiences with the Copper-T method, while a few shared negative experiences. In such situations, members could not figure out the right information to aid their decision-making. Thus, the members desired the moderator to resolve such conflicts and provide the right information.

Further, members desired the moderator to support knowledge building. Members expressed having limited knowledge about family planning and desired knowledge in different aspects, such as information on contraception methods and knowledge of local resources for enabling access to family planning services. For instance, information on injectibles - types, cost, time-duration, and local hospital for administration. Members wanted the moderator to share new and updated information on a regular basis for continuous knowledge gain.

Members also wanted the moderator to devise ways to foster rich engagement of the group members. Members had a desire to receive appreciation for their participation. This

desire seems to emerge from the lack of appreciation from their family. Members desired the moderator to appreciate a group member for sharing good experiences and knowledge to encourage the participation of the member and the group at large.

Finally, members suggested having multiple moderators in the group so that one could cover up for the other's absence and the workload of managing the group could be shared. They felt it would be challenging for a moderator to fulfill the different set of responsibilities all alone, given their busy schedules. Hence, multiple moderators would be able to divide the responsibilities among themselves and run the group smoothly without any delay.

Overall, the members visualized the moderator as being deeply involved in the group and not a passive moderator.

*Inclusion of a Doctor:*

Members wished to have a doctor in the group who could provide detailed information on methods and resolve their doubts. Members consider the experiences shared by fellow members beneficial and reliable but need to be more sure of the authenticity of their knowledge of methods. Hence, they desired to receive authenticated information from a doctor along with the moderator. Members considered the doctor's expertise slightly better than the moderators' medical knowledge.

*Privacy:*

Members expressed the need to share multimedia content in the group for better learning about family planning. However, they believed sharing videos on family planning should have certain privacy-preserving mechanisms. Members shared that their smartphones were sometimes used by their children and other family members. Since WhatsApp stores the shared videos in the phone's gallery, it would be embarrassing if others saw those videos. They desired the shared content to be stored within the chat only so that any unintended

person would not view it.

However, concerning the visibility of personal details such as content number, name, and display picture, members believed that hiding these would be too privacy-preserving and adversely affect their connection with other members. For instance, a member shared,

> ”If phone numbers are visible, then if we need to talk personally or get to know their experiences, we can easily do it.”(P23)

Participants felt that if their personal details were misused, such as a member's family member making inappropriate calls or messages, it could be solved simply by blocking them and removing the member from the group. On the other hand, hiding the details for privacy would make it inconvenient for members to reach out to others personally for help. Thus, the members desired privacy not within the group but outside of the group.

*Suite of Tools:*

Upon using the group, members could come up with ideas for different tools for supporting their family planning needs. Their views were not restricted to the group and extended beyond to video meet-ups, mobile applications, and chatbots. They visualized a whole suite of tools to build their support network for family planning. They perceived this suite to include tools to offer different types of support, such as informational, experiential, and emotional. They suggested different tools for different support, thus hinting at adopting a pluralistic approach to designing family planning tools. They did not desire a single tool for their needs and wanted different tools pertaining to their needs where each plays its own role in contributing to knowledge around family planning and building a support network to cover up for the limited support from family, doctors, and ASHA workers.

Members desired to use mobile applications and chatbots to gain a theoretical understanding of family planning, such as detailed information on the methods and the danger signs to be mindful of. For instance, a member shared,

> "App can provide detailed information about methods - what is Copper-T, its benefits, its side-effects and how those side-effects can be handled." (P05)

Another member shared,

> "App can be used just like Mother Child Protection card which we can open and see if anything is a danger sign." (P02)

They felt these tools could offer the flexibility of accessing information anywhere and anytime. They felt that they could seek experiential knowledge from peer support groups, but the fundamental knowledge could be better sought from 1:1-based interaction tools such as chatbots and mobile applications.

Further, members felt that sharing experiences in a more personalized manner with other members would help build a connection with them. The members suggested holding group video calls with fellow group members to see and talk to them virtually. Fostering community spirit was one of the intentions behind such video calls. Another intention was to have a direct question-answering session with a doctor whom they wished to include in the video calls. They wanted a doctor to participate in these calls and discuss their doubts. Regarding the frequency of these calls, they suggested having them once every two weeks due to the limited topics on family planning and their busy routines. For instance, a member shared,

> "Sometimes, it is difficult to join video calls due to household chores and childcare"(P03)

Though there are existing services such as mobile applications, such as ovulation tracking apps, government websites, and online articles related to family planning, our study population finds it challenging to seek information through them. The study population has limited literacy in English and limited technological literacy; hence, they are unable to access these services and understand the information offered through these services. Thus,

our group relied mainly on WhatsApp groups for healthcare support. They expressed the inclination to use such services but desired the services to fit into their context.

Overall, members desired a suite of tools to meet their support needs for family planning involving peers, doctors, and digital interventions. They did not think of one tool as a substitute for another and not even as a substitute for doctors. They just expressed their aspirations for a support system of their choice, which they could not get within their family and outside.

## 4.3 Discussion and Implications

We discuss developing a suite of tools to meet the support needs of women regarding family planning. Further, we present design implications for designing group-based interventions for family planning.

### 4.3.1 Suite of Tools for Family Planning

Adopting a singular view towards designing family planning interventions is not in line with our participants' aspirations around building a support network for their family planning needs. Our participants expressed the desire to extend the support received from the peer support group using video calls, mobile applications, and chatbots. They categorize different tools for fulfilling different needs, hence forming a suite of tools. Thus, a pluralistic approach towards designing for family planning needs of women in resource-constrained areas is important. This aligns with the Feminist HCI pluralism notion, which defies designing artifacts with a singular view [106].

Video-conferencing has been investigated in the Global North to offer diagnosis and assessment support for mental health and neurological disorders such as depression [107, 108], and support for lifestyle changes such as for preventing diabetes [109, 110]. These interventions showed positive results in terms of feasibility and acceptability. However, their effectiveness for rural populations needs further investigation. Thus, video conferenc-

ing could be investigated for its potential to build a support network for family planning in low-resource areas. This idea of video-conferencing calls for discussion is similar to the focus group discussions, which are practiced as a methodology in HCI to engage study participants on a topic. However, for demographics similar to our study population, the choice of platform for video-conferencing is crucial. Low-resource populations have limited literacy, making it challenging for them to use a platform unsuitable for their context. Our participants are very familiar with WhatsApp, which can be used to conduct such video calls. However, the WhatsApp video call feature does not offer the control to mute/unmute participants or play informative content. On the other hand, with Zoom, these features are possible. Interestingly, our participants, due to their connection with the NGO, have already been using Zoom for regular video meetups where they view informative content and ask their doubts about the NGO head. Thus, participants could undergo initial training on using Zoom. Moreover, such discussions would need a moderator, just like a moderator in the peer support group who could mute/unmute participants to conduct a healthy discussion, providing participants with a fair share of time. The moderator can also play informative videos as a discussion prompt similar to the text prompts in the group. Our participants also desired the presence of a doctor, apart from a moderator. A doctor can attend such calls for a short duration of the call and provide answers to participants' doubts. This would foster direct communication between participants and a doctor, cutting short costs and travel constraints. With such video calls, group members would be able to share experiences and discuss doubts. Thus, exploring how video-based interaction could add another layer of support would be interesting. In HCI, the use of videos for education on topics related to maternal and child health and farming has been studied [111, 112, 113]. However, the use of video calls needs investigation.

Further, participants felt the need to widen their realm of knowledge by incorporating theoretical knowledge through apps and chatbots. The use of mobile apps for health has been investigated in prior literature [114, 115] and specifically for family planning [76, 77].

However, these apps need to be designed considering the context of a low-resource population. The apps need to be mindful of the language, knowledge levels, and societal norms of the target population for effectiveness. Further, we also observed participants seeking and sharing information on local resources. Hence, the app could sense the user's location and provide information on locally available services, such as family planning services offered by ASHA workers in the area and the cost of administration of methods at nearby hospitals, among others. The app could offer a checklist of things to be practiced during family planning to provide an idea of dos and don'ts and danger signs during planning. However, the app should operate discreetly to offer privacy and avoid users feeling embarrassed. The app should not send notifications or have an icon representing family planning since women often share their phones with their children.

Regarding chatbots, they have been studied to understand their potential to support healthcare needs [116, 117]. These studies tested prototypes of chatbots for providing answers to users' healthcare queries in controlled settings and reported chatbots' potential to provide health information. Building on these studies, the scope of chatbots for providing support on a taboo topic like family planning seems a good option. We believe chatbots could offer more personalized counseling to users. It could ask a series of questions to understand the user's current health condition and preference for the type of method and suggest a method accordingly. With the shifting needs of women across temporary and permanent methods, chatbots can interact as per the need. Chatbot-based counseling could supplement the counseling an ASHA worker is supposed to provide. Moreover, an ASHA worker could also use such a chatbot during her field visit to women to help them decide on a method. Apart from helping decide a method, it could also offer information on methods and local services. Rule-based chatbots could be used given their minimal chances of misinterpreting users' queries for Indian regional languages. Kaur et al. have studied the use of rule-based chatbots on a large scale among low-resource populations in India and reported high feasibility and acceptability of the chatbot [118]. Hence, experimenting with

a rule-based chatbot for family planning could be a future direction. Moreover, the chatbot could be developed in an unplatformed fashion to keep the target population's learning curve minimal and align with their technology usage.

Thus, a network of group-based and individual-level support could help women develop an understanding of family planning and care for their health. Further, such support might take women closer to regaining agency around their bodies, given the influence of husbands, mothers-in-law, and other societal entities. In HCI, family planning is an understudied topic in itself. Thus, it makes sense to investigate this direction and see how such an interlinking of support tools works for low-resource women.

### 4.3.2 Implication 1: Adopt an Active Moderator Role

In the current study, we adopted a passive approach towards the role of moderator, with the moderator sharing only prompts and occasionally encouraging participation from members. We wanted to provide space for the members to discuss freely with minimal intervention from the moderator. However, we found that members desired a peer group but were under the guidance of a moderator. We observed participants having low engagement on days when the moderator did not share a discussion prompt. On such days, the conversation involved greetings and a few members sharing their concerns. Moreover, in the interviews, participants emphasized the need for a moderator in the group and shared feedback on how they visualize the role of a moderator. Thus, a moderator is needed to guide such groups since the non-guided group has low activity.

Moderated group-based support has been studied in literature such as [119, 120]. The role of the moderator is limited to sending prompts and regulating inappropriate behavior. These studies did not report participants' feedback on the kind of moderation desired. On the other hand, we gauged our participant's perspectives on moderation techniques. Our participants found the topics on family planning to be limited and desired more experience sharing. We suggest expanding the moderator's role to be more active by adopting certain

techniques for fostering richer engagement in the group. The moderator can tag members directly, requesting them to share their views or concerns on the prompt. Further, the moderator can re-share in the group the most detailed and informative experience shared in a day and write an appreciation for the member, encouraging the member and others to participate more actively to get appreciation again. The concept of performance boards can also be adopted. The moderator can maintain a performance board and share it at the weekend. The board could highlight the list of the top five members of the week who engaged in the group most actively. This might encourage others to open up more and get a chance to be listed on the board.

Information retention is another aspect of moderation. Techniques for assessing information retention, such as pre-post intervention tests, have been employed [121, 122]. However, techniques for enabling information retention are needed specifically for low-resource populations who have literacy issues. We suggest a moderator to conduct activities such as short quizzes to revise the discussed topics. Such quizzes can happen once a week to evaluate the information level of group members regularly. Based on the quiz scores, selected topics can be revisited, thereby avoiding topic redundancy.

Further, a moderator could employ certain techniques for moderating the group for off-topic discussions and inappropriate content. The moderator could leverage the access permissions offered by WhatsApp, restrict access to add new members and change group settings from group members. The moderator could share behavior guidelines once a month, stating not to use inappropriate language or share inappropriate content, keeping personal chats outside the group, and also blocking members who fail to comply with the guidelines. For peer support platforms apart from WhatsApp, it could be possible to develop auto-detection and auto-deletion of offensive content. However, with WhatsApp, the moderator and group members can do it manually.

### 4.3.3 Implication 2: Use Group as a Journal

Participants vented their emotions in the group, sharing the pressure of limited support from their families and disappointment with ASHA workers. As seen in the literature [9, 14, 15], women's decision-making around family planning is influenced by MIL and society at large, which was also the case with our participants. Moreover, participants expressed disappointment with ASHA workers for their limited guidance on family planning, due to which they had to face consequences such as unplanned pregnancy and confusion about the right method for themselves. Participants, thus, took the opportunity to release their stress and frustration through the group to relieve themselves.

The group could serve as a journal to support participants' emotional well-being. The participants may not necessarily be suffering from a mental health condition but still seek a space to release their emotions. O'Leary et al. explored the use of peer support groups for mental health support [68]. Building on this line of work, we suggest using peer support groups to support emotional well-being. Similar to a journal where individuals write their feelings, a group chat could be a space for members to write their emotions. Doing so might help them get closure to their emotions and also provide a feeling of solidarity to others going through similar situations. However, to keep the focus on family planning, a particular day, such as Sunday, could be designated as a journal day for members to share their hearts freely. It could be investigated what kind of discussion prompts are needed to foster a richer venting of emotions. Also, different group activities could be experimented with to help members relieve themselves of stress. Thus, a peer support group for women in resource-constrained areas can be multi-faceted with the kind of support it offers. It could offer experiential information as well as support for the emotional well-being of these women who face marginalization in terms of knowledge and agency.

### 4.3.4 Implication 3: Design with Indexing of Topics

In the group chat, members asked repeated concerns and concerns about certain fundamental knowledge about methods. With repeated discussions on similar concerns and limited topics, the group might feel boring to members over a longer period of time. Thus, to keep the group interesting, it is important to employ strategies to keep the members engaged. Concerns that are common and repeated could be indexed in the group with their answers so that a member can visit them before asking in the group. If the member remains unsatisfied, then the discussion on the concern could be open. Also, informative experiences shared by members could be indexed for members to revisit whenever needed. Moreover, with the influx of new members in the group, indexing would be beneficial. New members could benefit from the experiences shared by old members in earlier chats and also visit common concerns. With indexing, the focus could be on varied concerns and experiences. Moreover, indexing would share the workload of a moderator.

However, with WhatsApp, such an indexing is not possible, and shifting outside of WhatsApp might not be feasible due to participants' high familiarity with it. A workaround is that the moderator should maintain a separate indexing and use it from time to time to provide responses in the group. This would provide group members access to earlier helpful content.

# Chapter 5

# Understanding the Potential of AI-based Conversational Agents for Addressing Informational Needs around Family Planning

ChatGPT is a chatbot developed by OpenAI and launched in November 2022. As of April 2024, ChatGPT has 180.5 million users [1] with India ranking second highest in the proportion of users worldwide. ChatGPT has found applications in varied domains such as education [53, 56], finance [57], counselling [60, 61] and healthcare [62, 63]. In HCI, the potential of ChatGPT has been explored for healthcare-related tasks such as managing health conditions and supporting clinicians with tasks such as writing clinical patient letters and understanding patient experience in hospital settings. However, the focus of exploration has mostly been outside of the Global South and among populations having reasonable technology literacy. The exploration of ChatGPT as a healthcare tool in the Global South, specially in a country like India, needs a dedicated investigation. First, in our low-resource context, women have low literacy levels and experience healthcare at the intersection of poor support infrastructure, limited knowledge and agency, and a patriarchal social structure. Second, the scope of ChatGPT for meeting health needs around a health topic such as family planning which is considered a taboo in India is understudied. Hence, we are interested in understanding how postpartum women residing in resource-constrained areas of India use ChatGPT to meet their family planning needs.

HCI literature lacks the family planning aspect of women's health and needs exploration. Though research has focused on other stigmatized health topics such as mental health [18, 19, 20, 21, 22] but the focus has never been placed on family planning. The family planning needs of rural Indian women need attention, given their high unmet needs for family planning and spacing and the limited support available at their disposal due to the

[1] https://explodingtopics.com/blog/chatgpt-users

taboo nature of the topic and certain contextual barriers such as agency. HCI literature can contribute by highlighting the support needs of such marginalized women around family planning and encouraging research on designing support interventions. In line with this, we aim to understand how a chatbot could support the family planning needs of women, given the chatbot's potential for disseminating healthcare information. We intend to explore user interaction with an existing chatbot, ChatGPT, before developing a tailored chatbot for our target population to identify the design needs of the chatbot. Overall, we aim to address the following research question -

- How do marginalized women use ChatGPT to meet their family planning needs?
- What are the design considerations for a chatbot for supporting the family planning needs of marginalized populations?

Thus, with the objective of exploring ChatGPT's potential for supporting postpartum women, we conducted Zoom sessions with eight such women who engaged with ChatGPT to seek information about their family planning needs. We conducted interviews during the session to gauge participants' experiences and feedback towards ChatGPT. We identified the information needs of participants along with ChatGPT's performance in addressing participants' queries. Through this study, we intend to make the following contributions -

1. Empirical understanding of how women residing in resource-constrained areas engage with ChatGPT for their family planning needs.
2. Design implications for ChatGPT and chatbots in general for supporting the family planning needs of a population having low technology literacy.

### 5.1 Methodology

We conducted Zoom sessions with eight postpartum women, and we observed their interaction with ChatGPT (GPT-3.5) through screen sharing to seek help with their family

Table 5.1: Demographics of Study Participants

| **Demographic** | **Study Participants (8)** |
|---|---|
| Age | 18-24 (2), 25-34 (6) |
| Highest Education | Class 12th and below (6), Graduation (1), Post-graduation (1) |
| Employment | Homemaker (8) |
| Parity | One child (5), Two children (3) |
| Smartphone Ownership | Own (7), Shared (1) |

planning doubts. The sessions involved the women participants thinking aloud while interacting with ChatGPT. The participants were interviewed during the sessions to understand their perceptions and experience using ChatGPT. The study has been approved by the IRB committees of our institute and the collaborator NGO. The study participants were contacted through the NGO, and hence, the NGO validated the study protocol to ensure that data was collected from the participants appropriately.

### 5.1.1 Participants

We recruited postpartum women as participants. The participants were recruited with the help of our collaborator NGO, which operates in Northern India. The NGO runs WhatsApp groups of pregnant and postpartum women residing in resource-constrained areas of Northern India, through which they offer informational support related to maternal and child health to the women. The groups consist of NGO staff and the NGO head, who all have a background in healthcare. The groups are a space for women to ask their healthcare queries and receive answers for the same. During the COVID-19 times, the NGO started online discussions with the group members over Zoom to expand their support services. The NGO staff regularly trains old and new group members on using Zoom to join online discussions with a meeting link and muting/unmuting themselves. Hence, over time, members have become familiar with both WhatsApp and Zoom. We leveraged this familiarity

and employed the same set of digital tools as the NGO in our research study.

The first author, as a service to the NGO and its beneficiaries, runs a WhatsApp group dedicated to family planning support, along with an NGO staff member where the author helps in group management and engagement while the staff member offers authentic health information to women's queries. The group comprises 30 pregnant and postpartum women seeking help with family planning. The women have joined the group and participated in the research studies voluntarily. In the group, women share their family planning doubts and experiences, and the first author also shares prompts to foster discussion among the women. From the pool of these women, eight women shared an interest in using ChatGPT. The women were informed of the study details, and their queries related to participation were answered before they were asked for their verbal consent. The demographics of the participants are listed in the table 5.1.

### 5.1.2 Data Collection

The participants were familiar with joining Zoom meetings with a link. However, they were not aware of sharing their screen, which was necessary for observing their interaction with ChatGPT. We chose the online mode of data collection as it was quite challenging to collect data through face-to-face engagement given the geographical spread of the participants and the first author herself being pregnant, which further restricted her from traveling to the participants' location.

Once a participant joined the Zoom meeting link, the first author helped the participant share their screen by offering step-by-step instructions. To share the screen, the participants shared screenshots with the first author over WhatsApp, showing the options on their screen and asking for the next step when they could not understand the steps verbally. Given the prompts, seeking permission for screen sharing, being in English, the participants had to be told what the prompts meant and guided to grant access accordingly. Once the screen was shared, the participants were asked to open the ChatGPT web interface/mobile application.

One participant used the web interface due to limited storage on her phone for installing the app, while the rest used the app interface. Before the sessions, participants shared the link to install the app, which all of them did by themselves or with the help of their family members. During the session, participants were asked to raise their family planning queries to the ChatGPT. Participants asked queries in Hindi and Hinglish, Hindi written in English. All the sessions were recorded with the consent of the participants, and interviews were conducted during the sessions to understand participants' experiences with ChatGPT. Most of the participants chose to keep the video turned off, while one kept the video turned on, and accordingly, the first author shared her video. We collected the queries asked by the participants and their interaction with the first author while using the ChatGPT. The participants were interviewed regarding their perceptions and experiences with ChatGPT, such as challenges in framing queries and understanding answers, helpful features, and willingness to use ChatGPT in the future. Interview questions included, "Did you face any challenges in framing queries?", "Were you able to receive sufficient information?" and "How did you determine the authenticity of the answer?". The sessions were closed with thanking the participants for their time. Overall, we collected 224.14 minutes of session recordings, with 28 minutes being the average duration of a session.

### 5.1.3 Data Analysis

Zoom session recordings were in Hindi, which were translated and transcribed into English for analysis. Inductive thematic analysis [91] was used to develop codes and draw themes from the collected data. The authors coded the sessions individually and regularly discussed the codes to finalize the themes. For instance, codes such as 'ChatGPT should not give proper Hindi terms in answer' and 'Challenging to understand medical terms' contributed to the theme - 'Challenges in understanding ChatGPT's vocabulary'.

The queries collected during the sessions were analyzed to identify their nature and topic. Each question was categorized into either of the categories - general or condition-

| Nature/Sample | I | II |
|---|---|---|
| General | 'Which is the best family planning option for men?' | 'If we are having sex without condoms and discharging the sperm out of the body, are there still chances of pregnancy?' |
| Condition-based | 'It has been three months to my delivery and I have not got periods. I also took the pregnancy test which came out to be negative. What should I do?' | 'After how much time of C-section delivery should we have sex? Does it bleed while having sex first time after delivery?' |

Table 5.2: Sample participant queries for different categorisation

based query, where a general query meant a general question about family planning, such as details on contraceptive methods, while a condition-based query meant a question on family planning based on a participant's personal context. Overall, 11 topic categories were identified from the Zoom sessions, which denoted the topic of family planning raised by the participants. Topic categories included, 'Copper-T or Intrauterine device', 'Spacing', and 'Family planning methods for men'. The frequency of queries corresponding to each of the topic categories was calculated, and the specific doubts for each of the categories were also recorded. During our analysis, we did not compute the inter-rater reliability on account of it not being congruent to the thematic analysis approach and, moreover, not an appropriate criteria to judge the qualitative work [92, 93].

## 5.2 Findings

In this section, we report findings from the participants' interaction with ChatGPT for seeking help on their family planning queries.

### 5.2.1 Information Seeking

Across the sessions, participants raised 32 queries to ChatGPT, with an average of four queries. These queries were regarding general or specific family planning methods, men-

| Topic | Frequency of queries |
|---|---|
| Copper-T | 10 |
| Periods | 5 |
| General methods for unwanted pregnancy | 4 |
| FP methods for men | 2 |
| Implants | 2 |
| Sexual activity | 2 |
| Contraceptive tablets | 2 |
| Spacing | 2 |
| Injection | 1 |
| Ipill | 1 |
| Natural method | 1 |

Table 5.3: Query Topics and corresponding query frequencies

struation, and spacing. Out of 32 queries, 24 queries were general in nature, needing fundamental information about contraceptive methods, while eight were condition-based queries needing information based on the participant's context. Condition-based queries needed consideration of a participant's health parameters, such as mode of delivery - normal or C-section, type of feeding - breastfeeding or top-feeding, and the existence of any pre-medical condition - for ChatGPT to offer an answer. A sample of participant queries along with the general vs condition-based categorization are listed in table 5.2

Moreover, the queries spanned 11 topics. Topics included Copper-T, contraceptive methods for men, and a number of queries corresponding to the topic are listed in table 5.3. The highest number of queries were related to Copper-T (CuT) or Intrauterine device (IUD). Participants shared having limited knowledge about the different aspects of CuT. They sought detailed information on CuT in general. Moreover, participants were unaware of the insertion procedure of CuT and sought answers to doubts such as how CuT is inserted, whether the insertion procedure involves anesthesia, how long CuT stays after insertion, and what is the suitable time for CuT insertion after C-section delivery. Participants further lacked knowledge of the effect of CuT insertion on period flow and were

doubtful if it would lead to heavy bleeding. Moreover, participants sought information on the methods to avoid unwanted pregnancy and the best method with no side effects on the child. Participants not only inquired of methods for themselves but also for their husbands by raising queries seeking information on the best contraceptive methods, specifically on pills and injections for men. Participants also sought information on specific methods such as contraceptive tablets, Ipill, and injections. Participants wanted to understand if it was suitable to take Ipill during breastfeeding and what is the time duration during which the effect of the injection persists. Apart from the modern method, a participant was curious to know about the effectiveness of the natural pull-out method. ChatGPT also evoked curiosity among the participants to know about more family planning methods they were unaware of. When ChatGPT presented the option of implants in response to a query regarding general family planning methods, a participant further questioned ChatGPT to share more details and related pictures. Participants were also keen to ask about the ideal gap between the first and second child.

Participants also had doubts about the period flow after delivery. Participants wanted to know the ideal number of days of period flow after delivery, the ideal time of onset of periods after C-section, and when to consult a doctor for no periods after delivery. One participant shared her confusion and asked for possible next steps for not getting periods after delivery and the pregnancy test showing negative results. Interestingly, participants were curious to know about suitable time to resume sexual activity after delivery and if it would result in bleeding.

Thus, most of the doubts were general in nature, which needed fundamental knowledge to be addressed. This shows the lack of knowledge among participants regarding family planning, and with such a knowledge gap, it seems challenging for them to practice family planning in its entirety.

### 5.2.2 Language Adaptability of ChatGPT

Our participants can converse in Hindi and Hinglish, Hindi written in English, but not in proper English. They have low educational qualifications, and thus, it is challenging for them to read, write, and understand English; however, they can understand the basic English greeting words such as 'Hello' and 'Bye'. They are most familiar with Hindi, which is also their mother tongue; therefore, they seek support around health in Hindi from other information channels such as husbands, doctors, and community health workers. We observed that ChatGPT both could and could not adapt to participants' low literacy levels and current health information-seeking practices. We identified certain challenges with ChatGPT adapting to participants' language constraints and, at the same time, certain affordances of ChatGPT regarding the constraints.

The default language of ChatGPT is English, meaning a user must log in and go through the onboarding process in English before getting to the chat interface. The participants were able to install the ChatGPT app on their phones; however, four participants needed the help of the first author in setting up the app, while the remaining four took help from their family members. The first author helped the participants sign up using their email addresses, verify the email addresses in the email app, and log in after signing up. Five participants used their own email accounts, while three used their husband's email accounts. The participants were helped to set up their names and dates of birth. Later, the app asked for human verification, which was not understandable to the participants due to the prompts being in English. The first author had to intervene and help complete the verification step. Finally, ChatGPT informs users of its capabilities through tips, which are also in English. Though the ChatGPT provides the required information around its capabilities, it is not understandable on the part of the user. Finally, the chat interface appears. The interface is intuitive enough for users to identify the message box and type in their queries. However, the participants needed a second person to help them navigate the setup process and reach a point in ChatGPT where they could interact with ChatGPT. With such low language

adaptability of ChatGPT, it restricts its reach among people with low literacy levels who would want to take advantage of ChatGPT for different purposes, such as healthcare and education, among others.

After the setup, participants started conversing with ChatGPT to seek information on their family planning doubts. Some participants started their conversation with a greeting in English, such as 'Hello,' and received a reply in English itself. They followed by asking their query in Hinglish, and the reply was still received in English. On the other hand, another participant sent 'Hello' and received a reply in English and then sent a Hindi equivalent of Hello and received a reply in Hindi. However, after the greetings in English and Hindi, when the participant switched the query language to Hindi, ChatGPT continued to give answers in Hindi. ChatGPT seems to fix a language for a user session based on the language of the first message and, at times, based on the last query language. Figure **??** shows a screenshot of a chat exchange between a participant and ChatGPT for the discussed issue. Also, if the first query comprised only of keywords in English, such as IUD, with the subsequent query in Hinglish, the reply was in English. Even though the participant used the keywords of a contraceptive method name, hoping to get details of the method, the session language was set to English. Due to this, participants could not understand the conversation. The participants were then asked to swipe out the app from the stack and reopen it, which resulted in a new user session. When the first message was in Hinglish, ChatGPT provided replies in Hinglish, which the participants could make sense of. It seems ChatGPT switches between languages randomly. Moreover, the replies comprised certain terms that were either too medical or in English that the participants could not understand them. Some participants asked follow-up questions if a term was not understandable, while some asked the first author for clarification. For instance, a participant asked a doubt regarding the best family planning, which will have no side effects on her 10-month-old baby. In reply, ChatGPT mentioned about contraceptive implants which the participant did not know about and asked a follow-up question,

> "What are contraceptive implants? Give full information. Give contraceptive implant photo." (P01)

Overall, participants could understand most of the language of replies with the exception of a few complex words.

Another feature is the feedback option, where a user can click on the thumbs-down icon if the user is not satisfied with a reply. A participant clicked on the icon but could not proceed further due to the prompts being in English.

At the same time, some participants were pleased with ChatGPT for providing information in a language they were familiar with. When they asked questions in Hinglish and could get replies in the same language, it made it possible for them to engage in a conversation with ChatGPT and seek information on their doubts.

Overall, participants were comfortable with ChatGPT as long as it replied in a language they were familiar with but were not appreciative of the default language being English, which made it challenging for them to set up the app and use certain features by themselves. Participants felt that ChatGPT would not be a good option if it required dependency on another individual to understand the app's functioning and the information provided by ChatGPT. ChatGPT, in its current state, does not incorporate their language familiarity and literacy to offer health information that they can fully understand. Participants desired to have a more 1:1 interaction independent of other individual's interference. They were already uncomfortable discussing family planning within their social circle due to the fear of judgment and low agency, and the need for another individual to understand the information provided by ChatGPT defeated the purpose of using ChatGPT for support-seeking altogether. Thus, adaptability to language constraints of women residing in resource-constrained areas needs further thought to make ChatGPT compatible with the women seeking information from ChatGPT for their health needs, especially around taboo topics.


Figure 5.1: A chat exchange with language mismatch


Figure 5.2: A chat exchange with ChatGPT's incorrect reply

### 5.2.3 Framing Queries to ChatGPT and Query Interpretation by ChatGPT

Participants shared their experiences with framing queries to ChatGPT regarding how easy or challenging they found it to be. Some participants found framing queries to be easy without much thought on how to structure the words. For instance, a participant compared typing queries to writing exams at school,

> "I do not have to think that a word has to be placed here and the other word has to be placed there in the question. It is not like in a school where teachers deduct marks in an exam if the words are not structured well in a sentence." (P03)

These participants did not feel the need for ChatGPT to help them with framing queries as it was their responsibility to ask questions on their minds and not of ChatGPT. Contrary to this, some participants found it challenging to frame queries in a way that ChatGPT could understand. They struggled with using the right structure and vocabulary to ask their doubts accurately. They typed, removed, and then retyped queries to come up with the final

query. With limited literacy, participants struggled to put enough contextual information in their queries and thus experienced a cognitive load for seeking information. However, as presented in section 5.1, participants asked condition-based queries. Thus, it is important to provide ChatGPT with contextual information in the right manner so that it can offer personalized support. They also expressed the need for ChatGPT to help frame queries so they can understand the structure in which ChatGPT understands queries. For instance, a participant suggested that ChatGPT offer suggestions while framing queries similar to Google search.

A participant felt that asking a query in the WhatsApp group run by the first author is comparatively easy as the group members can understand the query correctly since they have a similar context, while ChatGPT does not have a similar context, which makes it important to structure queries well for it to understand them accurately.

Thus, in order to have a better and smoother interaction, it might be useful to train participants on framing queries to ease their cognitive load and offer a richer experience.

On the other hand, participants were mostly satisfied with ChatGPT's query interpretation capabilities. Participants found ChatGPT to interpret their queries correctly and provide answers to them. A few participants felt that ChatGPT was efficient in making sense of their queries, even if they lacked a proper structure. Moreover, participants blamed themselves for not framing queries correctly if ChatGPT was unable to give a desired answer. Participants felt that they were putting across their doubts in a wrong manner, which caused ChatGPT to not understand what was being asked and ended up giving them a different answer. For instance, a participant shared,

> "I wanted to ask how Copper-T is inserted, but I asked the question in a different manner, and ChatGPT answered correctly according to that." (P02)

Further, there was an instance where ChatGPT could not correctly understand a participant's query about Copper-T and gave a completely different reply. The participant asked a question about how Copper-T is inserted in the body, to which ChatGPT replied by sharing

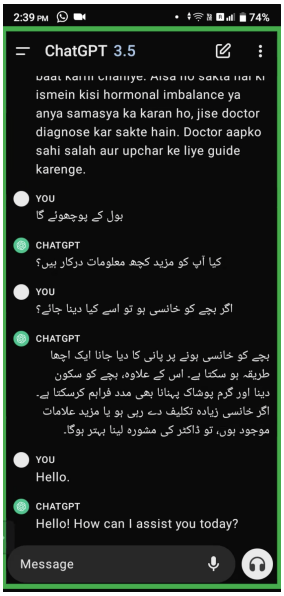


Figure 5.3: A voice-based chat exchange

the general feel of copper metal. Figure 5.2 shows a screenshot of this chat exchange. Surprisingly, the participant could not identify that ChatGPT provided an incorrect answer and had to be informed about the same towards the end of the session. This raises an ethical question regarding interpreting the answers correctly and believing them on the part of the user. Some users may be incapable of evaluating the correctness of answers and go ahead believing and practicing them, which could have severe consequences.

Overall, participants were satisfied with ChatGPT's interpretation skills. However, a few ethical concerns emerged during the interaction, which needs to be considered for safe use by people of different literacy levels.

### 5.2.4 User Strategies for Evaluating Correctness and Sufficiency of ChatGPT Answers

Participants shared receiving limited to no guidance around family planning from family, community health workers, and doctors. Moreover, due to their low education levels and limited digital literacy, they could either not access online platforms for health information or found them difficult to navigate. Therefore, their support-seeking was limited to the

family planning group. Further, they were exposed to health experiences shared by women in their families and neighborhoods. These factors played a role in ChatGPT's use among the participants since they could validate ChatGPT's answers only with the information obtained from sources such as their social circle and the family planning group. Participants used information from all these sources for triangulation. Participants asked queries from ChatGPT and compared the replies with the information received from other sources.

As a part of their strategy, participants started the conversation with ChatGPT, asking queries about which information they had received to some extent from other sources. This was their strategy for evaluating how correct ChatGPT was at providing answers. For instance, a participant shared,

> "I have already got the answer to this question I asked from ChatGPT. I got the answer from the family support WhatsApp group. ChatGPT gave the same answer as I got from the group, so I know it gives correct answers." (P06)

Once convinced of the authenticity of ChatGPT, participants went ahead and asked other queries. For instance, a participant initially asked a general query about the best family planning method and later followed up by asking a condition-based query inquiring about the best contraceptive method given her context - having a 10-month-old child and desiring no side effects on the child.

Participants were further prompted to share their strategies for verifying an answer if they were doubtful. Participants shared that in the case of ChatGPT providing completely different answers from what they have heard from other sources, they would cross-check it with an expert. A participant shared that for queries for which ChatGPT gave a contradictory answer, the answer would be taken as a danger sign/ precaution to be mindful of. For instance, the participant shared that if, for the query whether bleeding is normal on resuming sex after delivery, the other sources indicate normalcy, but ChatGPT indicates a problem, then the participant would take it as a danger sign and consult a doctor on experiencing bleeding. On the contrary, if other sources indicate bleeding as a danger sign

and ChatGPT indicates normalcy, the participant would consider bleeding once or twice as normal but repeated instances as a danger sign and consult a doctor. Moreover, some participants shared that if they asked a new query for which they had no prior information and were unsure of ChatGPT's answer, they would collect information for the query from other sources and finally triangulate the information for constructing the final answer.

Most of the participants felt that ChatGPT was able to provide sufficient information for queries that needed general information about contraceptive methods. However, participants were unconvinced with answers to queries that were situated in their context and also with answers that did not yield an exact answer. Participants found ChatGPT useful for offering general information but were doubtful of its capability to provide specific answers and wished it to offer personalized information for queries. For instance, participant, P03, asked a query related to period flow after Copper-T insertion, to which ChatGPT replied,

> "Yes, some women may experience heavy bleeding in the initial few months after getting the copper T inserted, but it is different for everyone. If this concerns you, then you should consult your doctor. You will get right guidance from their advice."

The participant found ChatGPT to be useless as it was not able to provide exact answers and was always directed to contact healthcare providers further. The participant wished ChatGPT would take the side of whether something was normal or not on its own instead of leaving the user in confusion.

Overall, participants had low health literacy around family planning, and they used information from different sources to gain knowledge about a method or understand the actionable steps toward a condition. Participants first verified ChatGPT for its authenticity and then went ahead with further information seeking. ChatGPT, in our participants' context, showed the potential to be useful for general information seeking but not for informational support for context-based healthcare queries needing personalized answers.

### 5.2.5 User Experiences with Voice-Based Conversation of ChatGPT

A few participants preferred text over voice-based conversations either due to their comfort level or to ensure privacy while asking their queries. These participants felt text provided the flexibility to ask family planning queries from ChatGPT even if they were surrounded by their family members. Participants felt uncomfortable discussing their family planning queries in the presence of their mothers-in-law or other family members out of fear of being judged or disclosing their family planning needs. Such participants were satisfied with using only text as a means of conversation. The rest of the participants were comfortable with using the voice feature, feeling it would be quicker to ask queries using voice than typing. Participants were open to using the voice feature for both asking queries and receiving replies. However, participants were hesitant to discuss family planning openly and, hence, preferred to use the voice feature privately.

Despite the preference, almost all participants experimented with the voice-based conversation feature of ChatGPT. The feature allowed the participants to ask queries using the mic option and voice-based conversation option. However, the participants incurred the same language barrier while granting permission for ChatGPT to access their microphone due to the prompts being in English. Thus, the first author had to intervene and help them navigate the prompts. Once the permission was granted, participants could use the voice feature.

All the participants unanimously disapproved of ChatGPT's voice feature. The participants asked their queries in Hindi while ChatGPT interpreted them and provided answers in a foreign language, such as Arabic, which was beyond the participants' understanding. Figure 5.3 shows the screenshot of one such voice-based conversation. Initially, a few participants blamed themselves for not framing queries correctly, but when, even after repeated attempts, the voice feature failed to interpret the query in the spoken language, participants started realizing it as a shortcoming of ChatGPT. Though ChatGPT could recognize basic English words, such as the greeting 'Hello,' it failed to interpret Hindi queries. Thus, due

to the poor functioning of the voice feature, all the participants expressed using only text to converse with ChatGPT. Participants were satisfied with the amount of information provided by ChatGPT in response to their queries; some queries had concise answers, while a few had detailed answers. Despite the volume of text in replies, all the participants were comfortable with text-based interaction, though they had other issues, as discussed earlier.

Overall, our participants faced dual challenges. Firstly, low literacy hampered seeking information through typing, and secondly, they sought information on family planning, a taboo health topic in their context. ChatGPT's voice support could help the participants seek support privately with minimal cognitive load of typing. However, ChatGPT's poor performance among the participants shows it lacks the potential to support the information needs of our population. The feature needs improvements, or the users need to be trained to speak in a manner understood by ChatGPT to support people of different literacy levels and users' preference for speaking over texting.

### 5.2.6 Affordances of ChatGPT

All the participants shared varied affordances of ChatGPT to support their family planning needs. Almost all the participants expressed that ChatGPT was one of the channels of information for gaining knowledge or clarification on their doubts. Participants gathered information from the family planning group, women in their social circle, and ChatGPT on their family planning needs and triangulated the information to come to a conclusion. Only one participant reported searching on Google for a family planning query once, while others reported rarely searching online for other healthcare needs. Participants shared that they were getting unnecessary information on Google searches. Participants felt that online search pages and videos provided unnecessary information before finally providing the desired information. Thus, online search did not serve as a channel of information, while ChatGPT seemed promising in enhancing participants' information support channels. Compared to other information channels, ChatGPT proved to be an instant source of

help where participants could receive information immediately without waiting for a human to reply, unlike in the group or their social circle. Moreover, participants felt ChatGPT could be used as a first point of contact before consulting any human to gain information about their query. This is in line with work by Yadav et al. [50], where breastfeeding women residing in semi-urban areas of India found the chatbot to serve as a first point of contact.

Further, participants were impressed that ChatGPT offered privacy in different ways. The biggest benefit ChatGPT could deliver to participants was its ability to offer a safe space to participants right where they were without human involvement to seek support by sharing information in any amount, which can also be highly personal. Given the patriarchal surroundings, participants' lives are controlled by their husbands and mothers-in-law. They cannot visit a doctor alone and are accompanied either by their husbands or mothers-in-law, who also make decisions regarding their health. Participants shared being denied contraception use by older women in their families and, sometimes, by their husbands. Thus, they desire to seek help privately without their family's knowledge. ChatGPT served as a channel where participants could seek help despite the shadow of patriarchy. Moreover, ChatGPT provided a non-judgmental space for seeking help on their family planning needs. Some participants, at times, felt uneasy asking certain questions in the family planning group out of fear of judgment and being mocked by group members. Similarly, participants were hesitant to discuss family planning with women personally known to them in their social circle to avoid any judgment. ChatGPT seemed a safe option for information seeking, especially for such participants who could seek help in a 1:1 fashion without human involvement and could share as much personal information as desired without any filter. ChatGPT also offered chat privacy to participants. Participants felt that since ChatGPT does not retain chat on the screen once the ChatGPT app is swiped out of the app stack, it reduces the chances of others seeing their chat. For instance, a participant shared,

"ChatGPT has an advantage. If someone checks my phone, they still would

not be able to see my chat since it is removed automatically when the app is closed." (P07)

Though most participants had their own smartphones, they shared that other family members also used them sometimes. With no chat retention, privacy was ensured. Also, with no specific indication on ChatGPT's app logo that it was meant to seek help with family planning needs, it managed not to attract any unwanted attention from family members who happened to use a participant's smartphone. Hence, ChatGPT was able to meet the privacy needs of participants.

Additionally, participants liked the flexibility of asking queries anytime and any number of times. Participants felt good that they could ask queries repeatedly if they were not satisfied with an answer and could do so without any time restriction. Moreover, participants could go to and fro the previous queries in a user session, unlike Google search, where they felt that previous queries get lost once a new query is asked. This could be due to their practice of using a single search tab in the browser.

Overall, participants appreciated ChatGPT's potential to serve as an information channel, its privacy provision, and its timeliness. Thus, ChatGPT had considerable affordances for our participants.

### 5.2.7 User Suggestions for ChatGPT

All the participants identified a shortcoming with ChatGPT. The participants needed images and videos in ChatGPT to aid their understanding. At the time of the study, ChatGPT did not have support for images/videos. However, participants felt that ChatGPT should provide images/videos explaining proper medical terms and also for certain types of queries, such as the insertion procedure of Copper-T, to make them aware of what to expect if they decide in favor of Copper-T. For instance, a participant shared

"I asked a question about Copper-T, for which ChatGPT could have given images to show how Copper-T is inserted and where it is inserted. ChatGPT could

offer images when text is not sufficient for understanding." (P05)

Additionally, participants felt that images/videos would help them know the physical appearance of methods new to them so that they could be mindful while purchasing them.

Further, participants desired ChatGPT to offer images/videos only when asked to do so. They did not want to get overloaded with unnecessary information and desired ChatGPT to provide images/videos only when they needed to aid understanding, or the text did not suffice their purpose. Also, participants shared that their children are around them when they use their phones, and such images/videos are inappropriate for children. They expressed that children would not be able to understand text while visuals would be more attractive.

Thus, participants identified different use cases of images/videos but desired the uses as per their command to ChatGPT and not according to ChatGPT's own intelligence.

## 5.3 Discussion

Drawing from our findings, we emphasize the need for ChatGPT to adopt a pluralistic approach to incorporate users with varying literacy levels. We further discuss the potential of ChatGPT to act as an educational tool for women in resource-constrained areas, building their fundamental knowledge about contraception but not suitable for personalized health information seeking. We also shed light on the need to include multimedia in ChatGPT to aid users' understanding.

### 5.3.1 Incorporating Pluralistic Approach

ChatGPT offers the flexibility to chat in a wide range of languages, including Hindi and Hinglish. Our participants appreciated this flexibility and benefited from it. However, there are certain issues with ChatGPT that make it challenging for our participants with limited literacy to take advantage of the language flexibility. Our participants could chat in a language of their choice only after logging in and onboarding the ChatGPT app with the help of another individual. Since the default app language is English, all the screens,

including the chat screen, appear in English. Moreover, all the prompts are also in English. As stated by Shevat it is crucial to design onboarding in an effective manner as it helps set the user expectations before interacting with a chatbot [123]. Our participants could not interpret the onboarding itself and, hence, could not have constructed a mental model of the chatbot's working. Though the chat interface has an intuitive message bar, even during a chat, ChatGPT switches between languages with its own mind, sometimes adapting to user query language and sometimes fixing the reply language to the language of the first query sent by the user. For instance, the first message could be a greeting in English, such as a Hello or Hi, and hence, ChatGPT holds further conversation in English irrespective of user health queries in Hinglish. Further, ChatGPT offers a voice conversation feature, which could be useful for users with low literacy. However, it does not function efficiently to support our participants. It interprets queries and provides answers in a foreign language, making it impossible for participants to understand the information provided. Overall, the ChatGPT app did not turn out to be intuitive in the case of our participants, who had to seek additional support in setting up the app and navigating through the language mismatches.

ChatGPT has over 180 million users, with India ranking second in the number of users worldwide [2]. However, to incorporate Indian women residing in resource-constrained areas and similar populations, we recommend that ChatGPT adopt a pluralistic approach. As in Feminist HCI, pluralism defies designing artifacts with a singular view [106]. ChatGPT needs to step away from the notion that using English as a default language would work fairly well for individuals of different demographics. In order to widen its range of users and create more use cases, ChatGPT should incorporate the notion that different sets of users will have different literacy levels, including technology-literacy levels, and hence, the design should be pluralistic to serve as many of them as possible instead of a single sample of people who are reasonably literate.

A pluralistic approach has been adopted by HCI researchers in designing systems to

[2]https://explodingtopics.com/blog/chatgpt-users

support individuals with different literacies and technology affordances. Systems based on Interactive Voice Response technology have been designed to support users with low literacy and poor affordance of smartphones for healthcare support [121, 124]. On the other hand, HCI researchers have also critiqued the design of artifacts to identify the extent of pluralism practiced within the artifacts. Tuli et al. studied an online platform, Menstrupedia, meant for disseminating menstrual health education through its website and comic among Indian audience [125]. The authors found the platform to be pluralistic to an extent by offering its website for open discussion to people across ages and genders. We suggest ChatGPT also consider pluralism to include a wider set of users and enhance its use cases.

ChatGPT could be pluralistic with respect to usability in different ways. Firstly, it could offer the option of choosing the app language at the start screen. The chosen language should be reflected in all the following screens and prompts. At the same time, ChatGPT should reply in the language of the query on an individual level rather than fixing a particular language or randomly switching between languages. This would enable a user to independently use the app without seeking help from another individual and would make their interaction smoother. Secondly, it should improve its voice conversation feature to further support users with challenges in framing and typing queries. Such users should be able to use the voice feature to ask queries without the cognitive load of typing queries in the right structure.

Overall, ChatGPT has the potential to be inclusive of a wider range of users provided it adopts a pluralistic approach and, thus, serves those who need such technology-mediated support interventions given their limited access to healthcare resources.

### 5.3.2 Potential of ChatGPT to Serve as an Educational Tool for General and not Personalized Health Information Seeking amid Possible Misinformation

Our participants found ChatGPT to provide correct answers to their general nature queries around family planning, where they inquired about options available for contraception or

information on certain methods. They perceived ChatGPT as one of the information channels in their support network. However, participants were not satisfied with ChatGPT's answers to health queries based on their personal context. They shared consulting an expert or other channel in their support network apart from ChatGPT for personal condition-based queries. They felt that ChatGPT could offer generic information but not personalized health information. A similar finding was observed by Yadav et al. that chatbot could act as a first point of contact for fact-based information [50]. Moreover, participants could also misjudge the answers for correctness, as can be seen in our study. The participant misjudged the answer to a generic question and, hence, had chances of minimal risk. However, any misjudgment could incur high risk when answering personalized condition-based queries. Thus, ChatGPT could be used for general information seeking to support the health needs of a population similar to our participants' demographics.

Participants' queries show their lack of fundamental information about family planning. Hence, ChatGPT could be used as an educational tool to build fundamental knowledge about family planning in resource-constrained areas. ChatGPT could offer fact-based information while users can consult experts for their condition-based queries. This would keep the risk level minimal since, in case of misinterpretation of an answer to be true, a user will not have health consequences as the answer would have only theoretical knowledge. For instance, for a query - 'What are the best family options for men?', the answer would just provide a list of methods and their details. But for a query - 'When should we resume sexual activity after delivery?', the answer is based on a user's context. Contextual parameters such as type of delivery and level of recovery after delivery must be considered. To this query, ChatGPT provides a generic answer of resumption after four to six weeks, explains the reasons behind the said duration, and follows it up with a suggestion to consult a doctor in case of any discomfort, pain, or bleeding. If the user believes the answer and resumes sexual activity after the said duration, irrespective of knowledge of self-recovery, then it could have health consequences. Expert advice and checkups are needed to determine

the extent of recovery and suggest the best time for getting sexually active after delivery. Thus, for critical healthcare domains and with potentially vulnerable users, those who have limited health literacy with limited sources for information verification, and also have had limited or no exposure to chatbots, misinformation may cause adverse health outcomes and loss of trust in technology solutions. Research has also shown that low health literacy negatively impacts users' evaluation of online health information and trust in the information [126]. Women with high educational qualifications residing outside of low-resource settings access online digital platforms for seeking/verifying health information and also have access to doctors for healthcare support [127]. These women compared the knowledge received online with existing knowledge and employed different cues for establishing information accuracy and source authenticity [127]. On the contrary, our participants are not digitally literate enough to access online platforms for seeking health information, and even if some of them do so, their access is restricted to Google searches. They face issues in getting the desired answer from such searches amid the plethora of unnecessary information provided. Further, health experts do not provide the required support, and they have to rely on non-health experts such as mothers-in-law who themselves have age-old beliefs and experiences. Thus, their support for information verification is limited and skewed. In our study, a few participants could not identify misinformation at all, while others approached the information provided by ChatGPT on personal situations with caution. These women used the provided information as something to be mindful of without relying on it completely to avoid adverse health consequences. Thus, the scope of ChatGPT could be better confined to general health information seeking, given the low-resource population's limited understanding of true and false information and their limited trust in personalized information.

ChatGPT could also employ certain strategies to further cater to the population at hand. It could suggest further questions similar to those asked by a user to build their knowledge. This would also reduce the cognitive load of those users who find it challenging to frame

queries but need information. For instance, one such conversation between ChatGPT and a user could be,

**User:** How is Copper-T inserted?

**ChatGPT:** Provides fact-based information

**ChatGPT:** Do you also want to know about the time duration of Copper-T?

Participants lack information and raise queries with their limited knowledge; hence, this technique would help develop comprehensive knowledge about a health topic. Further, ChatGPT, in its current version, does not offer support for localized resource searching. For instance, it could provide information on different contraceptive methods but not on where to get them. Participants can benefit further if ChatGPT can use their location to inform them of the different services and health centers in their region for family planning. An example of such a local resource sharing is when a user can inquire about the nearest health center where she can get contraceptive injections, to which ChatGPT could reply with the name, location, timings, and contact number of a health center. Further, ChatGPT could direct a user to healthcare professionals in their area for queries needing expert advice. Such localized resource sharing would also improve users' access to family planning resources. Moreover, using location, ChatGPT could incorporate local vocabulary in its answers to further aid users' understanding.

Further, the scope of ChatGPT can be expanded to include other healthcare topics to educate women residing in resource-constrained areas since they lack access to healthcare services in general due to lack of agency and societal constraints [5]. Women could seek information on other health topics such as maternal and child health, breast cancer, and cervical cancer. This might help build basic health literacy among women about their bodies.

Thus, ChatGPT holds the potential to serve as an educational tool for building fundamental knowledge around health topics but needs to be mindful of the boundary where it needs to direct users to health experts quite explicitly. Moreover, strategies for comprehen-

sive knowledge building and localized resource support need to be incorporated.

### 5.3.3 Designing Culturally Sensitive Chatbot using ChatGPT

Low-resource women have demonstrated information needs on different health topics related to maternal and child health as well as sexual and reproductive health. These needs relate to diagnostics, medications, fetus well-being, infant care, feeding, vaccination, diet, body image after delivery, contraception, safe abortion, fertile period, and early signs of pregnancy [128, 129, 130, 131]. Due to low digital literacy, these women find it challenging to use social media and other dedicated websites for seeking health information. Further, with limited guidance from health experts and community health workers, especially around sexual and reproductive health, rural women have to rely on family members and mass media for information [130]. However, with the penetration of smartphones in rural India, rural women leverage smartphone-based tools such as WhatsApp for healthcare support seeking [129, 128]. Thus, there exists an opportunity to further explore smartphone-based interventions, such as chatbots, to bridge the healthcare access gap and offer authentic information remotely to meet the varying health needs of such low-resource women.

ChatGPT, in its current interface, is meant for domains beyond healthcare and caters to a wide range of populations. One way to utilize ChatGPT to cater to the study population in a more personalized manner could be to design a chatbot using ChatGPT APIs. The APIs can be used to develop a chatbot that could serve women in resource-constrained settings in a more culturally sensitive manner. Moreover, the chatbot could be scalable to serve a larger population of similar demographics.

The chatbot could build on the local customs and belief systems prevailing in Northern India to fit well into the socio-cultural context of the target population. Every region has its own health beliefs, misconceptions, myths, and customs. For instance, in rural Northern India, it is a misconception that using Copper-T results in women losing more blood and their wombs being damaged [14]. The chatbot could take into consideration such miscon-

ceptions and address them for knowledge building of users. Analyzing the perceptions and misconceptions along with the usage of the contraceptive methods in the study area could help design a chatbot to effectively disseminate information about the different contraceptive methods and offer actionable insights for practicing family planning. For instance, a chat could look like,

**User:** Tell about contraceptive injections

**ChatGPT:** Provides fact-based information

**ChatGPT:** Do you want to know about the common misconceptions about contraceptive injections?

Moreover, women in resource-constrained areas have been found to lack agency around decision-making when it comes to their health and well-being given the patriarchal settings [5]. Women cannot themselves choose to use or not use contraception and also cannot practice birth spacing as per their desire. Their husbands and mothers-in-law are the final decision-makers, and women have to follow suit. Moreover, with family planning being a taboo topic in low-resource areas in India, it makes it challenging for women to seek information and hold discussions about family planning, even with women in their social circle, out of fear of judgment. Hence, chatbots serve as a private channel for information-seeking to low-resource women when other channels are restricted. Chatbots have the potential to ensure women's privacy by keeping their health information-seeking practices private from their families, who control their decisions. Further, in such settings, chatbots can be helpful for building knowledge of women by providing a safe space to enable them to form an opinion about their bodies and further offer suggestions for using the gained knowledge for negotiating their agency. Similarly, other socio-cultural barriers can be attempted to be addressed through the chatbot.

Additionally, the chatbot could offer health information using the local vocabulary to aid users' understanding. Our participants faced difficulty in understanding certain medical terms and English terms for contraceptive methods. Hence, local vocabulary would come

in handy in such situations and give a personalized touch.

We, as researchers, also need to be mindful of drawing a boundary when the chatbot needs to direct the chat to a health expert to avoid any health risks. Authentic and fact-based information could be offered while pushing condition-based queries to a health expert, or at least the chatbot's provided answer could be verified by a health expert. This is required to ensure the chatbot does not behave in a destructive manner.

We believe it would be interesting to explore the design of a culturally sensitive chatbot using ChatGPT APIs, which could attempt to build health-related knowledge of women in resource-constrained areas while addressing the prevailing misconceptions and myths. It would open areas for further exploration of ChatGPT use in large-scale real-world settings.

# Chapter 6

# Conclusion

This dissertation contributes to ongoing discussions in HCI, CSCW, and health informatics by advancing the understanding of responsible technology design in contexts of stigmatized health care. Grounded in empirical work with pregnant and postpartum women in low-resource settings, it challenges assumptions that information access alone can drive health empowerment. Instead, it highlights the importance of designing technologies that are socially aware, culturally sensitive, and privacy-preserving, especially when addressing taboo health topics such as family planning. By examining both peer-support interventions and AI-based conversational tools, the dissertation offers new perspectives on how responsible technology can be redefined to account for relational dynamics, stigma, and social structures, ultimately contributing to more equitable and contextually grounded digital health interventions. Next, we discuss our contributions and the potential research directions in line with this dissertation research.

## 6.1 Reframing Technology as Socially Embedded and Responsible

This dissertation contributes to HCI, CSCW, and health informatics by extending the understanding of responsible technology in stigmatized health contexts, grounded in detailed empirical studies of pregnant and postpartum women in low-resource settings. While much of the existing work focuses on bridging access and knowledge gaps, this research demonstrates that information access alone is insufficient. Women's engagement with family planning is deeply influenced by social stigma, cultural norms, familial power structures, and relational dynamics. Our findings reveal how these sociocultural factors impact not only women's ability to seek and discuss family planning information but also more concealed practices, such as the disposal of contraceptive methods to avoid social scrutiny.

By drawing on Bronfenbrenner's ecological systems theory [35], this dissertation highlights that effective digital interventions must acknowledge and engage with the multi-level ecosystems surrounding women, including family members, community norms, and healthcare actors. This work thus reframes responsible technology as a socially embedded construct that must account for interpersonal relationships, cultural stigmas, and privacy negotiations within marginalized contexts.

Additionally, this dissertation provides a nuanced understanding of smartphone-based interventions among recent technology adopters with low digital literacy. It demonstrates how technologies like chatbots and digital peer support groups can transcend formal healthcare gaps, offering private, safe spaces for knowledge-sharing, experiential learning, and emotional support. By showcasing how technology can facilitate access to stigmatized reproductive health information while respecting user privacy and cultural sensitivities, this dissertation expands theoretical discussions on responsible, dignity-preserving technology design for marginalized populations.

Overall, in the broader global health technology design discourse, this dissertation contributes to critical conversations on ethical and responsible innovation with a call for a broader framing of responsible technology, moving away from efficiency metrics to recognize the importance of cultural alignment, emotional safety, and social support in the design of health technologies.

## 6.2 Extending Responsible Technology Discourses to Peer Support and AI

The dissertation further extends the scope of responsible technology discourses by empirically examining two prominent forms of digital intervention - peer-support systems and AI-based conversational agents, within the sensitive context of family planning. Traditionally, peer support in CSCW has been examined in the realms of mental health and chronic disease management, often within clinical environments or structured institutional support. This work shifts the focus towards community-driven, informal digital spaces, demonstrat-

ing how WhatsApp-based peer groups foster trusted, stigma-sensitive exchanges, allowing women to access experiential knowledge and emotional reassurance in ways that are unavailable through formal healthcare systems. It illustrates the importance of localized, peer-led solidarity networks.

In parallel, this dissertation critically examines the use of AI conversational agents like ChatGPT in low-literacy, culturally sensitive environments. While conversational AI is frequently promoted as a means to democratize access to health information, this research uncovers the practical limitations and social risks of deploying such technology without cultural adaptation. Issues around language accessibility, question-posing abilities, and trust in AI-generated responses emerge as key barriers. By surfacing these challenges, the dissertation offers pragmatic design guidelines for creating responsible AI systems that prioritize privacy, cultural alignment, and relational trust, particularly for marginalized users navigating stigmatized health decisions. Key design recommendations emerging from this dissertation include: (1) Designing for balanced support, ensuring spaces for both emotional expression and knowledge-building without compromising either; (2) Incorporating mechanisms to support information retention, enabling women to revisit and internalize information over time; (3) Embedding privacy safeguards such as anonymous participation, discreet content sharing, and private browsing options to reduce stigma-related risks; (4) Employing a pluralistic design approach that accommodates varying levels of literacy, language proficiency, and digital confidence through multimodal and flexible interaction formats. Overall, this dissertation advances design thinking in HCI and health informatics by showing how responsible, context-aware technologies can empower marginalized women while respecting their privacy, cultural realities, and agency in making reproductive health decisions.

## 6.3 Advancing Ecological Theory for Digital Health Interventions

This dissertation draws on Bronfenbrenner's ecological systems theory [35] as a lens to examine the family planning practices of pregnant and postpartum women in rural India. Ecological theory offers a structured framework to understand how women's behaviors are shaped by multiple, interacting layers of influence, including individual beliefs, family dynamics, community norms, healthcare structures, and broader sociocultural systems. However, rather than limiting the use of ecological theory to a descriptive framing, this dissertation extends its application towards a more explanatory and generative contribution to the field of HCI and CSCW.

This approach is informed by Halverson's argument that theory in CSCW should "do more" than simply organize observations [36]. Halverson identifies four properties of effective theory: it should be descriptive, explanatory, predictive, and generative. This dissertation responds to this call by operationalizing ecological theory in a way that satisfies these theoretical properties:

- Descriptive: The thesis presents how social stigma, cultural norms, and power relations manifest in women's family planning decisions in low-resource settings, contributing to the underexplored area of sexual and reproductive health within HCI4D [132, 133].

- Explanatory: It uncovers the mechanisms through which familial control, social pressure, and limited autonomy influence women's ability to access and practice family planning, explaining why digital interventions succeed or fail in these environments [15, 14].

- Generative: The research contributes new conceptual insights by showing how smartphone-based interventions, including peer-support groups and chatbots, can introduce alternative support systems, reshaping traditional social ecosystems and offering privacy-

preserving, agency-enhancing pathways for women navigating stigmatized health decisions [70, 49, 134].

- Predictive: While not formally predictive, the findings offer design-oriented implications that can be transferred to similar marginalized contexts, suggesting how digital interventions might scale or adapt in other low-resource, stigmatized health environments.

Through this lens, the dissertation makes a theoretical contribution by reshaping ecological theory for digital health contexts, highlighting how technology can act as a sociotechnical layer that interacts with and restructures traditional ecological systems. It advances HCI and CSCW discussions by showing that responsible technology design must consider cross-level dynamics, including privacy concerns, trust, and the reconfiguration of informal support networks.

In doing so, this work aligns with broader calls within HCI for critical, situated, and relational approaches to technology design, particularly in the Global South, and provides a transferable model for applying ecological theory to stigmatized health interventions through digital technologies.

## 6.4 Implications for Future Work

Throughout this dissertation, we have observed the need for a suite of tools to strengthen the support network of pregnant and postpartum women. Therefore, moving forward, we would like to explore the potential of other smartphone-based interventions to widen the understanding of which and how an intervention supports these women. One of the interventions we would like to explore exploits the use of mobile applications to offer a blend of both individual and group-level support. So far, we have engaged with interventions offering individual and group support separately. Moving forward, we will work on co-designing a mobile application that allows users to obtain health information in a 1:1

manner and also offers a connection to a peer network. It would be interesting to see how pregnant and postpartum women would navigate a stand-alone app to support their family planning needs. Co-design with pregnant and postpartum women would further open up avenues for involving these women more closely in the design process.

Another direction we would like to explore is the scope of LLM-based conversational agents for maternal health in low-resource settings. In this dissertation, we experimented with ChatGPT to understand how it would work for pregnant and postpartum women, and we observed the need to design a culturally sensitive chatbot using LLM. Thus, we would like to explore the design of a chatbot that is mindful of the sociocultural context of pregnant and postpartum women while addressing the informational needs of family planning. Further, deploying such a chatbot on a large scale will bring deeper insights into the efficacy of LLM-based chatbots in the wild.

The last direction would be one that links all the previous works and answers how a suite of tools comprising a wide range of support interventions work in conjunction to meet the information needs of pregnant and postpartum women. We would like to draw parallels among the different interventions and offer a deeper understanding of the efficacy of those interventions as a support ecosystem.

## 6.5 Limitations

Firstly, in this dissertation, we engaged with women connected to our collaborator NGO for their healthcare support. We benefited from the NGO's long-standing presence and trust in the women. These women could open up to us, given our association with the NGO. For women outside the NGO's reach, there might be challenges in reaching out to pregnant and postpartum women and encouraging them to share their experiences with family planning. We acknowledge it would have taken a long time to establish a connection and sense of trust with the women if we had decided to reach out to women without NGO's collaboration.

Secondly, the methodologies adopted in this thesis were influenced by my pregnancy.

During some studies, I was pregnant and was unable to travel to participants' locations to have face-to-face interaction. Thus, overall, telephonic calls and Zoom sessions were used in the studies.

Lastly, this dissertation engages with pregnant and postpartum women residing in rural areas of Haryana in Northern India. Thus, the generalizability of our findings to other contexts might need further investigation.

# Publications

**Jasmeet Kaur**, and Pushpendra Singh. Exploring the Potential of ChatGPT for Supporting Family Planning Needs of Postpartum Women in Resource-constrained Areas of India. CSCW(2025) (Accepted)

**Jasmeet Kaur**, Riya Singh, and Pushpendra Singh. 2025. "I did not know what they are": Understanding Support Needs of Women around Family Planning in Rural India. Proc. ACM Hum.-Comput. Interact. 8, CSCW, (2025). https://doi.org/10.1145/3711002

**Jasmeet Kaur**, and Pushpendra Singh. 2025. Exploring the Potential of Peer Support Group for Family Planning Needs of Women in Resource-constrained Settings in India. Proc. ACM Hum.-Comput. Interact. 8, CSCW(2025). https://doi.org/10.1145/3710978

**Jasmeet Kaur**, Preetika Sharma, Vijay Kumar, Mona Duggal, Nadia Griffin Diamond-Smith, Alison El Ayadi, Kathryn Vosburg, and Pushpendra Singh. 2024. Exploring the Role of Chatbots in Tackling COVID-19 Vaccine Hesitancy among Pregnant and Breastfeeding Women in Rural Northern India. Proc. ACM Hum.-Comput. Interact. 8, CSCW1, Article 55 (April 2024), 29 pages. https://doi.org/10.1145/3637332

El Ayadi, Alison M., Pushpendra Singh, Mona Duggal, Vijay Kumar, **Jasmeet Kaur**, Preetika Sharma, Kathryn Bradford Vosburg, and Nadia G. Diamond-Smith. "Feasibility and acceptability of Saheli, a WhatsApp Chatbot, on COVID-19 vaccination among pregnant and breastfeeding women in rural North India." BMJ Innovations 9, no. 4 (2023).

Mishra, Ritwik, Simranjeet Singh, **Jasmeet Kaur**, Pushpendra Singh, and Rajiv Shah. "Hindi Chatbot for Supporting Maternal and Child Health Related Queries in Rural India." In Proceedings of the 5th Clinical Natural Language Processing Workshop, pp. 69-77. 2023.

Diamond-Smith, Nadia G., Preetika Sharma, Mona Duggal, Navneet Gill, Jagriti Gupta, Vijay Kumar, **Jasmeet Kaur**, Pushpendra Singh, Katy Bradford Vosburg, and Alison M. El Ayadi. "The supply is there. So why can't pregnant and breastfeeding women in rural India get the COVID-19 vaccine?." PLOS global public health 2, no. 12 (2022): e0001321.

**Jasmeet Kaur**, Meghna Gupta, and Pushpendra Singh. 2022. Understanding the Role of Technology-mediated Solutions for Women's Safety in Urban India. In Proceedings of the 5th ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies (COMPASS '22). Association for Computing Machinery, New York, NY, USA, 638–642. https://doi.org/10.1145/3530190.3534843

**Jasmeet Kaur** and Pushpendra Singh. 2020. Understanding Engagement of Parents In Online Health Communities for Early Childhood. In Proceedings of the 2020 International Conference on Information and Communication Technologies and Development (ICTD '20). Association for Computing Machinery, New York, NY, USA, Article 28, 1–5. https://doi.org/10.1145/3392561.3397582

**Jasmeet Kaur**, Asra Sakeen Wani, and Pushpendra Singh. 2019. Engagement of Pregnant Women and Mothers over WhatsApp: Challenges and Opportunities Involved. In Companion Publication of the 2019 Conference on Computer Supported Cooperative Work and Social Computing (CSCW '19 Companion). Association for Computing Machinery, New York, NY, USA, 236–240. https://doi.org/10.1145/3311957.3359481

# Appendix

Table 6.1: Summary of Dissertation

| Chapter | Study & Contribution | Research Questions | Study | Method& Participants |
|---|---|---|---|---|
| 4 | Understanding Information Needs around Family Planning | What are the practices and information needs of pregnant and postpartum women around family planning? | Qualitative | FGD (n=3)<br>Interviews (n=20)<br>Surveys (n=327) |
| 5 | Exploring the Potential of Peer Support for Family Planning Needs | How do pregnant and postpartum women use peer support group to meet their family planning needs? | Field Study | Survey(n=30)<br>Field deployment(n=30) |
| | | What are the design considerations for a peer support for supporting the family planning needs of pregnant and postpartum women? | | Interviews(n=10) |
| 6 | Exploring the Potential of AI-based Chatbot for Family Planning Needs | How do pregnant and postpartum women use ChatGPT to meet their family planning needs? | Field Study | Observation(n=8) |
| | | What are the design considerations for a chatbot for supporting the family planning needs of pregnant and postpartum women? | | Interviews(n=8) |

## References


[1] C Meh et al. “Trends in maternal mortality in India over two decades in nationally representative surveys”. In: *BJOG: An International Journal of Obstetrics & Gynaecology* 129.4 (2022), pp. 550–561.

[2] Kasisomayajula Viswanath. “Public communications and its role in reducing and eliminating health disparities”. In: *Examining the health disparities research plan of the national institutes of health: unfinished business. Washington, DC: Institute of Medicine* (2006), pp. 215–253.

[3] Zoe Matthews et al. “Antenatal care, care-seeking and morbidity in rural Karnataka, India: results of a prospective study”. In: *Asia Pacific Population Journal* 16.2 (2001), pp. 11–28.

[4] BR Ganatra, KJ Coyaji, and VN Rao. “Too far, too little, too late: a community-based case-control study of maternal mortality in rural west Maharashtra, India.” In: *Bulletin of the World Health Organization* 76.6 (1998), p. 591.

[5] Ashavaree Das and Madhurima Sarkar. “Pregnancy-related health information-seeking behaviors among rural pregnant women in India: validating the Wilson model in the Indian context”. In: *The Yale journal of biology and medicine* 87.3 (2014), p. 251.

[6] Debasis Barik and Amit Thorat. “Issues of unequal access to public health in India”. In: *Frontiers in public health* 3 (2015), p. 245.

[7] AM Amrutha et al. “Assessment of the Social Factors Affecting the use of Contraceptives and the Stigma Associated”. In: *International Journal of Preclinical & Clinical Research* 2.4 (2022), pp. 80–86.

[8] Gilda Sedgh, Lori S Ashford, and Rubina Hussain. “Unmet need for contraception in developing countries: examining women’s reasons for not using a method”. In: (2016).

[9] Nadia Diamond-Smith, Martha Campbell, and Seema Madan. “Misinformation and fear of side-effects of family planning”. In: *Culture, health & sexuality* 14.4 (2012), pp. 421–433.

[10] D Baker, S Keogh, G Luchsinger, et al. “Seeing the unseen: the case for action in the neglected crisis of unintended pregnancy”. In: *State of World Population 2022* (2022).

[11] World Health Organization et al. “Birth spacing: report from a WHO technical consultation”. In: (2006).

[12] Bindoo Yadav and Santvana Pandey. “Study of knowledge, attitude, and practice regarding birth spacing and methods available for spacing in rural Haryana, India”. In: *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* 7.4 (2018), pp. 1389–1394.

[13] Ministry of Health and Government of India Family Welfare. “Initiatives under the Family Planning Programme”. In: (2017). URL: https\://pib.gov.in/newsite/PrintRelease.aspx?relid=159064.

[14] Mokshada Jain et al. “Understanding drivers of family planning in rural northern India: An integrated mixed-methods approach”. In: *PloS one* 16.1 (2021), e0243854.

[15] Sunita Ghike et al. “Awareness and contraception practices among women-An Indian rural experience”. In: *Journal of South Asian Federation of Obstetrics and Gynecology* 2.1 (2010), pp. 19–21.

[16] Arundhati Char, Minna Saavala, and Teija Kulmala. “Influence of mothers-in-law on young couples’ family planning decisions in rural India”. In: *Reproductive health matters* 18.35 (2010), pp. 154–162.

[17] Anjali Widge. “Sociocultural attitudes towards infertility and assisted reproduction in India”. In: *Current practices and controversies in assisted reproduction* 60 (2002), p. 74.

[18] Alice Qian Zhang, Ashlee Milton, and Stevie Chancellor. “#Pragmatic or #Clinical: Analyzing TikTok Mental Health Videos”. In: *Companion Publication of the 2023 Conference on Computer Supported Cooperative Work and Social Computing*. CSCW ’23 Companion. Minneapolis, MN, USA: Association for Computing Machinery, 2023, 149–153. ISBN: 9798400701290. DOI: 10.1145/3584931.3607013. URL: https://doi.org/10.1145/3584931.3607013.

[19] Kathleen O’Leary et al. “Design Opportunities for Mental Health Peer Support Technologies”. In: *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*. CSCW ’17. Portland, Oregon, USA: Association for Computing Machinery, 2017, 1470–1484. ISBN: 9781450343350. DOI: 10.1145/2998181.2998349. URL: https://doi.org/10.1145/2998181.2998349.

[20] Megan Bogia et al. “Institutional Shadow Bodies in Mental Health Care Information Seeking”. In: *Companion of the 2018 ACM Conference on Computer Supported Cooperative Work and Social Computing*. CSCW ’18 Companion. ¡conf-loc¿, ¡city¿Jersey City¡/city¿, ¡state¿NJ¡/state¿, ¡country¿USA¡/country¿, ¡/conf-

loc¿: Association for Computing Machinery, 2018, 269–272. ISBN: 9781450360180. DOI: 10.1145/3272973.3274072. URL: https://doi.org/10.1145/3272973.3274072.

[21] Prateek Chanda et al. "MINDNOTES: A Mobile Platform to enable users to break stigma around mental health and connect with therapists". In: *Companion Publication of the 2021 Conference on Computer Supported Cooperative Work and Social Computing*. CSCW '21 Companion. Virtual Event, USA: Association for Computing Machinery, 2021, 213–217. ISBN: 9781450384797. DOI: 10.1145/3462204.3482895. URL: https://doi.org/10.1145/3462204.3482895.

[22] Md Romael Haque et al. "Perceptions of Mental Health Crisis among U.S. Military Veteran Peer Mentors and Potential of Mobile-Based Peer-Support Interventions". In: *Companion Publication of the 2023 Conference on Computer Supported Cooperative Work and Social Computing*. CSCW '23 Companion. Minneapolis, MN, USA: Association for Computing Machinery, 2023, 33–38. ISBN: 9798400701290. DOI: 10.1145/3584931.3607009. URL: https://doi.org/10.1145/3584931.3607009.

[23] Tamara Peyton et al. "" Every pregnancy is different" designing mHealth for the pregnancy ecology". In: *Proceedings of the 2014 conference on Designing interactive systems*. 2014, pp. 577–586.

[24] Mary Hui, Christine Ly, and Carman Neustaedter. "MammiBelli: Sharing Baby Activity Levels between Expectant Mothers and Their Intimate Social Groups". In: *CHI '12 Extended Abstracts on Human Factors in Computing Systems*. CHI EA '12. Austin, Texas, USA: Association for Computing Machinery, 2012, 1649–1654. ISBN: 9781450310161. DOI: 10.1145/2212776.2223687. URL: https://doi.org/10.1145/2212776.2223687.

[25] Kevin Doherty et al. "Engagement with Mental Health Screening on Mobile Devices: Results from an Antenatal Feasibility Study". In: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. CHI '19. Glasgow, Scotland Uk: Association for Computing Machinery, 2019, 1–15. ISBN: 9781450359702. DOI: 10.1145/3290605.3300416. URL: https://doi.org/10.1145/3290605.3300416.

[26] Munmun De Choudhury et al. "Characterizing and predicting postpartum depression from shared facebook data". In: *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*. CSCW '14. Baltimore, Maryland, USA: Association for Computing Machinery, 2014, 626–638. ISBN: 9781450325400. DOI: 10.1145/2531602.2531675. URL: https://doi.org/10.1145/2531602.2531675.

[27] Munmun De Choudhury, Scott Counts, and Eric Horvitz. “Major life changes and behavioral markers in social media: case of childbirth”. In: *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*. CSCW ’13. San Antonio, Texas, USA: Association for Computing Machinery, 2013, 1431–1442. ISBN: 9781450313315. DOI: 10.1145/2441776.2441937. URL: https://doi.org/10.1145/2441776.2441937.

[28] Deepika Yadav et al. “Feedpal: Understanding Opportunities for Chatbots in Breastfeeding Education of Women in India”. In: *Proc. ACM Hum.-Comput. Interact.* 3.CSCW (Nov. 2019). DOI: 10.1145/3359272.

[29] Tamara Peyton and Pamela Wisniewski. “Improving a Design Space: Pregnancy as a Collaborative Information and Social Support Ecology”. In: *Advances in Information and Communication*. Ed. by Kohei Arai and Rahul Bhatia. Cham: Springer International Publishing, 2020, pp. 505–525. ISBN: 978-3-030-12388-8.

[30] Maryam Mustafa et al. “Patriarchy, Maternal Health and Spiritual Healing: Designing Maternal Health Interventions in Pakistan”. In: *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. CHI ’20. Honolulu, HI, USA: Association for Computing Machinery, 2020, 1–13. ISBN: 9781450367080. DOI: 10.1145/3313831.3376294. URL: https://doi.org/10.1145/3313831.3376294.

[31] Mayara Costa Figueiredo and Yunan Chen. “Health Data in Fertility Care: An Ecological Perspective”. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. CHI ’21. ¡conf-loc¿, ¡city¿Yokohama¡/city¿, ¡country¿Japan¡/country¿, ¡/conf-loc¿: Association for Computing Machinery, 2021. ISBN: 9781450380966. DOI: 10.1145/3411764.3445189. URL: https://doi.org/10.1145/3411764.3445189.

[32] Marcus Ma et al. “It Takes Two to Avoid Pregnancy: Addressing Conflicting Perceptions of Birth Control Pill Responsibility in Romantic Relationships”. In: *Proc. ACM Hum.-Comput. Interact.* 7.CSCW2 (2023). DOI: 10.1145/3610073. URL: https://doi.org/10.1145/3610073.

[33] Mayara Costa Figueiredo et al. “Self-Tracking for Fertility Care: Collaborative Support for a Highly Personalized Problem”. In: *Proc. ACM Hum.-Comput. Interact.* 1.CSCW (2017). DOI: 10.1145/3134671. URL: https://doi.org/10.1145/3134671.

[34] Maryam Mustafa et al. “Religion and Women’s Intimate Health: Towards an Inclusive Approach to Healthcare”. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. CHI ’21. ¡conf-loc¿, ¡city¿Yokohama¡/city¿, ¡country¿Japan¡/country¿, ¡/conf-loc¿: Association for Computing Machinery, 2021.

ISBN: 9781450380966. DOI: 10.1145/3411764.3445605. URL: https://doi.org/10.1145/3411764.3445605.

[35] Dede Paquette-John Ryan. "Bronfenbrenner's ecological systems theory". In: *Retrieved January* 9 (2001), p. 2012.

[36] Christine A Halverson. "Activity theory and distributed cognition: Or what does CSCW need to DO with theories?" In: *Computer Supported Cooperative Work (CSCW)* 11.1 (2002), pp. 243–267.

[37] Zoya Mateen and Devang Shah. "Population: When saying condom aloud became birth control ad in India". In: (2023). URL: https://www.bbc.com/news/world-asia-india-65334384.

[38] Trevor Perrier et al. "Engaging Pregnant Women in Kenya with a Hybrid Computer-Human SMS Communication System". In: *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. CHI '15. Seoul, Republic of Korea: Association for Computing Machinery, 2015, 1429–1438. ISBN: 9781450331456. DOI: 10.1145/2702123.2702124. URL: https://doi.org/10.1145/2702123.2702124.

[39] Divya Ramachandran, Vivek Goswami, and John Canny. "Research and Reality: Using Mobile Messages to Promote Maternal Health in Rural India". In: *Proceedings of the 4th ACM/IEEE International Conference on Information and Communication Technologies and Development*. ICTD '10. London, United Kingdom: Association for Computing Machinery, 2010. ISBN: 9781450307871. DOI: 10.1145/2369220.2369253. URL: https://doi.org/10.1145/2369220.2369253.

[40] Michelle R Kaufman et al. ""Love me, parents!": impact evaluation of a national social and behavioral change communication campaign on maternal health outcomes in Tanzania". In: *BMC pregnancy and childbirth* 17.1 (2017), pp. 1–10.

[41] Peter Barron et al. "Mobile health messaging service and helpdesk for South African mothers (MomConnect): history, successes and challenges". In: *BMJ global health* 3.Suppl 2 (2018), e000559.

[42] Atik Ahsan and Ananya Raihan. "Understanding MHealth Impact among Aponjon (MAMA Bangladesh) Subscribers through a Phone Survey in Bangladesh". In: *Proceedings of the Sixth International Conference on Information and Communications Technologies and Development: Notes - Volume 2*. ICTD '13. Cape Town, South Africa: Association for Computing Machinery, 2013, 1–4. ISBN: 9781450319072. DOI: 10.1145/2517899.2517920. URL: https://doi.org/10.1145/2517899.2517920.

[43] Niranjan Pai et al. “Using automated voice calls to improve adherence to iron supplements during pregnancy: a pilot study”. In: *Proceedings of the Sixth International Conference on Information and Communication Technologies and Development: Full Papers-Volume 1*. 2013, pp. 153–163.

[44] Amna Abid and Suleman Shahid. “Helping pregnant women in the rural areas of Pakistan using a low-cost interactive system”. In: *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development*. 2017, pp. 1–5.

[45] Dipanjan Chakraborty, Akshay Gupta, and Aaditeshwar Seth. “Experiences from a mobile-based behaviour change campaign on maternal and child nutrition in rural India”. In: *Proceedings of the Tenth International Conference on Information and Communication Technologies and Development*. 2019, pp. 1–11.

[46] Konstantinos Kazakos et al. “A real-time ivr platform for community radio”. In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. 2016, pp. 343–354.

[47] Eleni Adamopoulou and Lefteris Moussiades. “An overview of chatbot technology”. In: *IFIP International Conference on Artificial Intelligence Applications and Innovations*. Springer. 2020, pp. 373–383.

[48] Benilda Eleonor V Comendador et al. “Pharmabot: a pediatric generic medicine consultant chatbot”. In: *Journal of Automation and Control Engineering* 3.2 (2015).

[49] Kyungmi Chung, Hee Young Cho, Jin Young Park, et al. “A Chatbot for Perinatal Women’s and Partners’ Obstetric and Mental Health Care: Development and Usability Evaluation Study”. In: *JMIR Medical Informatics* 9.3 (2021), e18607.

[50] Deepika Yadav et al. “Feedpal: Understanding opportunities for chatbots in breastfeeding education of women in india”. In: *Proceedings of the ACM on Human-Computer Interaction* 3.CSCW (2019), pp. 1–30.

[51] Rifat Rahman et al. “AdolescentBot: Understanding Opportunities for Chatbots in Combating Adolescent Sexual and Reproductive Health Problems in Bangladesh”. In: (2021).

[52] J Mantas et al. “Cory COVID-Bot: An Evidence-Based Behavior Change Chatbot for COVID-19”. In: (2022).

[53] Hyanghee Park and Daehwan Ahn. “The Promise and Peril of ChatGPT in Higher Education: Opportunities, Challenges, and Design Implications”. In: *Proceedings of the CHI Conference on Human Factors in Computing Systems*. 2024, pp. 1–21.

[54] Anna Lieb and Toshali Goel. “Student Interaction with NewtBot: An LLM-as-tutor Chatbot for Secondary Physics Education”. In: *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*. 2024, pp. 1–8.

[55] Mohammad Abolnejadian, Sharareh Alipour, and Kamyar Taeb. “Leveraging ChatGPT for Adaptive Learning through Personalized Prompt-based Instruction: A CS1 Education Case Study”. In: *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*. 2024, pp. 1–8.

[56] John Chen et al. “Learning Agent-based Modeling with LLM Companions: Experiences of Novices and Experts Using ChatGPT & NetLogo Chat”. In: *Proceedings of the CHI Conference on Human Factors in Computing Systems*. 2024, pp. 1–18.

[57] Sheryl Estrada. *A startup CFO used ChatGPT to build an FP&A tool—here’s how it went*. 2023.

[58] Pedro Ferreira. *Can ChatGPT Improve Technical Analysis and Trading Techniques*. 2023.

[59] Mikhail Taver. *ChatGPT is Coming to Finance, So Let’s Talk About the Risks and Rewards*. 2023.

[60] Daniel Kimmel. *ChatGPT Therapy Is Good, But It Misses What Makes Us Human*. 2023.

[61] Thomas Germain. *A mental health app tested ChatGPT on its users. The founder said backlash was just a misunderstanding*. 2023.

[62] Andrea Fox. *ChatGPT scored 72study shows*. 2023.

[63] Andrew Leonard. *Dr. Google’meets its match: Dr. ChatGPT*. 2023.

[64] Aditya kumar Purohit, Aditya Upadhyaya, and Adrian Holzer. “Chatgpt in healthcare: Exploring ai chatbot for spontaneous word retrieval in aphasia”. In: *Companion Publication of the 2023 Conference on Computer Supported Cooperative Work and Social Computing*. 2023, pp. 1–5.

[65] Stephen R Ali et al. “Using ChatGPT to write patient clinic letters”. In: *The Lancet Digital Health* 5.4 (2023), e179–e181.

[66] Angeline Chatelan, Aurélien Clerc, and Pierre-Alexandre Fonta. “ChatGPT and future artificial intelligence chatbots: what may be the influence on credentialed nutrition and dietetics practitioners?” In: *Journal of the Academy of Nutrition and Dietetics* 123.11 (2023), pp. 1525–1531.

[67] Xin Wang et al. “Co-Designing an AI Chatbot to Improve Patient Experience in the Hospital: A human-centered design case study of a collaboration between a hospital, a university, and ChatGPT”. In: *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*. 2024, pp. 1–10.

[68] Kathleen O’Leary et al. ““Suddenly, we got to become therapists for each other” Designing Peer Support Chats for Mental Health”. In: *Proceedings of the 2018 CHI conference on human factors in computing systems*. 2018, pp. 1–14.

[69] Daniel Lambton-Howard et al. “Blending into everyday life: designing a social media-based peer support system”. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 2021, pp. 1–14.

[70] Deepika Yadav et al. ““Should I visit the clinic”: Analyzing WhatsApp-mediated Online Health Support for Expectant and New Mothers in Rural India”. In: *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 2022, pp. 1–20.

[71] Ding Wang, Santosh D Kale, and Jacki O’Neill. “Please call the specialism: Using WeChat to support patient care in China”. In: *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 2020, pp. 1–13.

[72] Shefali Haldar et al. “Opportunities and design considerations for peer support in a hospital setting”. In: *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. 2017, pp. 867–879.

[73] Nicki Ashcroft et al. “Implementation of CycleTel Family Advice: an SMS-based service to provide family planning and fertility awareness information in India”. In: *Mhealth* 3 (2017).

[74] Rachel M Jones et al. “A short message service (SMS) increases postpartum care-seeking behavior and uptake of family planning of mothers in peri-urban public facilities in Kenya”. In: *PLoS One* 15.9 (2020), e0239213.

[75] Trevor Perrier et al. “Male partner engagement in family planning SMS conversations at Kenyan health clinics”. In: *Proceedings of the 1st ACM SIGCAS Conference on Computing and Sustainable Societies*. 2018, pp. 1–11.

[76] Rebecca Braun et al. “An evaluation of a family planning mobile job aid for community health workers in Tanzania”. In: *Contraception* 94.1 (2016), pp. 27–33.

[77] Melissa L Gilliam et al. “Development and testing of an iOS waiting room “app” for contraceptive counseling in a Title X family planning clinic”. In: *American journal of obstetrics and gynecology* 211.5 (2014), 481–e1.

[78] SA Hussain, O Folu, and B Shrish. *Chatbot for Family Planning Counseling*. 2019.

[79] Viswanath Venkatesh, James YL Thong, and Xin Xu. "Unified theory of acceptance and use of technology: A synthesis and the road ahead". In: *Journal of the association for Information Systems* 17.5 (2016), pp. 328–376.

[80] Abiodun I Adanikin, Uche Onwudiegwu, and Olabisi M Loto. "Influence of multiple antenatal counselling sessions on modern contraceptive uptake in Nigeria". In: *The European Journal of Contraception & Reproductive Health Care* 18.5 (2013), pp. 381–387.

[81] Salahuddin Ahmed et al. "Operations research to add postpartum family planning to maternal and neonatal health to improve birth spacing in Sylhet District, Bangladesh". In: *Global Health: Science and Practice* 1.2 (2013), pp. 262–276.

[82] KB Smith et al. "Is postpartum contraceptive advice given antenatally of value?" In: *Contraception* 65.3 (2002), pp. 237–243.

[83] Sarah Homewood. "Contraception and Hormones within Interaction Design". In: *Hacking Women's Health-CHI 2017*. 2017.

[84] Marcus Ma et al. "It takes two to avoid pregnancy: Addressing conflicting perceptions of birth control pill responsibility in romantic relationships". In: *Proceedings of the ACM on Human-Computer Interaction* 7.CSCW2 (2023), pp. 1–27.

[85] Erik Grönvall and Nervo Verdezoto. "Beyond Self-Monitoring: Understanding Non-Functional Aspects of Home-Based Healthcare Technology". In: *Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing*. UbiComp '13. Zurich, Switzerland: Association for Computing Machinery, 2013, 587–596. ISBN: 9781450317702. DOI: 10.1145/2493432.2493495. URL: https://doi.org/10.1145/2493432.2493495.

[86] Sarah Homewood, Harvey Bewley, and Laurens Boer. "Ovum: Designing for Fertility Tracking as a Shared and Domestic Experience". In: *Proceedings of the 2019 on Designing Interactive Systems Conference*. DIS '19. San Diego, CA, USA: Association for Computing Machinery, 2019, 553–565. ISBN: 9781450358507. DOI: 10.1145/3322276.3323692. URL: https://doi.org/10.1145/3322276.3323692.

[87] Munmun De Choudhury et al. "Characterizing and Predicting Postpartum Depression from Shared Facebook Data". In: *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*. CSCW '14. Baltimore, Maryland, USA: Association for Computing Machinery, 2014, 626–638. ISBN: 9781450325400. DOI: 10.1145/2531602.2531675. URL: https://doi.org/10.1145/2531602.2531675.

[88] Deepika Yadav et al. “Feedpal: Understanding Opportunities for Chatbots in Breastfeeding Education of Women in India”. In: *Proc. ACM Hum.-Comput. Interact.* 3.CSCW (2019). DOI: 10.1145/3359272. URL: https://doi.org/10.1145/3359272.

[89] Catherine D’Ignazio et al. “A Feminist HCI Approach to Designing Postpartum Technologies: ”When I First Saw a Breast Pump I Was Wondering If It Was a Joke””. In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. CHI ’16. San Jose, California, USA: Association for Computing Machinery, 2016, 2612–2622. ISBN: 9781450333627. DOI: 10.1145/2858036.2858460. URL: https://doi.org/10.1145/2858036.2858460.

[90] Meredith Ringel Morris. “Social networking site use by mothers of young children”. In: *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*. CSCW ’14. Baltimore, Maryland, USA: Association for Computing Machinery, 2014, 1272–1282. ISBN: 9781450325400. DOI: 10.1145/2531602.2531603. URL: https://doi.org/10.1145/2531602.2531603.

[91] Virginia Braun and Victoria Clarke. “Using thematic analysis in psychology”. In: *Qualitative research in psychology* 3.2 (2006), pp. 77–101.

[92] Victoria Clarke and Virginia Braun. “Successful qualitative research: A practical guide for beginners”. In: (2013).

[93] Virginia Braun and Victoria Clarke. “A critical review of the reporting of reflexive thematic analysis in Health Promotion International”. In: *Health Promotion International* 39.3 (2024), daae049.

[94] Shonali Choudhury, Jennifer Toller Erausquin, Mellissa Withers, et al. *Global perspectives on women’s sexual and reproductive health across the lifecourse*. Springer, 2018.

[95] M Singh. “India launches WhatsApp chatbot to create awareness about coronavirus, asks social media services to curb spread of misinformation”. In: *Techcrunch. com* 21 (2020).

[96] Naveena Karusala et al. ““That courage to encourage”: Participation and Aspirations in Chat-based Peer Support for Youth Living with HIV”. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 2021, pp. 1–17.

[97] Yanling Yang et al. “The effectiveness of wechat-based transitional care in patients with Myasthenia gravis”. In: *Chinese Journal of Practical Nursing* (2017), pp. 1–5.

[98] ZF Hu et al. “The effectiveness of wechat-based transitional care in patients with ankylosing spondylitis”. In: *Chin J Nurs* 50.2 (2015), pp. 175–178.

[99] Mustafa Naseem et al. “An Empirical Comparison of Technologically Mediated Advertising in Under-connected Populations”. In: *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. CHI ’20. ¡conf-loc¿, ¡city¿Honolulu¡/city¿, ¡state¿HI¡/state¿, ¡country¿USA¡/country¿, ¡/conf-loc¿: Association for Computing Machinery, 2020, 1–13. ISBN: 9781450367080. DOI: 10.1145/3313831.3376683. URL: https://doi.org/10.1145/3313831.3376683.

[100] Annu Sible Prabhakar et al. “Investigating the suitability of the asynchronous, remote, community-based method for pregnant and new mothers”. In: *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. 2017, pp. 4924–4934.

[101] Juan F Maestre et al. “Defining through expansion: conducting asynchronous remote communities (arc) research with stigmatized groups”. In: *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 2018, pp. 1–13.

[102] Haley MacLeod et al. “A guide to using asynchronous remote communities (ARC) for researching distributed populations”. In: *EAI Endorsed Transactions on Pervasive Health and Technology* 3.11 (2017).

[103] Deepika Yadav, Anushka Bhandari, and Pushpendra Singh. “LEAP: Scaffolding collaborative learning of community health workers in India”. In: *Proceedings of the ACM on Human-Computer Interaction* 3.CSCW (2019), pp. 1–27.

[104] Jasmeet Kaur et al. “Exploring the Role of Chatbots in Tackling COVID-19 Vaccine Hesitancy among Pregnant and Breastfeeding Women in Rural Northern India”. In: *Proceedings of the ACM on Human-Computer Interaction* 8.CSCW1 (2024), pp. 1–29.

[105] Nicole E Johns et al. “Validation of the Interpersonal Quality of Family Planning Scale in a rural Indian setting”. In: *Contraception: X* 2 (2020), p. 100035.

[106] Shaowen Bardzell. “Feminist HCI: taking stock and outlining an agenda for design”. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI ’10. Atlanta, Georgia, USA: Association for Computing Machinery, 2010, 1301–1310. ISBN: 9781605589299. DOI: 10.1145/1753326.1753521. URL: https://doi.org/10.1145/1753326.1753521.

[107] Nasreen Khatri et al. “Comparing telehealth-based and clinic-based group cognitive behavioral therapy for adults with depression and anxiety: a pilot study”. In: *Clinical interventions in aging* (2014), pp. 765–770.

[108] Celia Woolf et al. “A comparison of remote therapy, face to face therapy and an attention control intervention for people with aphasia: a quasi-randomised controlled feasibility study”. In: *Clinical rehabilitation* 30.4 (2016), pp. 359–373.

[109] Liane M Vadheim et al. “Adapted diabetes prevention program lifestyle intervention can be effectively delivered through telehealth”. In: *The Diabetes Educator* 36.4 (2010), pp. 651–656.

[110] Kristen MJ Azar et al. “Virtual small groups for weight management: an innovative delivery mechanism for evidence-based lifestyle interventions among obese men”. In: *Translational behavioral medicine* 5.1 (2015), pp. 37–44.

[111] Sebastien Cuendet et al. “VideoKheti: Making video content accessible to low-literate and novice users”. In: *Proceedings of the SIGCHI conference on human factors in computing systems*. 2013, pp. 2833–2842.

[112] R Gandhi et al. *Digital Green: Participatory Video and Mediated Instruction for Agricultural Extension. Los Angeles: USC Annenberg School for Communication*. 2008.

[113] Brittany Fiore-Silfvast et al. “Mobile video for patient education: the midwives’ perspective”. In: *Proceedings of the 3rd ACM Symposium on Computing for Development*. 2013, pp. 1–10.

[114] Gloria Ejehiohen Iyawa, Aliyu Rabiu Dansharif, and Asiya Khan. “Mobile apps for self-management in pregnancy: a systematic review”. In: *Health and Technology* 11.2 (2021), pp. 283–294.

[115] Kathryn I Marko et al. “Testing the feasibility of remote patient monitoring in prenatal care using a mobile app and connected devices: a prospective observational trial”. In: *JMIR research protocols* 5.4 (2016), e6167.

[116] Rifat Rahman et al. “AdolescentBot: Understanding Opportunities for Chatbots in Combating Adolescent Sexual and Reproductive Health Problems in Bangladesh”. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. CHI ’21. ¡conf-loc¿, ¡city¿Yokohama¡/city¿, ¡country¿Japan¡/country¿, ¡/conf-loc¿: Association for Computing Machinery, 2021. ISBN: 9781450380966. DOI: 10.1145/3411764.3445694. URL: https://doi.org/10.1145/3411764.3445694.

[117] Deepika Yadav et al. “Feedpal: Understanding Opportunities for Chatbots in Breastfeeding Education of Women in India”. In: *Proc. ACM Hum.-Comput. Interact.* 3.CSCW (2019). DOI: 10.1145/3359272. URL: https://doi.org/10.1145/3359272.

[118] Jasmeet Kaur et al. “Exploring the Role of Chatbots in Tackling COVID-19 Vaccine Hesitancy among Pregnant and Breastfeeding Women in Rural Northern India”. In: *Proc. ACM Hum.-Comput. Interact.* 8.CSCW1 (2024). DOI: 10.1145/3637332. URL: https://doi.org/10.1145/3637332.

[119] Naveena Karusala et al. ““That courage to encourage”: Participation and Aspirations in Chat-based Peer Support for Youth Living with HIV”. In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. CHI ’21. ¡conf-loc¿, ¡city¿Yokohama¡/city¿, ¡country¿Japan¡/country¿, ¡/conf-loc¿: Association for Computing Machinery, 2021. ISBN: 9781450380966. DOI: 10.1145/3411764.3445313. URL: https://doi.org/10.1145/3411764.3445313.

[120] Suha J Patel et al. “Providing support to pregnant women and new mothers through moderated WhatsApp groups: a feasibility study”. In: *Mhealth* 4 (2018).

[121] Deepika Yadav et al. “Sangoshthi: Empowering Community Health Workers through Peer Learning in Rural India”. In: *Proceedings of the 26th International Conference on World Wide Web*. WWW ’17. Perth, Australia: International World Wide Web Conferences Steering Committee, 2017, 499–508. ISBN: 9781450349130. DOI: 10.1145/3038912.3052624. URL: https://doi.org/10.1145/3038912.3052624.

[122] Geri W Beers and Susan Bowden. “The effect of teaching method on long-term knowledge retention”. In: *Journal of nursing education* 44.11 (2005), pp. 511–514.

[123] Amir Shevat. *Designing bots: Creating conversational experiences.* ” O’Reilly Media, Inc.”, 2017.

[124] Konstantinos Kazakos et al. “A Real-Time IVR Platform for Community Radio”. In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. CHI ’16. San Jose, California, USA: Association for Computing Machinery, 2016, 343–354. ISBN: 9781450333627. DOI: 10.1145/2858036.2858585. URL: https://doi.org/10.1145/2858036.2858585.

[125] Anupriya Tuli et al. “Learning from and with Menstrupedia: Towards Menstrual Health Education in India”. In: *Proc. ACM Hum.-Comput. Interact.* 2.CSCW (2018). DOI: 10.1145/3274443. URL: https://doi.org/10.1145/3274443.

[126] Nicola Diviani et al. “Low health literacy and evaluation of online health information: a systematic review of the literature”. In: *Journal of medical Internet research* 17.5 (2015), e112.

[127] Lisa Mekioussa Malki, Dilisha Patel, and Aneesha Singh. ““The Headline Was So Wild That I Had To Check”: An Exploration of Women’s Encounters With

Health Misinformation on Social Media". In: *Proc. ACM Hum.-Comput. Interact.* 8.CSCW1 (Apr. 2024). DOI: 10.1145/3637405. URL: https://doi.org/10.1145/3637405.

[128] Deepika Yadav et al. ""Should I visit the clinic": Analyzing WhatsApp-mediated Online Health Support for Expectant and New Mothers in Rural India". In: *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. CHI '22. New Orleans, LA, USA: Association for Computing Machinery, 2022. ISBN: 9781450391573. DOI: 10.1145/3491102.3517575. URL: https://doi.org/10.1145/3491102.3517575.

[129] Jasmeet Kaur, Asra Sakeen Wani, and Pushpendra Singh. "Engagement of Pregnant Women and Mothers over WhatsApp: Challenges and Opportunities Involved". In: *Companion Publication of the 2019 Conference on Computer Supported Cooperative Work and Social Computing*. CSCW '19 Companion. Austin, TX, USA: Association for Computing Machinery, 2019, 236–240. ISBN: 9781450366922. DOI: 10.1145/3311957.3359481. URL: https://doi.org/10.1145/3311957.3359481.

[130] Sushanta K Banerjee et al. "How prepared are young, rural women in India to address their sexual and reproductive health needs? A cross-sectional assessment of youth in Jharkhand". In: *Reproductive health* 12 (2015), pp. 1–10.

[131] Shraboni Patra and Sayeed Unisa. "Addressing reproductive health knowledge, infertility and coping strategies among rural women in India". In: *Journal of Biosocial Science* 53.4 (2021), pp. 557–565.

[132] Indrani Medhi et al. "Designing mobile interfaces for novice and low-literacy users". In: *ACM Trans. Comput.-Hum. Interact.* 18.1 (May 2011). ISSN: 1073-0516. DOI: 10.1145/1959022.1959024. URL: https://doi.org/10.1145/1959022.1959024.

[133] Nithya Sambasivan et al. "" They Don't Leave Us Alone Anywhere We Go" Gender and Digital Abuse in South Asia". In: *proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 2019, pp. 1–14.

[134] Rifat Rahman et al. "AdolescentBot: Understanding Opportunities for Chatbots in Combating Adolescent Sexual and Reproductive Health Problems in Bangladesh". In: *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. CHI '21. Yokohama, Japan: Association for Computing Machinery, 2021. ISBN: 9781450380966. DOI: 10.1145/3411764.3445694. URL: https://doi.org/10.1145/3411764.3445694.