GRIFFITH COLLEGE DUBLIN

Assignment Cover Sheet

Learner name(s): ANAGHA NANDAN

Learner number(s): [redacted]

Assignment Type: **Individual:** YES **Group:** COHORT 2

Course: MSC MEDICAL DEVICE TECHNOLOGY AND BUSINESS **Stage/year:** SEMESTER 3

Module: DISSERTATION

Study Mode: Full time YES Part-time

Lecturer Name: MOHAMMED GANGAT

Assignment Title: "EXPLORING USABILITY AND TRUST IN FERTILITY TRACKING TECHNOLOGY: A STUDY OF MIRA TRACKER USE AMONG WOMEN WITH PCOS IN KERALA, INDIA"

No. of pages: 116

Uploaded to Moodle: Yes YES No

Additional Info:

Date due: 24/08/25

Date submitted: 24/08/25

Plagiarism disclaimer:

I understand that plagiarism is a serious offence and have read and understood the college policy on plagiarism. I also understand that I may receive a mark of zero if I have not identified and properly attributed sources which have been used, referred to, or have in any way influenced the preparation of this assignment, or if I have knowingly plagiarised my work or allowed others to plagiarise my work.

I hereby certify that this assignment is my own original work, based on my personal study and/or research, it is all written in my own words and I have acknowledged all references and sources used in its preparation. I also certify that the assignment has not previously been submitted for assessment and that I have not copied in part or whole or otherwise plagiarised the work of anyone else, including other students.

I have also not used any third parties, AI tools or websites to generate any parts of my assignment.

Signed & dated: 24/08/25

*Please note: Students **MUST** retain a hard / soft copy of **ALL** assignments as well as a receipt issued as proof of submission.*

“EXPLORING USABILITY AND TRUST IN FERTILITY TRACKING TECHNOLOGY: A STUDY OF MIRA TRACKER USE AMONG WOMEN WITH PCOS IN KERALA, INDIA”

GRIFFITH COLLEGE DUBLIN

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MSc.in Medical Device Technology and Business

Inno pharma labs and the faculty of science

Griffith College Dublin

Dissertation Supervisor: Mohammed Gangat

ANAGHA NANDAN

AUG 2025

CANDIDATE DECLARATION

I hereby declare that the dissertation entitled exploring usability and trust in fertility tracking technology: a study of Mira tracker uses among women with PCOS in Kerala, India is submitted in partial fulfilment of MSc in Medical Device Technology and Business is my original piece of work and due acknowledgment is given, where the reference is made to others work. I also affirm that I have not plagiarised anybody else's work, either partially or entirely, including other students.

Candidate Name: Anagha Nandan

Date:24/08/2025

Candidate signature: 

Supervisor Name: Mohammed Gangat

Date:

Supervisor Signature:

ACKNOWLEDGMENT

Firstly, I would like to begin by thanking God Almighty for the strength, wisdom, and perseverance that helped me complete this dissertation.

I would like to extend my deepest appreciation to my supervisor, Mohammed Gangat, for his invaluable guidance, unwavering support, and encouragement throughout this research. His expertise and insights were crucial in shaping the direction of this study. I am also immensely thankful to all the faculty members of the Medical Device Technology and Business department for their support and direction throughout my academic journey and during the various stages of this dissertation. Their assistance was instrumental in overcoming the challenges encountered during this research. I would like to express my sincere gratitude to the People in Kerala who participated in my survey. Your willingness to share your perspectives and experiences was essential to the success of this study. I am also deeply thankful to my friends and colleagues who assisted in distributing the survey and offered their unwavering support throughout this process.

I also wish to thank my family- my parents, brother, for their constant love, support, and encouragement throughout this journey. A special mention goes to my best friend, whose calming presence brought me peace in countless ways. To my dear friends, thank you for being there with your kind words and encouragement when I needed them the most.

ANAGHA NANDAN

TABLE OF FIQURES

Table of Contents

LIST OF TABLES

LIST OF ABBREVIATION

AI	artificial intelligence
BBT	basal body temperature.
E3G	estron-3-glucuronide
ELISA	enzyme-linked immunosorbent assay
FSH	follicle stimulating hormone
ICF	information consent form
LH	luteinizing hormone
LMIS	logistics management information system
OPK	ovulation prediction kit
PCOS	polycystic ovary syndrome
PdG	pregnanediol glucuronide
PIL	participant information letter
TAM	technology acceptance model
USD	united states dollar

ABSTRACT

Fertility tracker devices are becoming increasingly important for women's reproductive health, particularly in managing diseases like polycystic ovary syndrome (PCOS). Nevertheless, awareness and adoption remain limited in large parts of India. This paper investigates awareness, attitudes, and adoption obstacles of the Mira Fertility Tracker among women in Kerala. It was prompted by the absence of local data relating to digital femtech uptake in rural and semi-urban areas. Mixed methods design through surveys was employed, with an aim sample of 144 non-users (44 were obtained) and 8 users of Mira (all 8 were obtained). Quantitative data were analyzed via descriptive and inferential statistics, while qualitative data from open-ended questions and interviews were explored through thematic analysis. Data cleaning and coding were performed in Microsoft Excel to ensure reliability and integrity.

Findings reveal low levels of general knowledge about fertility tracking devices, such as Mira, even in rural and semi-urban settings. Although eagerness to use Mira was high if cost and doctor support were addressed, cost and trust are the primary drivers of adoption. Privacy concerns, limited digital literacy, and cultural dispositions were strong inhibitions. Perceived advantages of Mira users are better cycle tracking, hormone monitoring, and tailored information, which point to clear value if barriers are overcome. The study recognizes the potential for femtech to enhance women's health in Kerala, subject to the conditions that affordability, accessibility, and trust are emphasized. Intervention options include awareness programs, targeted education interventions, subsidy programs, and enhanced healthcare provider promotion of devices. The findings contribute to the evidence base supporting femtech uptake in India and convert into actionable policy recommendations for policymakers, health professionals, and developers.

Keywords: Mira Fertility Tracker, PCOS, Femtech uptake, Kerala, reproductive well-being, cost-effectiveness, digital literacy, medical approval, cultural resistance, mixed-methods study.

CHAPTER 1

Introduction

Polycystic Ovary Syndrome (PCOS) is a prevalent endocrine disorder affecting women of reproductive age globally, with an estimated prevalence of 8% to 13%. It is characterized by hormonal imbalance, chronic anovulation, and metabolic disturbance, which contribute to insulin resistance, type 2 diabetes and infertility and increased risks of cardiovascular disease. In India, the prevalence of PCOS varies widely - from 9.13% to 36% - due to the diagnostic criteria and the difference in population diversity. Kerala is notable for the highest female literacy rate and a well -established public healthcare system in India, providing a unique reference to reproductive health research. Recent data suggests that about 15% to 20% of women in Kerala are influenced by adults and young adults, PCOS, outlining the need for accessible monitoring and management tools. (Devi, 2025)

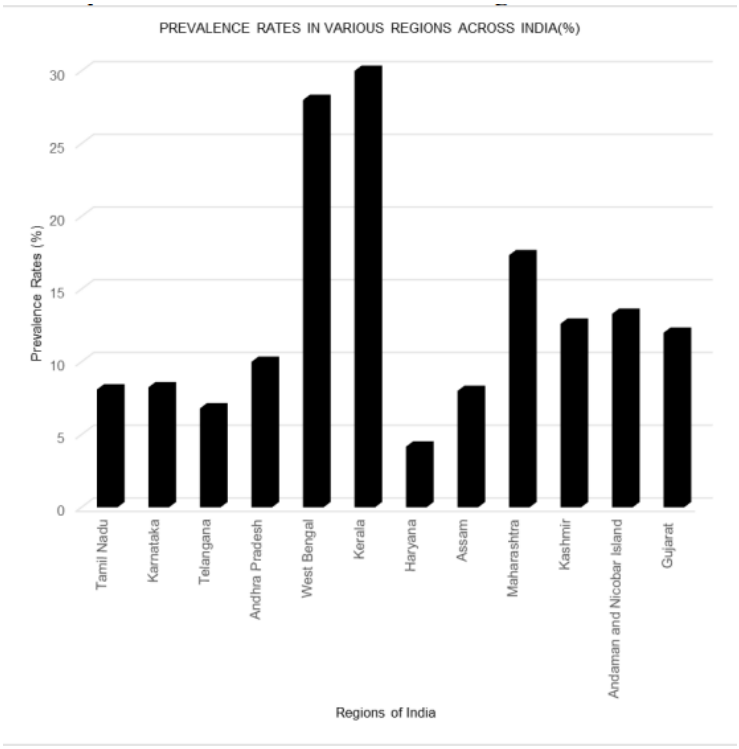


Figure 1: PCOS prevalence rate in various regions across India %(Devi et al., 2024)

The emerging area of Femtech provides innovative, technology-driven solutions to support the reproductive health of women, bridging the gaps left by conventional monitoring methods. The Mira fertility tracker is an AI enabled a home-based diagnostic device designed to measure four important fertility hormones from urine samples: luteinizing hormones (LH), estron-3-Glucuronide (E3G), pregnanediol glucuronide (PdG), and Follicle Stimulating Hormone (FSH). Unlike traditional ovulation predicter kits, which usually provide only a qualitative ("yes/no") indication of an LH surge, Mira generates precise quantitative hormone concentration data expressed in a nanograms oi milli-international units per millilitre.

The device is integrated with Mira mobile application via Bluetooth, which enables seamless data transfer. Once uploaded, the AI algorithms do longitudinal patterns analysing, which compared the user's hormone trends against the clinically validated model and previous cycles of the individual. This allows the system to:

1. Identify the exact time of fertile window and ovulation with high accuracy.
2. Detect the atypical hormonal fluctuation, which may indicate underlying conditions such as luteal phase deficiency or frequent anovulation.
3. Customize predispositions over time, personalizing fertility insight to each user.

By 2024, Mira was adopted by more than 100,000 users worldwide(mira, 2025.). Globally, the use of femtech use among women of reproductive age is 20–25%, while in Kerala, adoption is relatively low 10–15%. However, improvement in digital literacy, more awareness about reproductive health, and private, self-managed monitoring is gradually increasing. Despite these trends, limited empirical research exists on the effectiveness, user experience and cultural acceptance of AI enabled fertility devices in India, Play an important role in reference-specific factor-digital capacity. The Mira fertility tracker was chosen for the ability to provide accurate, quantitative measurements of several hormones (LH, E3G, PDG, FSH), which enables the accurate monitoring of ovulation and hormonal irregularities, especially in conditions such as PCOS. Its AI-operated analysis evaluates long-term trends, identifies atypical patterns, and provides individual reproduction insights. (Patel *et al.*, 2016)

Purpose of study

The purpose of this study is to detect women's experiences with PCOS in Kerala, using Mira Fertility Tracker, focus on purpose, trusts, costs, and cultural effects, to understand how to increase reproductive healthcare in the Femtech region. Analyse confidence in hormone-based data and AI predictions, and the impact of cultural, economic, and digital literacy factors on adoption. It checks how trackers shape reproductive behaviour and knowledge, which can restrict its use, identifying obstacles such as costs, limited awareness, and sociological sensitivity. By evaluating perceptions of the device’s accuracy, practical value, and cost-effectiveness in a middle-income Indian context, the study seeks to generate insights that can guide healthcare providers, educators, and femtech developers in creating more accessible, culturally sensitive, and impactful reproductive health solutions.

Background

Polycystic Ovary Syndrome (PCOS) is a widespread hormonal disorder affecting up to 20% of women in Kerala, India, making fertility management particularly challenging due to irregular ovulation and hormonal disruptions. Femtech devices like the Mira Fertility Tracker, which utilizes artificial intelligence to monitor multiple fertility-related hormones, offer a promising solution. However, there is limited research on how such tools are received in culturally specific, resource-limited settings like Kerala(Hod *et al.*, 2023). This study employs a mixed-methods approach, combining qualitative interviews with 6–8 women and quantitative surveys with 52 participants, all diagnosed with PCOS and residing in Kerala, who have used the Mira

device for a minimum of two months. The research examines various aspects of user experience, including ease of use, confidence in AI-driven hormone analysis, digital familiarity, financial considerations, and cultural perceptions surrounding reproductive technologies.

Preliminary expectations indicate that while users may value the Mira Tracker's hormonal accuracy and insights, they could also face issues related to interface complexity, affordability, and cultural stigma. Trust in the technology is likely influenced by digital competence and prior exposure to AI-based health tools. This study seeks to bridge current knowledge gaps by providing context-specific insights into femtech usage in Kerala. Findings will offer valuable guidance for technology developers and public health professionals aiming to expand access to personalized reproductive care.

Justification of study

Polycystic Ovary Syndrome (PCOS) is a prevalent hormonal disorder affecting women of reproductive age, often leading to challenges in fertility, metabolic health, and emotional well-being. In Kerala, while general literacy levels are high, conversations around reproductive health remain shaped by cultural norms and stigma, contributing to misinformation, delayed treatment, and poor self-management practices. However, adoption of such femtech solutions in the Indian context—especially in semi-urban and rural communities—is hindered by factors such as varying levels of digital literacy, high costs, and cultural reluctance to discuss fertility openly.

Current literature on femtech use in India is limited, and studies that address the specific needs of women with PCOS within their sociocultural environment are scarce. By focusing on this group in Kerala, the present research will address a significant knowledge gap and generate evidence on usability, trust, and barriers to adoption. These insights will be valuable for healthcare professionals, educators, and technology developers aiming to create reproductive health solutions that are both culturally appropriate and widely accessible.(Wiederhold, 2021)

Research Aim and Objectives

Aim

This study aims to investigate the experiences of women with PCOS in Kerala who use the Mira Fertility Tracker. The research will focus on multiple dimensions, including the usability of the device, the degree of trust users places in the hormone-based data and AI-generated predictions, the impact of digital literacy and cost considerations, as well as the cultural acceptability of such technology in a traditionally conservative society.

objectives

1.To evaluate user experiences with the Mira Tracker, focusing on ease of use, interface design, and overall usability among women with PCOS in Kerala.

2. To examine the influence of Mira Tracker usage on fertility-related health behaviours and knowledge, identify the cultural, digital, and economic obstacles limiting its widespread adoption, and propose effective strategies to address these barriers to enhance accessibility and user acceptance.

3. To investigate user trust in the Mira Tracker's hormone monitoring and fertility prediction capabilities, as well as perceptions of its practical value and cost-effectiveness in a middle-income Indian setting.

Research questions

1. How do women with PCOS in Kerala perceive the usability and design of the Mira Fertility Tracker?
2. In what ways does using the Mira Fertility Tracker influence fertility-related health behaviours and knowledge among women with PCOS?
3. What cultural, digital literacy, and economic factors affect the adoption and continued use of the Mira Fertility Tracker among women with PCOS in Kerala?
4. How much trust do users place in the hormone data and AI-generated predictions provided by the Mira Fertility Tracker?
5. What is the perceived value and cost-effectiveness of the Mira Fertility Tracker among women with PCOS in a middle-income Indian context?

Structure of the dissertation

Chapter 1: Introduction- This chapter introduces the study by outlining the background and context of PCOS care in Kerala alongside the growing use of digital fertility tracking tools. It explains the study's purpose, importance, aims, objectives, and research questions, stressing the need to understand women's experiences with the Mira Fertility Tracker, focusing on usability, trust, cultural fit, and adoption challenges in a traditionally conservative setting.

Chapter 2: Literature Review- This section offers an in-depth examination of existing studies related to PCOS treatment, digital fertility monitoring devices, and hormone tracking through AI technologies. It discusses important aspects such as device usability, user confidence, digital literacy levels, financial constraints, and cultural influences on the acceptance of such technologies among Indian women and comparable populations. The review also highlights gaps that this research aims to fill.

Chapter 3: Methodology- This chapter explains the mixed-methods approach, combining qualitative and quantitative techniques to thoroughly explore the experiences of women using the Mira Fertility Tracker. It describes the sampling process, data collection methods—including questionnaires, interviews, and device data analysis—and the analytical methods used to evaluate usability, trust, cultural, and economic factors. Ethical considerations and study limitations are also addressed.

Chapter 4: Findings and Discussion- This chapter presents the results from both qualitative and quantitative data, analysing users' views on the ease of use of the device, their trust in hormone and AI-based fertility predictions, changes in fertility-related behaviours, and how factors like digital skills, cost, and cultural acceptance affect usage. The findings are discussed in relation to existing research to identify key enablers and barriers to adoption.

Chapter 5: Conclusion and Recommendations- The concluding chapter summarizes the primary outcomes and discusses their relevance for improving technology design, healthcare delivery, and policy concerning fertility management among women with PCOS in Kerala. It provides actionable recommendations to enhance device accessibility, user support, and cultural sensitivity, and proposes areas for future research to overcome remaining challenges.

CHAPTER 2

Literature review

The Mira Fertility Tracker and its Relevance in PCOS Fertility Monitoring

Technical and functional features of Mira Fertility Tracker

The Mira fertility tracker simultaneously distinguishes itself from the traditional fertility monitoring tool through the ability to measure multiple urinary reproductive hormones. While the OPKs usually detect a surge in the LH to predict imminent ovulation, Mira's immunoassay-based test wands four major biomarkers: LH, estron-3-Glucuronide (E3G), pregnanediol glucuronide (PdG), and follicle stimulating Hormone (FSH). Collectively, these hormones provide a broader profile of the menstrual cycle (Zokaityte, 2025).

Figure 2 Mira fertility tracker (Mira, 2025)

- Luteinizing hormones (LH): Signals impending to ovulation but may remain in PCOS, by reducing OPK reliability(Lewis, 2024).
- estron-3-glucuronide (E3G): A urinary metabolite of estrogen refers to the follicular phase and arises before ovulation (Su *et al.*, 2017)
- pregnanediol glucuronide (PdG): A progesterone metabolite, which is used to confirm ovulation and luteal sufficiency.
- Follicle -stimulating hormone (FSH): controls follicle development, with abnormalities in PCOS cycles (Norman *et al.*, 2007)

The device is integrated with a Bluetooth-able analyser that uploads hormonal data on the smartphone application. This app applies ownership AI algorithms to identify fertile windows, ovulation events and hormonal imbalances on several cycles (Mira, 2022)Unlike static calendar methods, Mira's algorithm continues to continue for variability, learning from historical data to increase accuracy in predicting future cycles. Another major feature is contained in visual data presentation. Through the trend graph and reproductive score, users can monitor their cycle dynamics in real time. (Mira, 2023)

Clinical validation and evidence

The reliability of reproductive technologies rests on rigorous verification against clinical gold standards. Mira is similar those used in laboratory diagnosis, which employs enzyme-links immunoassay (ELISA)- for home use. Many studies have assessed its accuracy in determining the level of urinary hormones and predicting ovulation. (Menon *et al.*, 2016)

Validation Studies: Research conducted in the United States demonstrated strong correlations between Mira's hormone qualification and laboratory immunoassays, with more than 0.9 for LH and E3G (Brown, 2021). PdG tracking with Mira is shown to confirm ovulation with more than 95% sensitivity compared to serum progesterone test. Pilot studies also suggest that Mira may detect micro hormonal ups and downs that offer an expanded fertile window detection beyond OPK (ResearchGate, 2024)before ovulation for several days.

However, they were industry-sponsored and employed relatively small, homogenous samples, raising suspicions of selection bias and commercial influence. Furthermore, they recruited women with regular cycles rather than those with PCOS, which questions the generalizability of their findings to irregular and anovulatory cycles.(Bouchard *et al.*, 2025)

PCOS-specific evidence: Promising, specific evidence for PCOS population is limited. Some published studies have systematically evaluated the performance of Mira in women with chronically LH or irregular ovulation, with situations that complicate predictions (Lewis, 2024). Reports of anecdotes suggest better cycle insight for PCOS users, but the test -reviewed tests are rare.

Evidence is also contradictory: while Lewis (2024) reports that Mira improves prediction in irregular cycles, Knight (2017) identifies that long-term LH elevation in PCOS undermines algorithm reliability, inducing potential false fertile windows. The discrepancy emphasizes the

weakness of the evidence base and the need for larger, independent trials solely in PCOS populations.

Current evidence limits:

- Most of the studies are industry-sponsored and include small sample sizes.
- Geographical focus is heavy towards the western population.
- Some independent evaluations exist in lower and medium-oriented countries.

Therefore, although Mira displays high technical validity, its efficacy for women with PCOS in various settings remain unspecified for women.

Figure 3 interface of Mira fertility tracker (Mira, 2025)

User-centric perspective

Beyond diagnostic accuracy, the user adoption rests on the practicality and acceptance of the device. Mira requires users to collect daily urine samples during the cycle and put a test wand in analyser. While the app simplifies the interpretation by generating scores and charts, the need for frequent testing may be burdensome for some women, especially in resources-constrained or rural contexts (Patel et al., 2016). Compared to OPK, which often achieve vague results in PCOS, Mira provides rich feedback that many users get empowered (Harper et al., 2022). However, women also report concerns about the cost of consumable materials (test wands) and time commitment for daily testing (Mira, 2022). Also, evidence from other digital fertility aids suggests that use tends to fall after 2–3 months of daily usage (Park et al., 2024),

which is a concern for the real-world sustainability of Mira. By contrast, less accurate but cheaper and easier to use OPKs may have better use, therefore greater effectiveness in real-world settings even with reduced technical validity. Continuous engagement with digital health devices is often low. Fertility tracking requires frequent data entry, and drop-off rates can reduce utility (ResearchGate, 2025)In India, disparities in digital literacy further complicate adherence.

Comparison with traditional methods: BBT Charting is inexpensive but incredible in PCOS, due to the Anovulatory cycle). OPks are more user friendly but interprets LH. Calendar-based methods consider regularity, which disrupts PCOS (Norman et al., 2007). Mira, more accurate, trades the strength for accurate - raises questions about scalability in LMIC contexts.

AI, Trust, and Ethical consideration

The AI algorithm of Mira represents one of its most newly controversial characteristics. By learning from the user-specific hormonal patterns, the system can adapt to predictions in cycles. However, AI's "Black Box" nature raises questions about transparency (Paranjape *et al.*, 2022) Trust in AI predictions: Studies show that trust is shaped by perceived accuracy, clarification of explanation and prior experiences with technology. Women can hesitate to rely on AI output for important reproductive decisions without physicians guidance (Harper et al., 2022).

Ethical and privacy concerns: fertility data are highly sensitive, storage, data ownership and third-party access (Patel et al., 2016) increase issues. Commercial Femtech platforms often work outside stringent healthcare rules, consumer equipment and medical technologies blur the boundaries (Paranjape *et al.*, 2019).In LMICS, weak digital governance increases the risks of data misuse. A second constraint is that Mira's own algorithms have not been independently audited or peer-tested, so claims of predictive accuracy should be taken with scepticism. Third, the AI was educated primarily on Western hormonal data sets and thus may be constrained in validity when applied to South Asian populations whose hormonal standards and cycle dynamics are different.(Mehrnezhad and Almeida, 2021)

Algorithm bias: Most AI training datasets originate from the Western population, potentially limit the applicability for the dynamics of the South Asian hormonal patterns and cycles. For PCOS users in India, such prejudice may reduce future accuracy (ResearchGate, 2025).

Economic and market dimensions in India

LMIC has a power to adopt. Mira's analyser is priced at the premium range, with a recurring cost for the test wand, it is in position above the cost of OPKS or BBT thermometer.

Economic obstacles: In India, 55.9% healthcare expenses come directly from homes(worldbank, 2025.). The recurring consumption costs of Mira may be therefore prohibitive for low- and middle-income homes. Fertility treatment is already financially burden; Adding expensive monitoring equipment can increase inequalities (Bacchus *et al.*, 2019)

Market segmentation: Mira is the most accessible for urban, educated, middle- and upper-class women who can afford premium health technology (brown, 2021). For rural and low-or-low groups, adoption is unlikely without subsidy or local adaptation (ResearchGate, 2024).

Comparative market status: During the cheap options dominating in India, Mira captures a niche of women seeking data-rich, clinically informed reproductive insights. It creates a stress between innovation and access.

Cultural and socio-technical context in Kerala

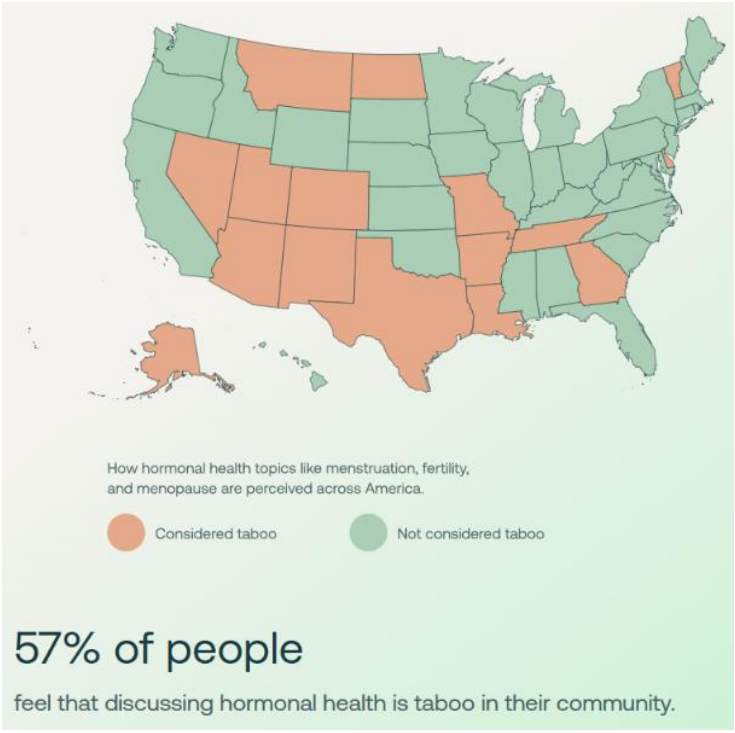


Figure 4 Cultural taboo across America (Mira, 2025.)

Kerala presented a unique atmosphere to investigate Meera's adoption. While 57% of people feel that discussing hormonal health is a taboo in their community. Although direct quantitative data on cultural taboos surrounding fertility and reproductive health in Kerala, the figures are 57% of women who are stigmatized when they talk about fertility-related issues. But sociocultural settings differ studies indicate that taboos are ubiquitous, and their severity depends on local traditions, socioeconomic factors, and health literacy. In Kerala, where cultural pressures intersect with high literacy levels but deep gendered roles, the same factors may influence uptake and use of fertility monitoring technologies such as Mira.

High literacy and health awareness: With more than ninety-five%of the female literacy rate, Kerala is posted relatively well to women to connect with digital health applications compared to the national average.

Stigma and privacy concerns: Despite high literacy, fertility is a sensitive and tarnished issue. Women may prefer discreet, home-based monitoring on the clinical visit. Meera aligns with this requirement but raises new concerns about data privacy within shared houses (Bacchus *et al.*, 2019)

Urban -rural division: Digital infrastructure is strong in urban Kerala, but in rural areas, internet access and digital literacy are encountered. Hence adoption may be slant to urban, educated women (ResearchGate, 2025).

Gender criteria and decisions: Traditional gender dynamics can limit women's autonomy in adopting expensive techniques. Spousal approval and family effects often shape reproductive health decisions, which affect the ability to adopt (Joshi et al., 2014). Thus, Kerala provides both opportunities (literacy, healthy behaviour) and obstacles (stigma, strength, rural inequalities) for the integration of Meia in breeding health practices. Geographical bias in recent validation studies is also a methodological limitation: most evidence comes from Western cohorts, since it implicitly takes for granted that hormonal patterns, cultural problems, and digital literacy are identical in India. This is problematic because socio-cultural norms such as spousal influence in health decisions and stigma from infertility are not examined in device adoption studies.(Chen, 2025)

Introduction to literature review

Polycystic Ovary Syndrome (PCOS) is a complex and highly prevalent endocrine condition affecting women of reproductive age, with global prevalence estimates ranging from 8% to 13% under the Rotterdam diagnostic criteria (humrep, 2023).Rates are notably higher in South Asian populations, including India, where prevalence has been reported between 9.13% and 22.5%, depending on the diagnostic approach (Joshi *et al.*, 2014).Clinically, PCOS is diagnosed when at least two of the following are present: oligo- or anovulation, biochemical or clinical signs of hyperandrogenism, and polycystic ovarian morphology on ultrasound (Rotterdam ESHRE/ASRM, 2004). The condition is linked not only to infertility but also to metabolic comorbidities such as insulin resistance, obesity, metabolic syndrome, and an elevated risk of type 2 diabetes, all of which have lasting effects on quality of life and long-term health outcomes. From a reproductive perspective, PCOS disrupts ovulation patterns, making it difficult to accurately determine fertile windows—an essential factor for conception planning.

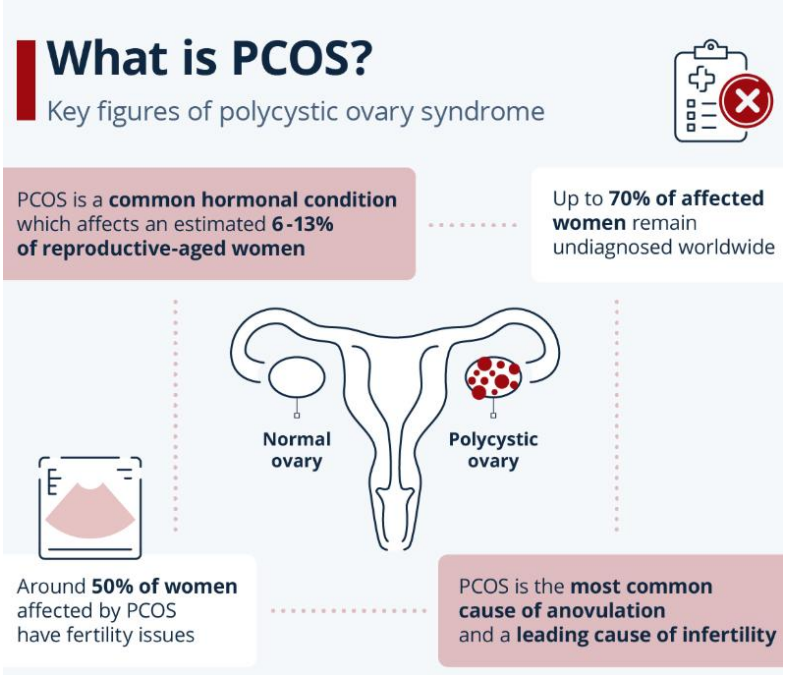


Figure 5 Infographic selection of key figures on polycystic ovary syndrome. (Canva, 2025.)

Traditional fertility tracking methods, including calendar-based approaches and basal body temperature (BBT) monitoring, depend on predictable ovulatory cycles, which are often absent in PCOS. Similarly, luteinizing hormone (LH)-based ovulation predictor kits (OPKs)

frequently yield false positives for this population, as LH levels may remain chronically elevated. These shortcomings underscore the need for advanced, hormone-based, and personalised tracking technologies.

Over the past decade, the "femtech" sector—encompassing digital health applications, wearable devices, and AI-enabled tools specifically targeting women's health—has grown into a major segment of the health technology industry. Valued at USD 18.75 billion in 2019, the global market is projected to reach USD 75.1 billion by 2025(Brown, 2021).Fertility and pregnancy monitoring products account for a substantial share of this growth, driven by consumer demand for home-based, accessible, and data-rich health solutions(sage Pub, 2025.). The Mira Fertility Tracker exemplifies this innovation, measuring multiple reproductive hormones—LH, estrone-3-glucuronide (E3G), pregnanediol glucuronide (PdG), and follicle-stimulating hormone (FSH)—and applying AI algorithms to generate personalised fertility assessments. Such multi-hormone, longitudinal analysis has the potential to offer greater accuracy than single-hormone OPKs, particularly for women with irregular cycles.Although clinical research on fertility monitoring devices has largely prioritised diagnostic accuracy and algorithmic performance, comparatively little attention has been paid to user experience, trust in AI-based predictions, and cultural suitability—especially in low- and middle-income countries (LMICs). In the Indian context, uptake of reproductive health technologies is shaped by multiple intersecting factors:

- Economic constraints – With 55.9% of total health spending coming directly from households , high device costs can be a significant barrier (world bank, 2025.)
- Digital literacy disparities – India has over 750 million smartphone users but proficiency in digital health applications varies widely by geography, education, and income level.(Mishra *et al.*, 2025)
- Cultural attitudes – Fertility and reproductive health remain sensitive subjects in many Indian communities, including in Kerala, where stigma, privacy concerns, and traditional gender norms may affect technology adoption(Patel *et al.*, 2016)

Kerala presents a particularly distinctive context for investigating femtech adoption. The state has one of India's highest female literacy rates (95.2%, Census 2011) and relatively strong public health indicators, yet uptake of digital health innovations is inconsistent, particularly in rural areas and lower-income groups. Specialised fertility care is often

concentrated in private facilities, which may increase interest in discreet, home-based monitoring options among women with PCOS.

Accordingly, this literature review aims to critically appraise existing research on PCOS, fertility monitoring, the femtech industry, and the socio-technical determinants of adopting AI-enabled reproductive health tools in India, with a specific focus on Kerala. The review is organised around five interrelated thematic areas:

- PCOS and fertility monitoring challenges – exploring physiological and practical barriers to accurate fertility prediction in PCOS.

- Femtech as a solution to self-managed fertility – examining the emergence of personalised, technology-driven reproductive health tools.

- Usability and interface design of digital health tools – assessing the influence of user experience on device engagement and sustained use.

- Trust in AI and data-driven health technologies – identifying factors that shape confidence in algorithm-generated interpretations and data governance.

- Perceived cost and market availability in India – analysing the role of economic and accessibility considerations in adoption decisions.

By integrating findings across these themes, the review highlights persistent knowledge gaps—most notably the absence of context-specific, user-centred research in Indian settings—and lays the groundwork for the present mixed-methods study on the experiences of women with PCOS in Kerala using the Mira Fertility Tracker.

SYNTHESIS OF LITERATURE

Theme 1: PCOS and Fertility Monitoring challenges

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder in women of reproductive age, marked by irregular menstrual cycles, elevated androgen levels, and polycystic ovaries (Peña et al., 2020). This condition significantly interferes with ovulation, making it difficult for affected women to identify their fertile periods. Traditional fertility tracking approaches, like calendar counting and basal body temperature (BBT) measurements, depend on predictable ovulation cycles—something often lacking in women with PCOS. However, the reliability of OPKs is debated. Some studies suggest that even among PCOS patients, sporadic peaks of LH may still be detected and used to predict ovulation (Brown, 2021), leaving mixed evidence for their outright uselessness. This variability highlights the need for more rigorously designed high-enrolment trials comparing multi-hormone monitors with OPKs particularly among PCOS women. Yet, despite this, most multi-hormone device validation studies, like Mira, are commercially funded and make use of small, selected samples, limiting generalisability and risking commercial bias. More significantly, these studies often exclude women with anovulatory cycles, exactly those who stand to gain most from improved monitoring of fertility. New technologies such as the Mira Fertility Tracker, which assess multiple reproductive hormones (LH, E3G, PdG, and FSH) and utilize AI for pattern analysis, offer the possibility of more tailored and accurate fertility tracking. Existing clinical studies tend to focus on hormonal data and diagnostic validity but overlook how these tools are experienced and used by everyday women—especially those in resource-constrained or culturally unique environments like Kerala. This highlights the need to investigate user perspectives and cultural influences on technology use, leading into the next theme about femtech's role in facilitating self-managed fertility care.

Theme 2: Femtech as a Solution to Self-managed Fertility

The recent fem tech (female technology) represents a growing sector data-driven, personalized, and accessible healthcare solutions. The femtech industry is set to reach USD 75 billion by 2025(frost & sullivan,2018) with fertility trackers, menstrual apps, wearable biosensors, and more. The likes of Mira Tracker are at the forefront, enabling users to test hormone levels at home and receive automatic feedback on their fertility status.

According to (Lupton, 2017) would intimate, femtech allows for a form of "self-care biopolitics" in which women become active agents in their reproductive health via digital technologies. As freeing as this agency is, however, there is the possibility that it further entrenches neoliberal health discourse as far as onus is put squarely on the user. Furthermore, most examinations of femtech adoption have occurred in Western contexts where cultural restrictions on reproductive health are less stringent and digital literacy is higher. On the other hand, countries like India, where social stigma around infertility persists, present unique challenges and possibilities for femtech. Most of the femtech adoption studies published to date have been in Western settings with high digital literacy and open reproductive health discourse. Applying those findings to India exposes them to cultural bias, as local stigma, spousal influence, and uneven household decision-making power are seldom represented in current evidence. The absence of India-specific evidence is a methodological shortfall in the understanding of adoption outside Western environments. Little research has been conducted on how Indian women interpret and engage with such technologies, or how diverse sociocultural processes shape trust and adoption.

Most research on femtech adoption has focused on Western contexts, where social and digital factors differ substantially from India. In Indian society, where infertility stigma remains strong and digital literacy varies widely, understanding women's perceptions and trust in these technologies is crucial—but remains understudied. The next step involves examining how usability and interface design influence women's ability to effectively engage with femtech devices.

Theme 3: Usability and Interface Design of Digital Health

Usability significantly influences the adoption of digital health. Nielsen (1994) identifies five usability principles that are critical: learnability, efficiency, memorability, errors, and satisfaction. Intuitive design, minimal setup, obvious feedback, and accessible support are what these principles imply for femtech. Studies have shown that users are more likely to stick with health devices when user interface is simple and onboarding is effective (Park *et al.*, 2024).

For products like Mira, usability can be especially crucial as they are for long-term, everyday use. The presence of AI-created graphs and hormone measurements means that users must not only input data but also interpret complex trends. This puts a reliance on simple-to-understand visualizations and available educational resources. In Kerala, where female literacy is excellent, but digital health experience is lacking, utilization of Mira would be strongly

dependent on prior experience with technology and access to support systems like community forums. However, to our knowledge, no studies have yet released an evaluation of Mira's user interface or usability among Indian women with PCOS. This lack is particularly noticeable since consistency is a typical limitation in health devices that are digital: fertility app studies reveal drop-off rates in the first 2–3 months of usage (Park et al., 2024). Without usability testing in the Indian context, no one knows whether Mira's more complicated interface would support extended use, especially in rural or low-digital-literacy groups.

In Kerala, where female literacy is high, but digital health experience may be limited, the success of devices like Mira depends on users' prior tech familiarity and access to support systems. Yet, no research has specifically evaluated Mira's usability among Indian women with Coeffective usability supports trust-building, which is vital for acceptance of AI-driven health tools, the subject of the next theme.

Theme 4: Trust in AI and Data-Driven Health Tools

Trust is at the forefront of the adoption of AI-based health devices, especially those in non-clinical settings that are not under strict supervision. (Bilal Unver and Asan, 2022)argue that trust in AI depends on perceived accuracy, transparency, explainability, and data privacy. For women monitoring fertility, they must believe that the AI can accurately interpret their hormonal data and tell them when they are most likely to ovulate. In case of PCOS or unpredictable fluctuating hormone levels, uncertainty may arise if forecasts appear inexplicable or inconsistent. To make things worse, the "black box" nature of AI algorithms can instil uncertainty, especially among uneducated populations regarding the operation of machine learning or with low health literacy. A second limitation is that Mira's algorithms have never been the subject of independent peer review or third-party audits. (Cromack and Walter, 2024)

Most of the testing is internal or through industry-sponsored research, which calls transparency and overstated claims to accuracy into question.". Furthermore, the algorithms have been calibrated to predominantly Western hormone datasets, and as such, algorithmic bias is a concern, which can decrease prediction accuracy in South Asian women whose hormonal profiles and cycle dynamics may be dissimilar. Transparency about how the Mira Tracker is reading information, the ease of its predictions, and offering educational support are all integral to building trust. And then there is the issue of data privacy: in India, there is concern regarding digital surveillance and unauthorized data sharing are prevalent (Sharma *et al.*, 2024) and may

affect user willingness to rely on AI-based reproduction tools. These trust concerns interact with economic and market factors, leading to the final theme focused on cost and availability.

Theme 5: Perceived Cost and Market Availability in India

Within the Indian healthcare setting, where out-of-pocket expenditure accounts for most health-related costs, cost remains a determining factor in technology adoption (Mishra *et al.*, 2024).The cost of Mira Tracker is approximately ₹20,000 which is approximately equivalent to €195.31 Euros, which is a significant investment for most middle-class families. Even though consumers can justify the cost if the product is beneficial in the long term, initial costs remain an issue. Peer pressure, word of mouth, and social networks have been identified to play parts in femtech adoption decisions. The problem of perceived value for money—price versus anticipated health benefit—is significant. In India, reproductive health is often tabooed and may entail clinical consultation unaffordable or delayed, femtech goods like Mira can serve as a good alternative. No comprehensive studies, however, have examined price sensitivity and willingness to pay by potential users in Kerala or similar markets.

Likewise, there are no cost-effectiveness evaluations comparing Mira with cheaper options such as OPKs or BBT. This is an important methodological gap because without comparison studies it is unclear if Mira's potential clinical benefit will be worth its high price for Indian families who already must pay substantial out-of-pocket health costs. It is an important gap for commercial planning strategy and scale-up in emerging markets. There is a lack of detailed research on how price sensitivity and willingness to pay affect femtech adoption in Kerala or similar Indian markets, a crucial gap for informing business and public health strategies. Understanding these financial and social barriers underscores the importance of conducting detailed, localized research to guide product development and outreach—an aim central to the current study.

Gaps and Opportunities in Research:

This literature review points out several gaps that make the suggested research. To begin, there are no localized, user-focused studies in Kerala or other middle-income states in India where both digital literacy and health inequities both exist. Second, clinical or Western user-based literature dominates the field, providing little information on the ways sociocultural norms influence trust and femtech engagement.(Cromack and Walter, 2024) Third, business-oriented

assessments of user behaviour especially concerning usability, perceptions of cost, and digital learning curves are in short supply. Such gaps highlight the call for qualitative context-specific research that will inform product development, user support, and market entry efforts.

Conceptual framework

This study is grounded in a comprehensive conceptual framework aimed at understanding how women with Polycystic Ovary Syndrome (PCOS) in Kerala perceive and interact with the Mira Fertility Tracker, an AI-enabled Femtech device for monitoring fertility hormones. The framework initially examines the level of awareness and understanding among these women regarding fertility tracking technologies, including their knowledge of hormone monitoring and AI-driven fertility predictions. It also considers the influence of Kerala's unique socio-cultural, economic, and digital literacy contexts on awareness and acceptance of such devices.

Subsequently, the framework explores user experiences with the Mira device, focusing on its usability—such as ease of operation, interface design, and overall user satisfaction—as well as the degree of trust users place in the accuracy of hormone measurements and AI-generated predictions. It further investigates how engagement with the device impacts fertility-related behaviours and knowledge, shedding light on the role of Femtech in supporting reproductive health management. The framework also identifies barriers that may hinder adoption, including financial costs, digital literacy challenges, cultural norms surrounding fertility and reproductive health, and perceptions of medical credibility within a traditionally conservative society. Understanding these obstacles is essential for addressing the factors that influence the continued use and recommendation of such technologies.

Finally, the study emphasizes the importance of incorporating user feedback to enhance device affordability, accessibility, and cultural appropriateness. It highlights the need for targeted education and policy initiatives to improve digital health literacy and foster broader acceptance of Femtech solutions. Overall, this framework seeks to provide nuanced insights into how women with PCOS in Kerala engage with AI-powered fertility tracking technologies, offering valuable guidance for developers, healthcare providers, and policymakers in designing and promoting reproductive health innovations that are responsive to cultural and conceptual realities.

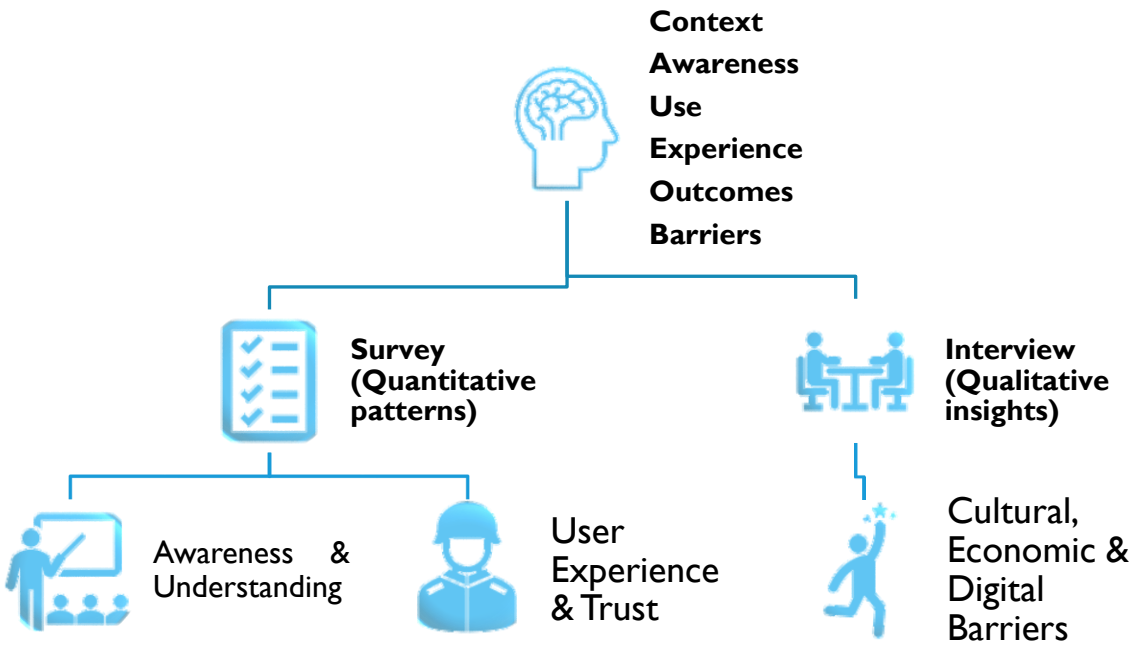


Figure 6 Conceptual framework

Conclusion:

Femtech expansion holds significant potential for women with PCOS to become the active managers of their reproductive health through self-tracking and AI-based fertility solutions. Success in adoption in India, however, will depend on the technology being easy to use, credible, affordable, and culturally acceptable. The Mira Fertility Tracker exemplifies both the potential and the challenges in bringing such technologies to varied settings. Through in answer to these five thematic areas, the current research aims to bridge significant knowledge gaps in both scholarship and business, paving the way for more equitable, effective, and accessible femtech solutions.

CHAPTER- 3

Research Methodology

Introduction

The chapter describes the research strategy designed to investigate the experience of women with Polycystic Ovary Syndrome (PCOS) in Kerala with the Mira Fertility Tracker. Adopting a pragmatic research philosophy, the study applies both quantitative and qualitative methods to understand richly the user experience, trust in hormone-based readings and predictions by AI, and socio-cultural and economic influences on the use of the technology in the context of a historically conservative society.

The research design provides a specific description of participant recruitment through certain screening criteria, data collection procedures through surveys, interviews, and analysis of device data, and the analytical approaches used in interpreting results related to device usability, trust, cultural acceptability, and affordability. Ethical issues, including informed consent, confidentiality, and voluntary participation, are strictly addressed to uphold research integrity.

This mixed-methods approach enables rich primary data collection from adult women with PCOS in Kerala, and as such, it is possible for the study to represent true and diverse voices. By a focus on eyewitness accounts, the study aims to provide subtlety to current understanding regarding the usability and social acceptability of the Mira Fertility Tracker and ultimately to deliver insights that can inform technology design enhancement and healthcare practice adjustment appropriate to middle-income Indian contexts.

Research philosophy

The research philosophy is fundamental in shaping how a study is structured, how data is gathered, and how results are interpreted. This study follows a pragmatic philosophy, which emphasizes adaptability and practical outcomes. Pragmatism is well-suited for exploring complex, real-life issues such as how women with PCOS in Kerala experience and accept the Mira Fertility Tracker.

This approach supports a mixed-methods design, combining both quantitative and qualitative data to gain a well-rounded understanding of users' interactions with the device. Pragmatism values objective measurements—like usage patterns and trust levels—alongside personal insights about cultural influences, usability, and obstacles to adoption.

By integrating structured surveys with open-ended interviews, this method allows for capturing diverse viewpoints and recognizing trends that reflect the nuanced realities of technology use in a traditionally conservative, middle-income Indian setting. This ensures the study's findings are practical and relevant, providing meaningful guidance to enhance the design, acceptance, and cultural appropriateness of fertility tracking technology for women with PCOS in Kerala.

Research onion

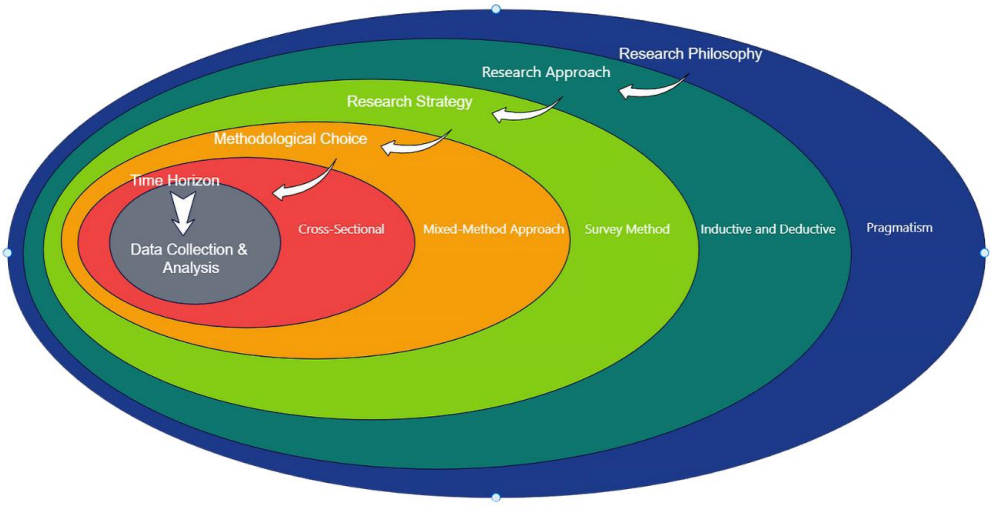


Figure 7 research onion

Research Approach and Design

Approach: Combined Inductive and Deductive Methodology

This research primarily adopts an inductive approach to deeply explore the lived experiences, perceptions, challenges, and suggestions for improvement related to the Mira Fertility Tracker among women with PCOS in Kerala. Both qualitative and quantitative data are leveraged to develop a comprehensive understanding of how users engage with the device. In addition to this exploratory focus, a deductive approach is also applied to test specific hypotheses through statistical analysis. This includes examining potential relationships between key variables such as digital literacy, user trust, and patterns of device usage. Employing this dual approach facilitates a balanced methodology that integrates empirical data with theory-driven inquiry, drawing insights from a diverse participant sample for robust analysis.

Strategy: Use of Surveys and Semi-Structured Interviews

The study employs a mixed-methods strategy combining both quantitative and qualitative data collection techniques to obtain a nuanced understanding of user experiences. The quantitative component involves a structured survey designed to quantify factors such as usability, trust in the device's hormone and AI-based predictions, cultural acceptance, and demographic characteristics. Meanwhile, the qualitative component consists of semi-structured interviews, which provide participants with the opportunity to articulate detailed, context-rich personal narratives and cultural reflections. This methodological strategy aligns with the study's pragmatic philosophy, promoting flexibility and depth in addressing the complex research questions.

Methodological Choices: Integration of Quantitative and Qualitative Data

By integrating quantitative surveys with qualitative interviews, the study benefits from both standardized, measurable data and rich, descriptive insights. Quantitative findings reveal observable trends such as frequency and patterns of Mira Tracker use, perceptions of cost-effectiveness, and levels of trust. Qualitative responses contribute deeper understanding of cultural factors, personal trust dynamics, and obstacles related to digital literacy and economic constraints. The inclusion of open-ended questions in the survey, coupled with in-depth interview data, enables thorough thematic analysis and enhances the interpretation of findings, ensuring that results are contextually grounded and relevant to middle-income women managing PCOS in Kerala.

Time Horizon: Cross-Sectional Design

This research adopts a cross-sectional design, with data collection occurring at a single point in time. This approach is appropriate for assessing the current landscape of user attitudes, experiences, and challenges related to the Mira Fertility Tracker within the target population, providing a snapshot of adoption and engagement.

Techniques and Procedures: Data Collection and Analysis

Data Collection: The deployment of Likert-scale items enables attitudes and perceptions to be measured, and trends among respondents to be analysed statistically. Open-ended questions, by contrast, allow users to explain experiences in their own words, and notice cultural and emotional subtleties. Together, these two complementary data sources provide breadth and depth of understanding about user experiences.

- **Surveys:** An online questionnaire administered through platforms such as Google Forms and data is collected. The survey will include a combination of multiple-choice, Likert-scale, and open-ended questions to capture quantitative data on usage patterns, trust levels, usability perceptions, and socio-economic information. Screening questions will confirm participants meet inclusion criteria: women aged 20 to 40 years, residing in Kerala, diagnosed with PCOS, and having used the Mira device for at least two months and from Mira nonusers also.
- **Interviews:** Semi-structured interviews conducted remotely via Zoom or Google Meet, with participants given the choice to communicate in English (transcribed). These interviews aim to collect detailed qualitative data regarding personal experiences, cultural acceptance, and trust in the device's technology.

Participant Recruitment:

Recruitment will primarily focus on online PCOS communities and social media platforms such as Facebook, Instagram, WhatsApp, Reddit, LinkedIn, and Facebook groups, to expand reach and diversity within Kerala. Online recruitment offers efficiency and broad reach, particularly in accessing dispersed PCOS populations. It could, nevertheless, overrepresent digitally literate respondents and underrepresent women with limited internet availability or

lower digital confidence. This potential bias will be considered in interpreting results. Efforts to mitigate this limitation include outreach to women's health organizations and clinics that are offline in Kerala, thereby facilitating inclusivity.

- Women with PCOS (both Mira Tracker users and non-users): Recruitment targeted women through social media channels and groups dedicated to women's health and PCOS in Kerala. Study invitations will clearly communicate the research aims, eligibility criteria, and the importance of participant involvement. Collaboration with local women's health organizations and support groups will be sought to further promote the survey and encourage participation.
- Gynaecologists and Health Educators: Healthcare professionals and educators is approached through professional networks like LinkedIn and direct outreach to clinics, hospitals, and educational institutions in Kerala. Personalized invitations will explain the study's purpose, with purposive sampling ensuring a diverse range of clinical and educational backgrounds among participants for the qualitative interviews.

Data Analysis

The integration of quantitative survey results with qualitative interview findings allows for triangulation. Statistical patterns (e.g., correlations between digital literacy and trust) will be examined alongside narratives that contextualize these patterns. This combined interpretation strengthens validity by ensuring that findings are not limited to numerical trends but also grounded in lived experiences.

- Quantitative data will be analysed using descriptive statistics to summarize key variables, and inferential statistics (such as chi-square tests or correlation analyses) to explore associations between variables like digital literacy and device trust.
- Qualitative data from interviews and open-ended survey responses will be subjected to thematic analysis, identifying recurring themes around usability, cultural acceptance, trust, and barriers to device adoption.

Study Participants

The study focuses on a targeted participant group consisting of women aged between 20 and 40 years who have a confirmed diagnosis of PCOS, reside in Kerala, and have been using the Mira Fertility Tracker for a minimum of two months, non-Mira users, gynaecologists, educators. This targeted selection ensures that collected data are relevant and reflective of authentic user experiences with the device.

Recruitment efforts will leverage online support groups and social networks dedicated to PCOS, alongside snowball sampling to broaden participant diversity and inclusivity. This strategy provides a cost-effective, accessible, and wide-reaching method to engage women from varying socio-economic and cultural backgrounds.

Sample size calculation.

The sample size required to conduct this study was estimated using the standard formula for calculating sample size in a finite population.

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

Figure 8 equation for sample size calculation (surveymonkey, 2025.)

MIRA USERS: 8

This study focuses on women aged 20–40 residing in Kerala, who have a self-reported diagnosis of PCOS and have been using the Mira Fertility Tracker for at least two months. As Mira is a relatively new and specialized femtech product, its adoption among women in Kerala remains limited. To reflect this niche usage realistically in the sample size calculation, the population proportion was conservatively estimated at 0.5% (i.e., P = 0.005). This low value accounts for the restricted availability, cost factors, and limited awareness of the device within the target population.

$n = (1.96)^2 \times 0.005 \times 0.995 / (0.05)^2$
$n = 3.8416 \times 0.004975 / 0.0025$
$n = 0.01911896 / 0.0025$
$n = 7.65$
Therefore, the required sample size is approximately **8 participants**.

MIRA NON-USERS

For women who meet the same demographic and clinical criteria—aged 20–40, residing in Kerala, and self-reporting PCOS—but **are not currently using the Mira Fertility Tracker**, a higher population proportion was p=9.13% (Devi, 2025b). Non-users likely represent a broader segment of the population, especially considering the low market penetration of femtech in semi-urban and rural India. This ensures parity in calculation and reflects the relative difficulty in accessing and engaging with this specific subgroup for primary data collection.

- $Z = 1.96$ (for 95% confidence level)
- $P = 0.0913$ (population proportion of 9.13%)
- $E = 0.05$ (margin of error of 5%)

Calculation:
$N = (1.96^2 \times 0.0913 \times (1 - 0.0913)) / 0.05^2$
$N = (3.8416 \times 0.0913 \times 0.9087) / 0.0025$
$N = 0.3185 / 0.0025$
$N = 127.4$
Therefore, the required sample size is approximately **128 participants**.

Data analysis

Data analysis drew upon a combination of descriptive statistics, inferential testing, and qualitative methods to serve the aims of the study to address the research questions. Quantitative data collected by means of survey were summarized with descriptive statistics to highlight significant trends and participant demographics. Before being analysed, the data was cleaned and formatted in accordance with standard practices using Microsoft Excel. This included deleting incomplete answers inappropriately, correcting spelling errors, ensuring uniformity in answers (e.g., demographic questions and responses to Likert scales), and restructuring multiple-choice questions with more than one alternative to binary-coded variables. All non-relevant or missing values, i.e., blanks or "not applicable" answers, were removed or appropriately coded to maintain data integrity. (Taherdoost, 2022)

For the qualitative data obtained from interviews and open-ended questionnaires, thematic analysis was employed. This involved coding responses systematically to identify recurring themes and patterns of device usability, cultural acceptability, trust, and barriers to use. Visual tools like charts and tables were used to display quantitative results in a readily comprehensible format with narrative summaries captured from the qualitative data providing an overall understanding of the study outcomes.

Survey data analysis methodology.

Survey 1 for Mira fertility tracker device users **(**women between 20–40 years, residing in Kerala, self-reporting pcos diagnosis, not undergoing current clinical fertility treatment, having used the Mira fertility tracker for at least two months) and survey 2 for women aged 20–40, residing in Kerala, and self-reporting PCOS—but are not currently using the Mira Fertility Tracker

The survey data were analysed using descriptive statistical methods to summarise the responses of participants and determine overall trends. Responses were first organised by variable type, with closed-ended questions coded into ranges that reflected age brackets, duration of use, or rating scales. Open-ended responses were examined through thematic coding, where recurring concepts were gathered into themes to allow frequency counts and interpretation.

For all ordinal and categorical data, percentages and frequencies were calculated to show the response distribution. Likert-scale questions were shown as distributions across the five-point scale, and averages and medians were reported where appropriate to provide an indication of central tendency. As the purpose of this study was descriptive, no statistical tests beyond this level were conducted. Instead, the emphasis was on eliciting patterns and variation among groups of participants, and particularly among new and more experienced users and users and non-users of the Mira Fertility Tracker.

For the purposes of clarity, results were supported with visualizations where suitable for the type of data. Bar and pie charts were used for categorical responses, diverging bar charts for Likert scale responses, stacked bar charts for multi-response items, and word clouds or bar charts for thematic summaries of open-ended responses. Each finding was followed by a brief interpretation that linked the descriptive results to broader conclusions about user experience, awareness, and perceptions of fertility tracking. The fact that the analysis covered both users and non-users allowed for a more revealing understanding of adoption barriers, levels of satisfaction, and utilization of these kinds of tools in PCOS management in Kerala.

Qualitative data analysis approach

To identify recurring ideas, patterns, and inconsistencies between gynaecologists and health educators, thematic analysis was employed to analyse interview data. The process began with familiarization, where transcripts were read repeatedly to gain a general sense of participants' views. The key phrases, ideas, and expressions were then pinpointed and coded into initial categories. Next, these codes were compiled into themes and sub-themes that represented the main dimensions of participant answers. For example, codes related to exposure and knowledge were gathered under the general theme of Familiarity and Awareness of Femtech Devices, while references to affordability or stigma were placed under Barriers to Adoption. Each theme was assigned a clear definition, with sub-themes developed to reflect specific aspects of the issue (e.g., Clinical Exposure, Professional Motivation, Community Awareness).(Williamson and Johanson, 2017)

Representative quotes from participants were embedded in each sub-theme to maintain closeness to the data. This promoted transparency and credibility and gave voice for participants' perceptions. Themes were organized in a logical sequence, such as perceived effectiveness, user experience, accuracy, psychological impact, barriers to adoption, integration into practice, recommendations, and willingness to take part in research. For additional insight, a comparative analysis was conducted between gynaecologists and health educators.(Maring, 2001) This allowed exploration of both converging and diverging perspectives. For instance, whereas both groups recognized the empowering possibilities of femtech devices, gynaecologists emphasized their complementary but limited clinical utility, whereas health educators highlighted their motivational and educational utility for community health. Similarly, barriers such as cost and stigma were identified by both groups, though health educators placed greater emphasis on cultural and digital literacy concerns. Overall, the thematic analysis followed a descriptive yet interpretive path: explaining what participants said, summarizing patterns across respondents, and highlighting contrasts between professional groups. This systematic process assisted in ensuring that the analysis not only captured the richness of participant views but also developed findings relevant to the adoption of femtech devices in the management of PCOS in Kerala.

Ethical consideration

The researcher upheld the highest ethical standards to ensure that the rights, requirements, values, and well-being of the participants were respected in the entire research process. The ethical approval for the study was obtained through the application and declaration form (see Appendix

A) through the Griffith College/Inno pharma. This process ensured that all aspects of research, including design, data collection and analysis, comply with institutional and legal moral requirements. Prior to participation, all participants were provided with a participant information letter (PIL) and information consent form (ICF), in which PIL clearly explained the purpose of the study, the procedures involved and the rights of the participants, including the right to withdraw in any stage or leave any question without facing any negative results. Participants were obtained before proceeding with the survey, before ensuring voluntary participation. Throughout the research, oblivion and privacy were strictly maintained. No personally identified information was collected, and the reactions were considered strictly confidential. The data collected was used only for the purposes of this research study and handled according to general data security regulation. All digital data was safely stored on a password-protected laptop, which is only accessible to the researcher and was a research supervisor appointed for guidance and response. According to the approved ethics application, all raw research data will be maintained safely for two years and then destroyed to ensure ongoing compliance with moral and data security standards. By following these measures, the study ensured the autonomy of the participants, the protection of their personal information, and thereafter destroyed.

Chapter 4

Finding and analysis

Introduction

This section presents the findings and analysis of research, which employed the mixed-method approach to the use of Mira fertility trackers for exploring the adoption, usage and perception with semi-structured interviews among women with PCOS in Kerala, as well as insights from health professionals and teachers. The purpose of research is to understand the factors affecting usage, confidence, cultural acceptance of the device. The survey collected data from women with PCOS, which are either Mira tracker users or non-users, which capture their experiences, perceptions and socio-economic references. Interviews from gynaecologists and healthcare providers intensive qualitative insights about clinical approaches, digital health literacy, and cultural factors affecting adoption. The data collected was analysed to identify patterns and relationships in quantitative reactions and to detect recurring subjects in qualitative narratives. This dual approach allowed for a broad understanding of both measurable trends and nuanced experiences, which form the basis for thematic conclusions and discussions presented in the following sections.

Survey 1: finding and analysis Mira users.

This study targeted women aged 20–40 in Kerala with a self-reported diagnosis of PCOS who have been using the Mira Fertility Tracker for at least two months. Given that Mira is a new and specialized femtech device, its adoption in Kerala is limited. To account for this niche usage, the population proportion was conservatively estimated at 0.5%, resulting in a required sample size of approximately 8 participants. All 8 identified Mira users were successfully surveyed, providing insights into usage patterns, perceptions, and experiences with the device.

Participants to Question 1: 8 participants.

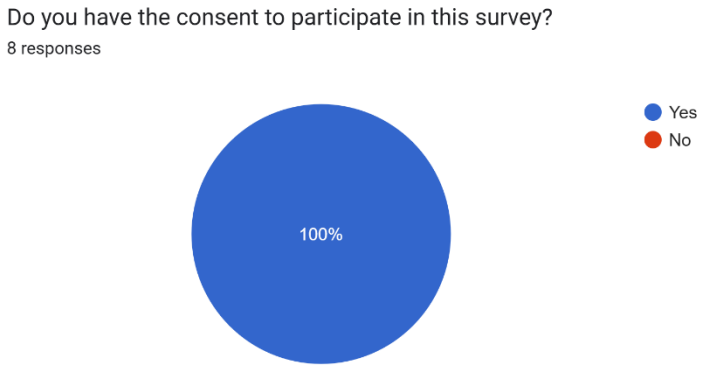


Figure 9 : pie chart showing consent to participate

Outcome:

- Positive responses (8 participants): Progressed to Question 2.
- Negative responses (0 participants): Directed to the end of the survey and thanked for their time.

Interpretation: The results show that all participants provided consent to participate in the survey. This indicates that the consent procedure was clear and effectively communicated to all respondents. No participants declined, suggesting no immediate ethical concerns regarding participation.

participants to Question 2: 8 participants.

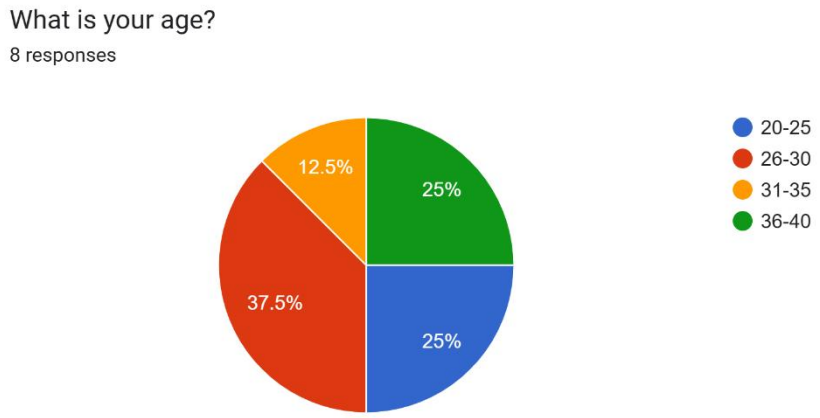


Figure 10 : piechart on age of participant

Responses by age group:

- 20–25: 2 participants (25%)
- 26–30: 3 participants (37.5%)
- 31–35: 1 participant (12.5%)
- 36–40: 2 participants (25%)

Outcome:

- Most participants (3 participants, 37.5%) are in the 26–30 age group.
- All age groups were represented, allowing a range of perspectives to be considered in the survey.

Interpretation: The age distribution shows that young adults (20–30) form the largest segment of respondents. There is moderate diversity, with fewer participants in the 31–35 age range. Overall, the sample includes representation from multiple adult age groups, which supports a balanced analysis of responses across different ages. Majority (62.5%) are young adults (20–30), consistent with literature showing early adulthood as peak fertility tracking interest (Sharma et al., 2022).

participants to Question 3: 8 participants.

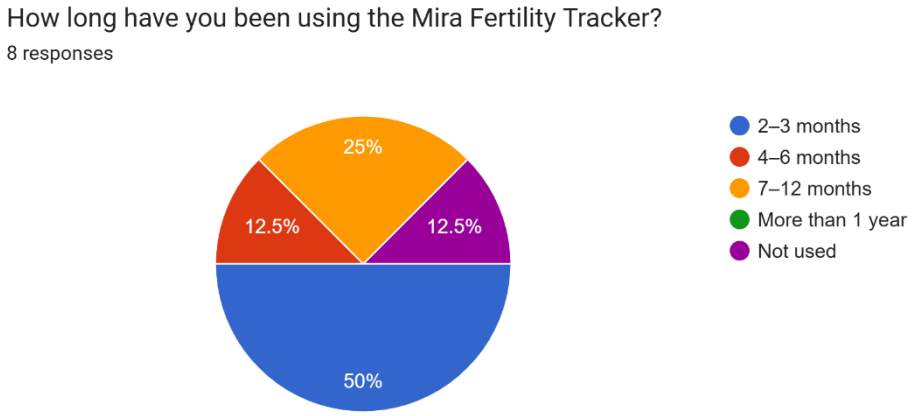


Figure 11 pie chart on duration of Mira use

Responses by duration:

- Not used: 1 participant (12.5%)
- 2–3 months: 4 participants (50%)
- 4–6 months: 1 participant (12.5%)
- 7–12 months: 2 participants (25%)

Outcome:

- Most participants (4 participants, 50%) have been using the Mira Fertility Tracker for 2–3 months.
- There is a mix of users with varying experience, including one participant who has not used the tracker.

Interpretation: Femtech does not always translate into behavioural change (Lupton, 2017). The contradiction suggests that additional factors—like motivation, confidence in self-management, or understanding of AI outputs—may mediate the adoption of recommended health behaviours.

.

participants to Question 4: 8 participants.

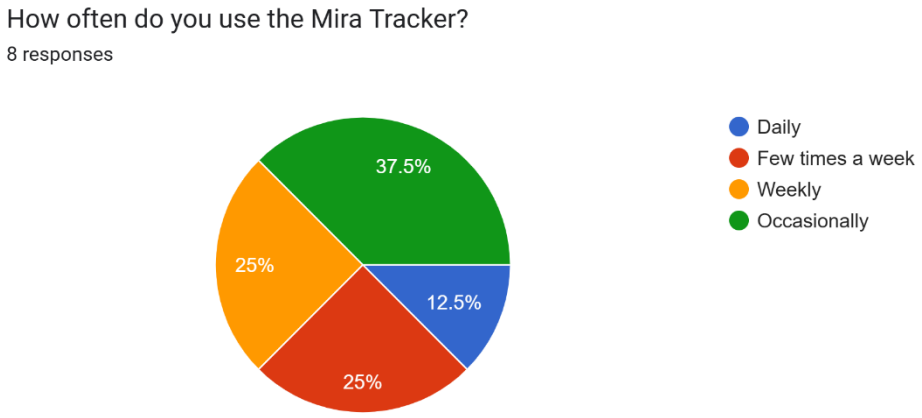


Figure 12 Pie chart on frequency of Mira use

Responses by frequency:

- Daily: 1 participant (12.5%)
- Few times a week: 2 participants (25%)
- Weekly: 2 participants (25%)
- Occasionally: 3 participants (37.5%)

Outcome:

- Most participants (3 participants, 37.5%) reported using the tracker occasionally.
- Usage frequency varies across respondents, ranging from daily use to occasional use.

Discussion:
The results indicate that most participants are occasional users, suggesting that the Mira Tracker is not yet part of a daily routine for many. Mira is not yet routine for most users; irregular engagement may limit behavioural impact, a known challenge in self-tracking technologies (Lupton, 2016).

participants to Question 5: 8 participants.

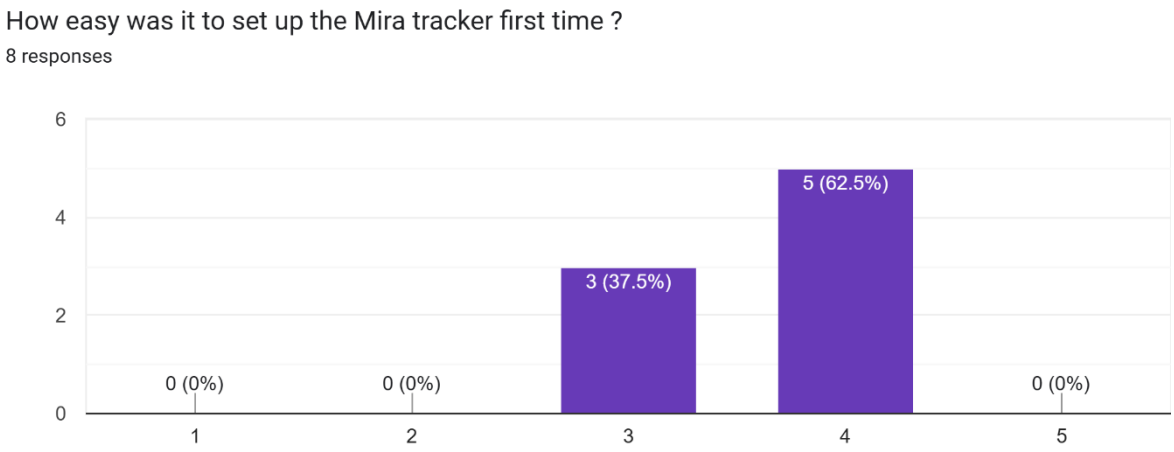


Figure 13 Likert scale on ease of first time set up

Responses (Likert scale 1–5, where 1 = very difficult, 5 = very easy):

- 3: 3 participants (37.5%)
- 4: 5 participants (62.5%)

Outcome:

- Most participants (5 participants, 62.5%) rated the setup as 4, indicating it was easy.
- A smaller group (3 participants, 37.5%) rated it 3, suggesting moderate difficulty.

Interpretation: The setup process appears user-friendly. This insight suggests that the device is accessible for most users but may benefit from minor improvements or additional guidance for first-time users. Initial setup is generally user-friendly; minor barriers may exist for first-time users. Ease of onboarding is key to adoption (Vandenberghe et al., 2021).

Participants to Question 6: 8 participants.

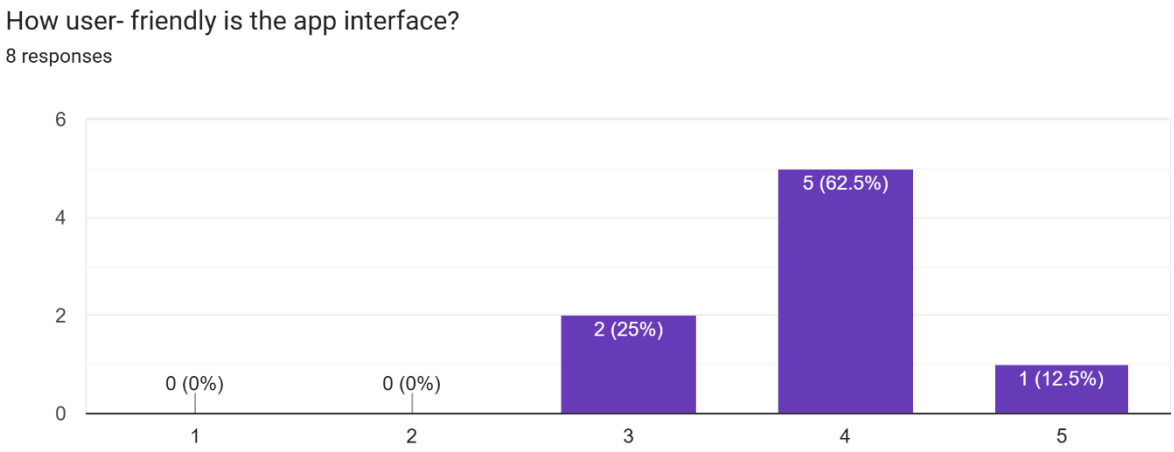


Figure 14 Likert scale on user friendliness of app

Responses (Likert scale 1–5, where 1 = not user-friendly, 5 = very user-friendly):

- 3: 2 participants (25%)
- 4: 5 participants (62.5%)
- 5: 1 participant (12.5%)

Outcome:

- Most participants (5 participants, 62.5%) rated the app interface as 4, indicating it is user-friendly.
- A smaller group rated it 3 (moderate user-friendliness) and 5 (very user-friendly), showing slight variation in experience.

Interpretation: Most participants find the interface user-friendly, suggesting that design and navigation meet user expectations. This aligns with literature emphasizing that intuitive UI and effective onboarding improve digital health adoption (Nielsen, 1994; Park et al., 2024).

Participants to Question 7: 8 participants.

Question 7: “What aspects of the app or device are most difficult for you to use?”

- Responses by aspect:
    - Application: 1 participant (12.5%)
    - Data accuracy: 1 participant (12.5%)
    - Data analysis: 1 participant (12.5%)
    - None: 1 participant (12.5%)
    - Data syncing: 1 participant (12.5%)
    - Maintaining a daily routine (missing tests can reduce accuracy): 1 participant (12.5%)
    - Understanding results: 1 participant (12.5%)
    - Interpreting results correctly (especially with fluctuating hormone levels): 1 participant (12.5%)

Outcome:

- Participants reported a variety of challenges, with no single aspect overwhelmingly identified as difficult.
- One participant indicated no difficulties, suggesting that the app and device are manageable for some users.

Interpretation: The survey shows that while the app is mostly usable, targeted improvements in guidance, data presentation, and user support could enhance the experience. Varied challenges highlight need for guidance, reminders, and tutorials. Supports the notion that tech literacy influences adoption and correct usage (Shaw et al., 2018).

Participants to Question 8: 8 participants.

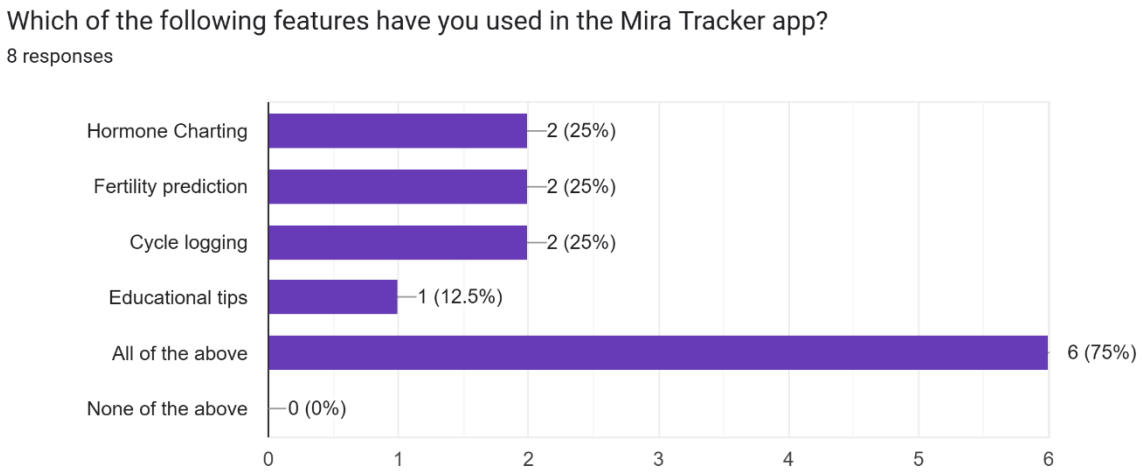


Figure 15 Likert scale on features of app

Responses by feature usage:

- All the above: 6 participants (75%)
- Hormone Charting, Fertility prediction, Cycle logging, educational tips: 1 participant (12.5%)
- Hormone Charting, Fertility prediction, Cycle logging: 1 participant (12.5%)

Outcome:

- Most participants (6 participants, 75%) reported using all features of the app.
- A smaller number of participants have used only selected features, indicating some variation in engagement.

Interpretation: Most participants are fully engaging with the app's features, suggesting that the range of tools (hormone tracking, AI predictions, visualizations) is both relevant and accessible. This aligns with research indicating that well-designed digital health tools encourage comprehensive usage, which can improve self-managed fertility care (Lupton, 2017; Frost & Sullivan, 2018).

Participants to Question 9: 8 participants.

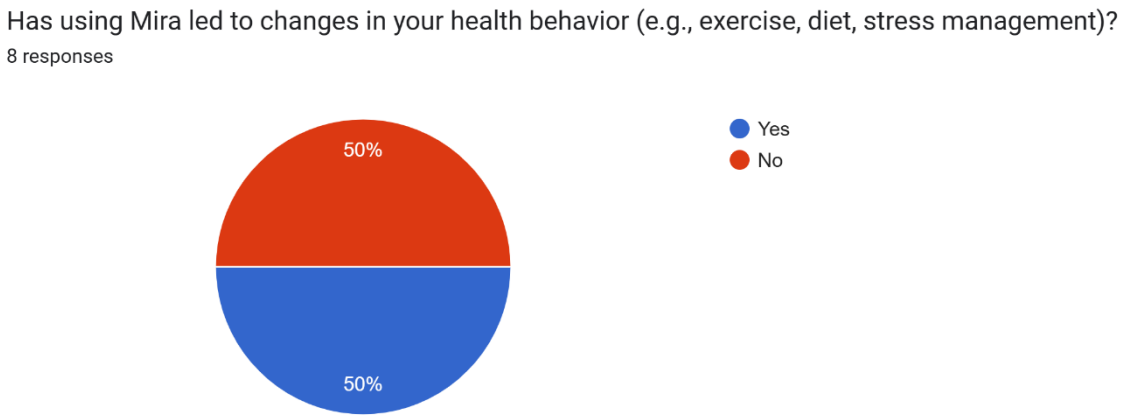


Figure 16 pie chart on influence of Mira

Responses:

- Yes: 4 participants (50%)
- No: 4 participants (50%)

Outcome:

- Half of the participants reported that using Mira has influenced changes in their health behaviour, while the other half did not notice any changes.

Discussion:
The results indicate a split among users regarding behavioural impact. For some, the Mira Tracker serves as a tool that encourages healthier habits, while others may use it primarily for fertility tracking without adjusting lifestyle behaviours. This insight highlights that while the app can support behaviour change, additional features or guidance might increase its influence on overall health management. Mira can influence lifestyle behaviours, but effects are inconsistent. Motivational support may enhance impact (Michie et al., 2017).

Participants to Question 10: 8 participants.

Question 10: “If yes, what changes have you made?”

- Responses by type of change:
    - No / None / No changes made: 5 participants (62.5%)
    - Kept track of hormone levels, reducing stress and anxiety (PCOS): 1 participant (12.5%)
    - Educational tips from the app were very useful: 1 participant (12.5%)
    - Reduced pain: 1 participant (12.5%)
    - Exercise, stress management, diet: 1 participant (12.5%)

Outcome:

- Most participants (5 participants, 62.5%) reported no changes in their health behaviours.
- A smaller number of participants reported specific positive changes influenced by the app.

Interpretation: Even though most users trust the app and find it convenient (as seen in previous analyses), trust does not necessarily result in behavioural change. This mirrors earlier contradictions where perceived usefulness and engagement do not automatically translate to health outcomes, highlighting the need for additional behavioural nudges or support mechanisms.

Participants to Question 11: 8 participants.

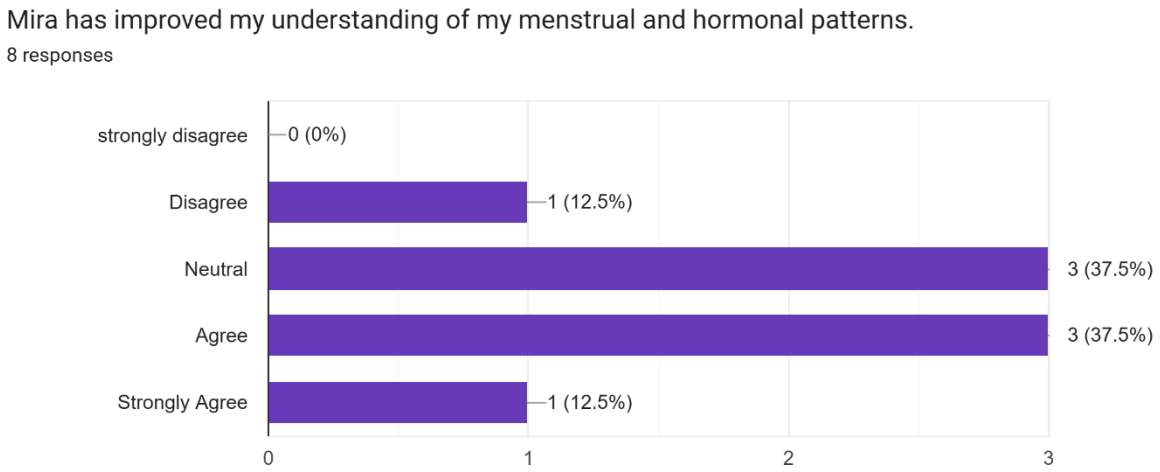


Figure 17 Likert scale on understanding of Mira

Responses (Likert scale):

- Strongly Agree: 1 participant (12.5%)
- Agree: 3 participants (37.5%)
- Neutral: 3 participants (37.5%)
- Disagree: 1 participant (12.5%)

Outcome:

- Most participants (4 participants, 50%) agreed or strongly agreed that Mira improved their understanding of menstrual and hormonal patterns.
- A similar number (4 participants, 50%) were neutral or disagreed, indicating that the impact on understanding varies among users.

Discussion:
The results suggest that Mira has enhanced awareness of menstrual and hormonal patterns for some users, but not all. The mixed responses highlight that while the app can be educational, additional guidance, tutorials, or feature explanations might help more users fully understand and interpret their data. This insight can guide improvements in educational support within the app.

Participants to Question 12: 8 participants.

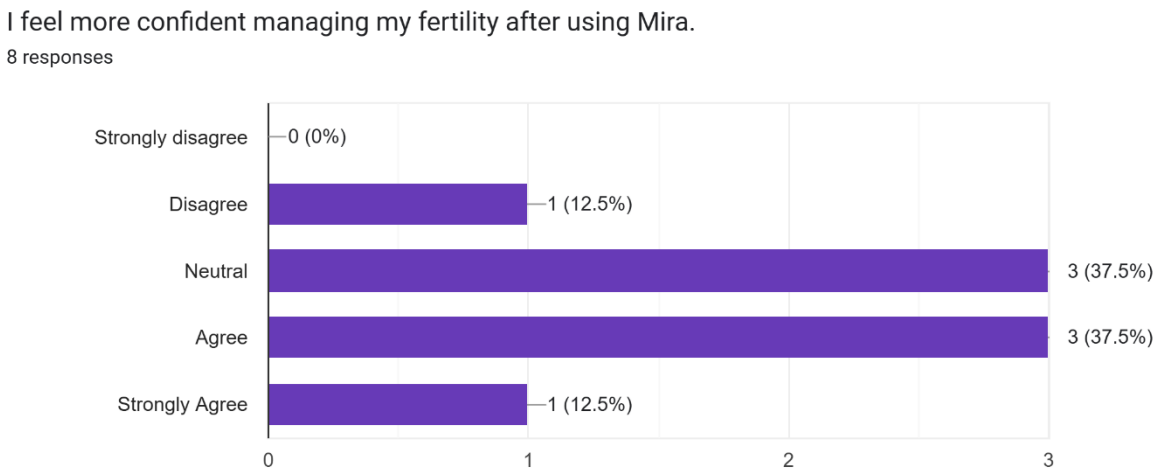


Figure 18 : Likert scale on confidence about Mira

Responses (Likert scale):

- Strongly Agree: 1 participant (12.5%)
- Agree: 3 participants (37.5%)
- Neutral: 3 participants (37.5%)
- Disagree: 1 participant (12.5%)

Outcome:

- Half of the participants (4 participants, 50%) agreed or strongly agreed that Mira increased their confidence in managing fertility.
- The remaining half (4 participants, 50%) were neutral or disagreed, suggesting varied impact on user confidence.

Discussion:
The survey indicates that Mira enhances fertility management confidence for some users, but others remain neutral or unconvinced. This variation may depend on factors such as individual experience with the app, prior knowledge, or consistency of use. Even among users who trust the app and use most features, some remain neutral, indicating that trust and usage alone do not guarantee perceived empowerment. This highlights the importance of supporting users not just with functionality but also with interpretive and motivational resources to improve self-efficacy.

Participants to Question 13: 8 participants.

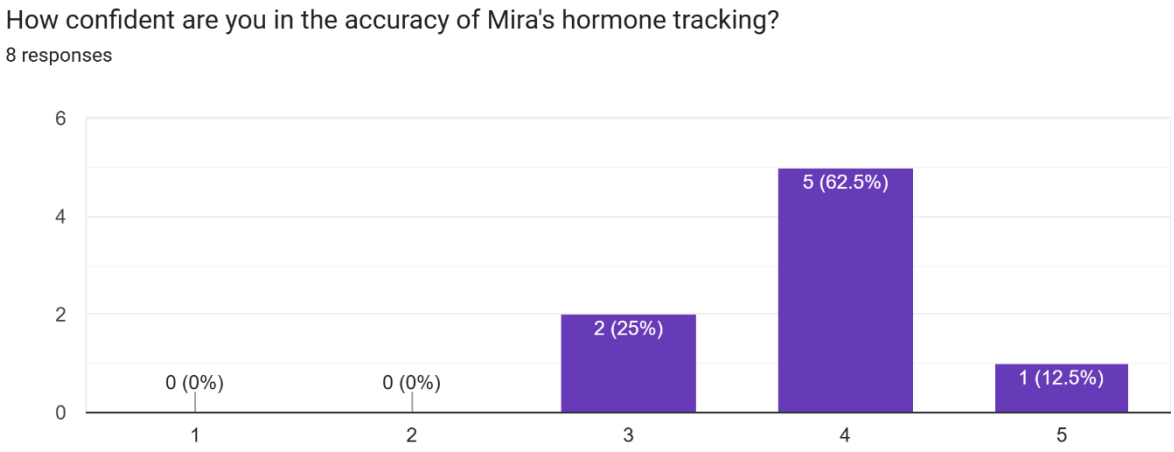


Figure 19 Likert scale on accuracy of Mira

Responses (Likert scale 1–5, where 1 = not confident, 5 = very confident):

- 3: 2 participants (25%)
- 4: 5 participants (62.5%)
- 5: 1 participant (12.5%)

Outcome:

- Most participants (5 participants, 62.5%) rated their confidence as 4, indicating high confidence in Mira's hormone tracking.
- A smaller number (2 participants, 25%) rated their confidence as 3, and 1 participant (12.5%) rated it as 5, showing some variation in perceived accuracy.

Interpretation: Most users trust the accuracy of hormone tracking, suggesting that Mira's measurements and AI predictions are perceived as reliable. This aligns with literature highlighting that perceived accuracy is critical for digital health adoption (Bilal Unver & Asan, 2022).

Participants to Question 14: 8 participants.

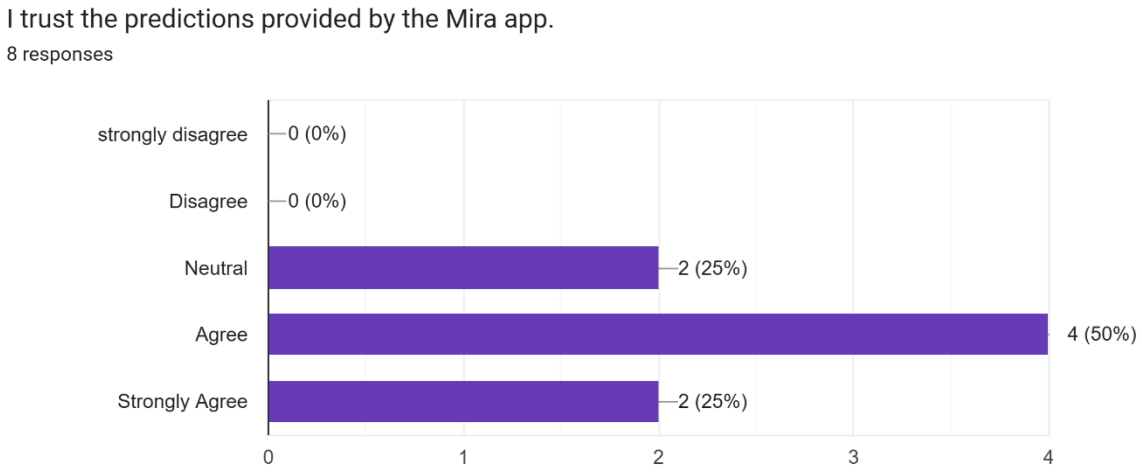


Figure 20 Likert scale on trust

Responses (Likert scale):

- Strongly Agree: 2 participants (25%)
- Agree: 4 participants (50%)
- Neutral: 2 participants (25%)
- Disagree: 0 participants (0%)

Outcome:

- Most participants (6 participants, 75%) agreed or strongly agreed that they trust Mira's predictions.
- A smaller portion (2 participants, 25%) were neutral, indicating some uncertainty among a minority of users.

Interpretation: Most participants trust Mira's AI-generated fertility predictions, suggesting that users perceive the device as reliable. This aligns with literature emphasizing that trust in AI accuracy is critical for adoption of digital health tools (Bilal Unver & Asan, 2022).

Participants to Question 15: 8 participants.

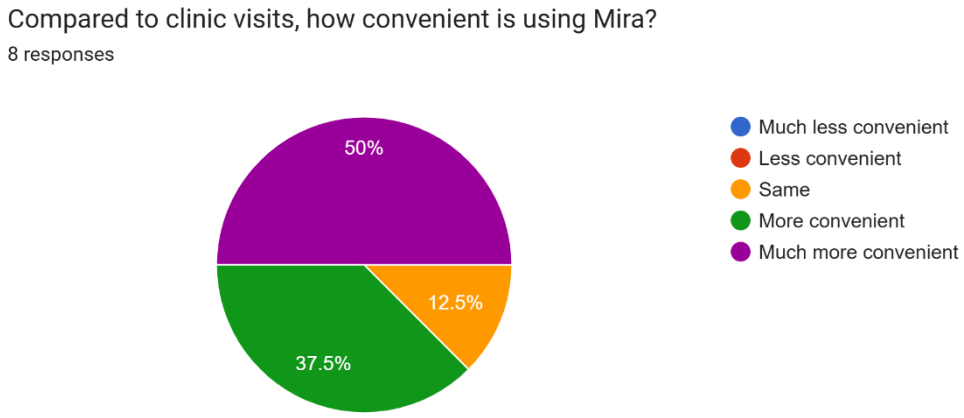


Figure 21 : pie chart on convenient in Mira app

Responses:

- Much more convenient: 4 participants (50%)
- More convenient: 3 participants (37.5%)
- Same: 1 participant (12.5%)
- Less convenient / Much less convenient: 0 participants (0%)

Outcome:

- Most participants (7 participants, 87.5%) found using Mira more or much more convenient than clinic visits.
- Only 1 participant (12.5%) found it equally convenient as clinic visits.

Discussion:
The findings indicate that Mira provides a clear convenience advantage over traditional clinic visits for most users. This reinforces the value of the app as a flexible and accessible fertility management tool. The single participant who found it equally convenient suggests that a small subset of users may not perceive a major difference compared to in-person visits. Strong perceived convenience supports global trends where home-based digital health tools reduce reliance on in-person visits (Cohen et al., 2020).

Participants to Question 16: 8 participants.

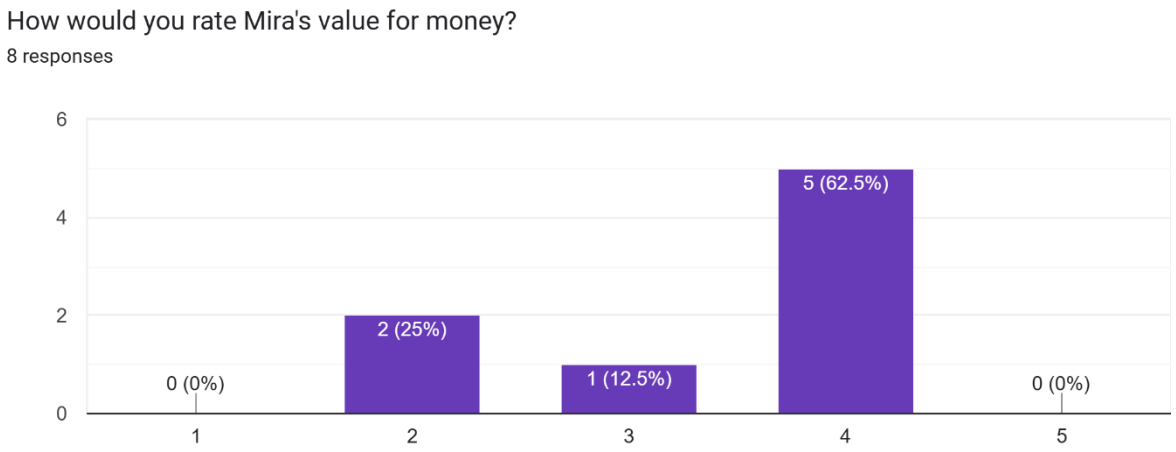


Figure 22 Likert scale on rating of value for money

Responses (Likert scale 1–5, where 1 = poor value, 5 = excellent value):

- 2: 2 participants (25%)
- 3: 1 participant (12.5%)
- 4: 5 participants (62.5%)
- 5: 0 participants (0%)

Outcome:

- Most participants (5 participants, 62.5%) rated Mira's value for money as 4, indicating good perceived value.
- A smaller number (3 participants, 37.5%) rated it lower (2 or 3), suggesting some users feel the cost may be higher than expected.

Interpretation: Overall, most users perceive Mira as offering good value for money, though there is a small segment who feel it could be more cost-effective. Highlighting the app's features, benefits, and long-term savings compared to clinic visits could help improve perceived value among these users. Some participants rate the device lower, indicating sensitivity to cost and expectations of affordability. This aligns with literature highlighting that out-of-pocket expenses and perceived cost-benefit impact Femtech adoption in India (Mishra et al., 2024).

Participants to Question 17: 8 participants.

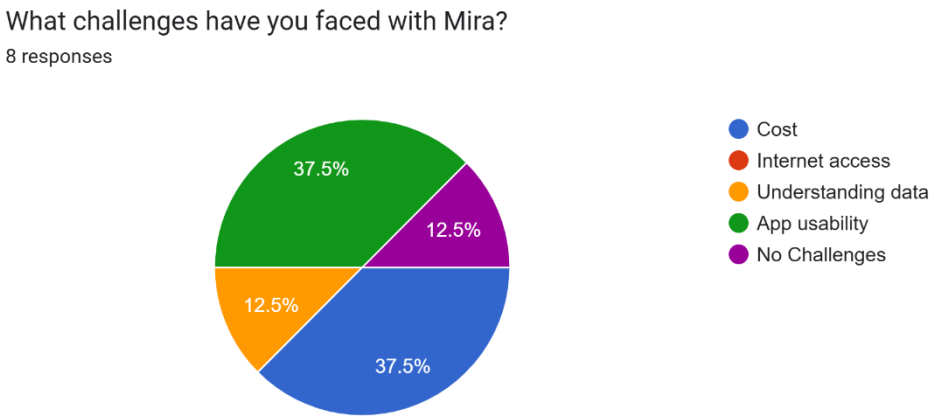


Figure 23 pie chart on challenges with Mira

Responses by type of challenge:

- Cost: 3 participants (37.5%)
- App usability: 3 participants (37.5%)
- Understanding data: 1 participant (12.5%)
- No challenges: 1 participant (12.5%)

Outcome:

- The most frequently reported challenges were cost and app usability, each cited by 3 participants (37.5%).
- Fewer participants reported difficulties in understanding data or indicated no challenges.

Interpretation: The results highlight that while most users can use Mira effectively, cost and app usability remain notable barriers. Cost and usability are the main challenges affecting adoption and sustained engagement. This aligns with literature showing that financial constraints and digital literacy are key barriers to Femtech adoption in India (Mishra et al., 2024; Park et al., 2024).

Participants to Question 18: 8 participants.

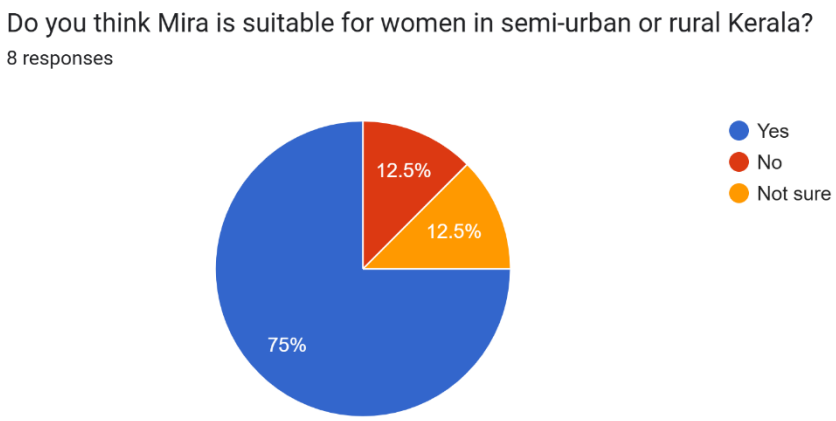


Figure 24 pie chart distribution of response

Responses:

- Yes: 6 participants (75%)
- No: 1 participant (12.5%)
- Not sure: 1 participant (12.5%)

Outcome:

- Many participants (6 participants, 75%) believe that Mira is suitable for women in semi-urban or rural Kerala.
- A small proportion were either unsure or disagreed (2 participants, 25%).

Interpretation. The uncertainty or disagreement among a minority of participants may reflect concerns about accessibility, digital literacy, or regional infrastructure, which could be addressed through targeted awareness campaigns or support services. Even with positive perceptions of suitability, practical adoption may be limited by access, affordability, and awareness, highlighting the need for complementary support strategies for rural users.

Participants to Question 19: 8 participants.

Question 19: “Please explain your answer regarding Mira’s suitability for women in semi-urban or rural Kerala.”

Theme	Participants (%)	Key Point
Personalized fertility insights	3 (37.5%)	Tailored monitoring
Awareness / education	1 (12.5%)	Need more info
Accessibility challenges	2 (25%)	Cost, internet, smartphone
Convenience	2 (25%)	Reduces hospital visits
Health-specific benefits	1 (12.5%)	Useful for PCOS

Table 1:Themes from respondents on Mira’s suitability for women in semi-urban or rural Kerala

Outcome:

- Most participants highlighted Mira’s potential to provide useful fertility insights and reduce reliance on frequent hospital visits.
- Some participants raised concerns about awareness, cost, and accessibility, which may affect adoption in semi-urban or rural areas.

Discussion:
The responses suggest that while Mira is considered beneficial for fertility monitoring, successful adoption in semi-urban or rural Kerala may require addressing affordability, digital accessibility, and awareness. The device’s health-specific advantages, such as managing PCOS, were noted as particularly valuable, reinforcing the app’s relevance for targeted populations. Participants emphasize both practical accessibility and trust, aligning with technology acceptance models (TAM) focusing on perceived usefulness and ease of use.

Participants to Question 20: 8 participants.

Question 20: “What could Mira improve to make it more accessible or trustworthy?”

Theme	Participants (%)	Key Point
Availability	3 (37.5%)	More access
Awareness	2 (25%)	Info / guidance
Data / AI	2 (25%)	Accuracy / transparency
Affordability	1 (12.5%)	Subsidies
Offline / Privacy	1 (12.5%)	Offline use / privacy
No suggestions	1 (12.5%)	Satisfied

Table 2: Themes from respondents on improvements to make Mira more accessible or trustworthy

Outcome:

- Participants highlighted that accessibility can be enhanced through wider distribution, affordability, and awareness campaigns.
- Trustworthiness could be improved through greater transparency in algorithm functioning, better data accuracy, and privacy assurances.

Discussion:
The responses suggest that Mira has room for improvement in both accessibility and user confidence. Expanding local availability, offering training, and communicating clearly about data handling and algorithm processes can make the device more user-friendly and trusted, especially in semi-urban or rural. Indicates high satisfaction and potential for peer-driven adoption.

Participants to Question 21: 8 participants.

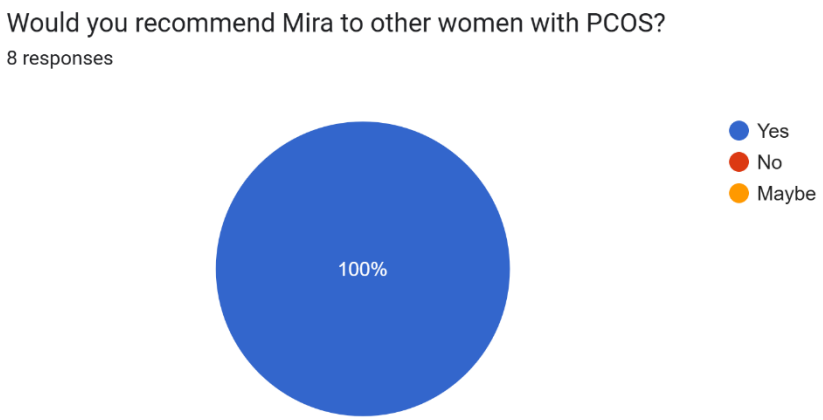


Figure 25 pie chart on recommendation among women with PCOS

Responses:

- Yes: 8 participants (100%)
- No: 0 participants (0%)

Outcome:

- All participants (100%) indicated that they would recommend Mira to other women with PCOS.

Discussion:
The unanimous positive response demonstrates strong user satisfaction and perceived value of the Mira Fertility Tracker among women managing PCOS. This suggests high confidence in the app's effectiveness and reinforces its potential as a recommended tool within the target community.

Survey 2: non-users of fertility tracker

This survey targeted women aged 20–40 in Kerala with a self-reported diagnosis of PCOS who are not currently using the Mira Fertility Tracker. Non-users represent a broader segment of the population, given the low market penetration of femtech in semi-urban and rural India (Devi, 2025).

Based on population estimates, the calculated sample size for this group was 128 participants to achieve a 95% confidence level with a 5% margin of error. However, due to time constraints and challenges in accessing this specific subgroup, only 44 responses were successfully collected. Despite the smaller sample, the data provides meaningful insights into non-users' awareness, perceptions, and potential barriers to adopting fertility tracking technology.

Participants to Question 1: 44 participants.

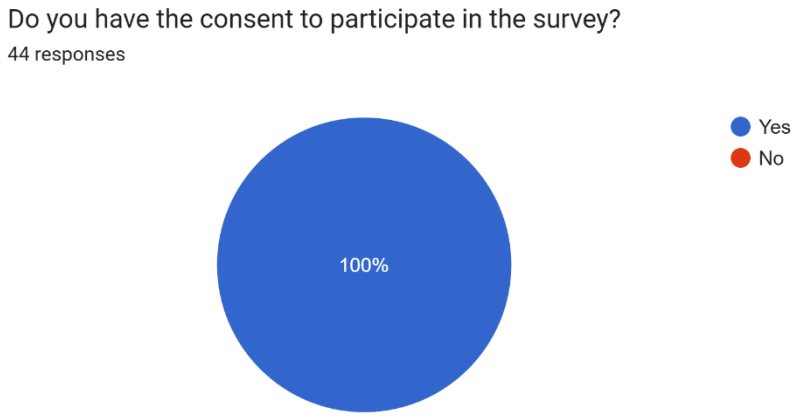


Figure 26 pie chart on consent for survey

Response:

- Positive responses (Yes): 44 participants (100%)
- Negative responses (No): 0 participants (0%)

Outcome:

- Positive responses (44 participants): Progressed to Question 2.
- Negative responses (0 participants): Directed to the end of the survey and thanked for their time.

Discussion:
The results indicate that the consent procedure was clear and effectively communicated. All participants agreed to participate, suggesting no immediate ethical concerns regarding survey participation.

Participants to Question 2: 44 participants.

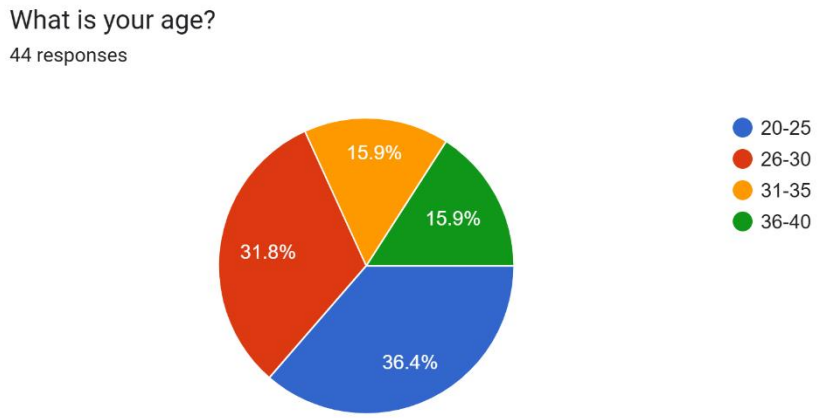


Figure 27 pie chart on demographic

Response

- 20–25 years: 16 participants (36.36%)
- 26–30 years: 15 participants (34.09%)
- 31–35 years: 8 participants (18.18%)
- 36–40 years: 5 participants (11.36%)

Interpretation: This age distribution can help in tailoring awareness campaigns or educational interventions targeting this demographic. Early adulthood is a critical period for fertility awareness, consistent with global findings that younger women are more likely to benefit from timely fertility education and tracking (Lupton, 2017).

Participants to Question 3: 44 participants.

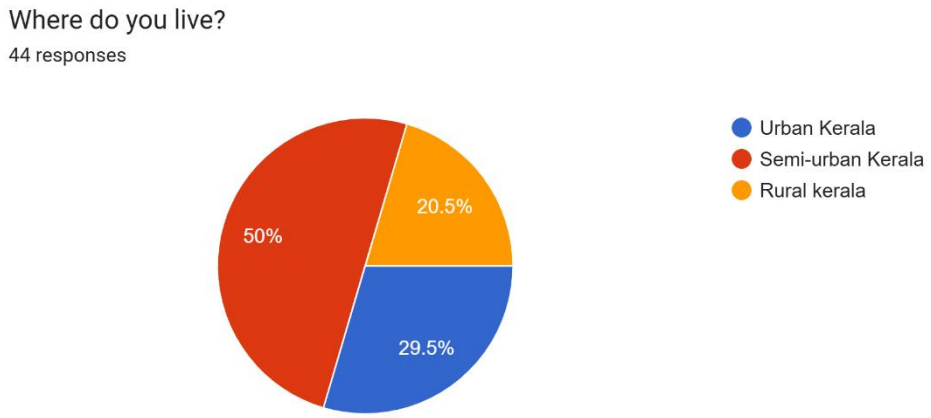


Figure 28 : pie chart on distribution of participants by location

Responses (Frequency count):

- Urban Kerala: 12 participants
- Semi-urban Kerala: 24 participants
- Rural Kerala: 8 participants

Discussion:
Most respondents (24 participants, 54.55%) reside in semi-urban areas, followed by urban (12 participants, 27.27%) and rural areas (8 participants, 18.18%).

This suggests that non-users of the Mira Fertility Tracker are in semi-urban regions, where awareness of femtech may be moderate but access to specialized devices is still limited. The lower representation from rural areas indicates potential barriers such as limited internet connectivity, smartphone availability, and lower exposure to digital health tools. Even where digital infrastructure exists (urban areas), adoption is not guaranteed, suggesting that factors beyond access, such as cost, trust, or perceived usefulness, also influence uptake.

Participants to Question 4: 44 participants.

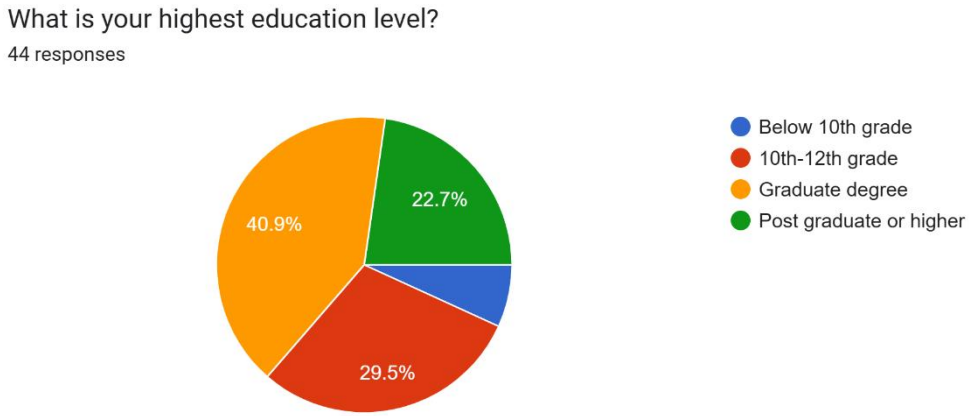


Figure 29 : pie chart on education level

Responses:

- Postgraduate or higher: 12 participants
- Graduate degree: 23 participants
- 10th–12th grade: 12 participants
- Below 10th grade: 3 participants

Interpretation: Many respondents hold a graduate degree, followed by those with postgraduate or higher qualifications and those with 10th–12th grade education. A smaller proportion of respondents have education below 10th grade. This indicates that non-users of the Mira Fertility Tracker are from moderately to highly educated backgrounds, suggesting that awareness and access to femtech devices may be higher among individuals with formal education.

Participants to Question 5: 44 participants.

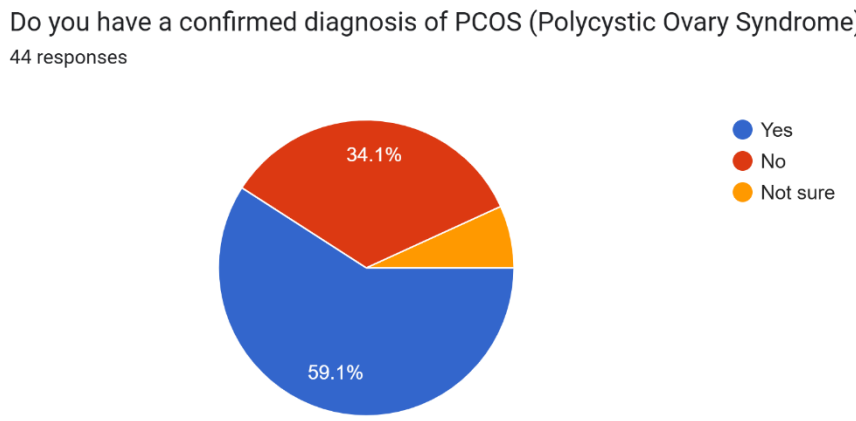


Figure 30 ： pie chart on the distribution of respondents by confirmed PCOS diagnosis

Response:

- Yes: 24 participants (54.55%)
- Not sure: 3 participants (6.82%)
- No: 17 participants (38.63%)

Discussion:
A little over half of the respondents (54.55%) reported a confirmed diagnosis of PCOS, while a significant portion (38.63%) reported not having a diagnosis, and a small number (6.82%) were unsure. This indicates that among non-users of the Mira Fertility Tracker, awareness of PCOS status varies. The results suggest that many women may not have had access to proper diagnosis or awareness, highlighting a potential barrier to adopting specialized fertility tracking devices.

Participants to Question 6: 44 participants.

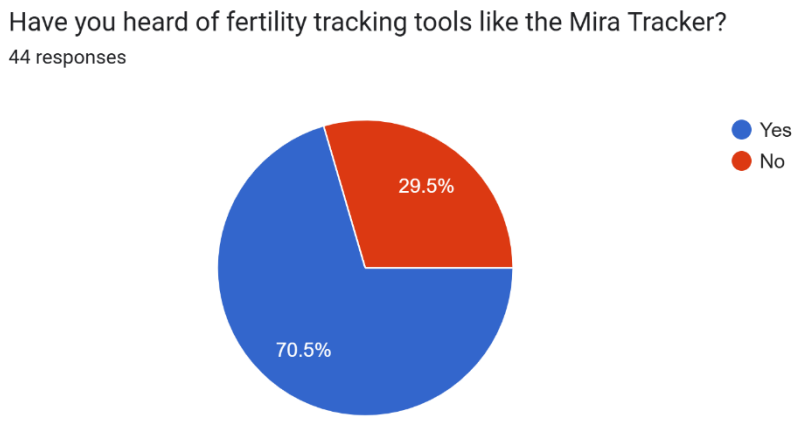


Figure 31 : pie chart on awareness of Mira

Responses:

- Yes: 33 participants
- No: 17 participants

Discussion:
Most respondents (33 out of 50) have heard of fertility tracking tools like the Mira Tracker, while a smaller proportion (17 participants) have not. This suggests that awareness of femtech devices is high among the surveyed group, although there is still a notable segment that may require more information and outreach to improve familiarity with such tools.

Participants to Question 7: 44 participants.

Question 6: "If yes, how did you first hear about it?"

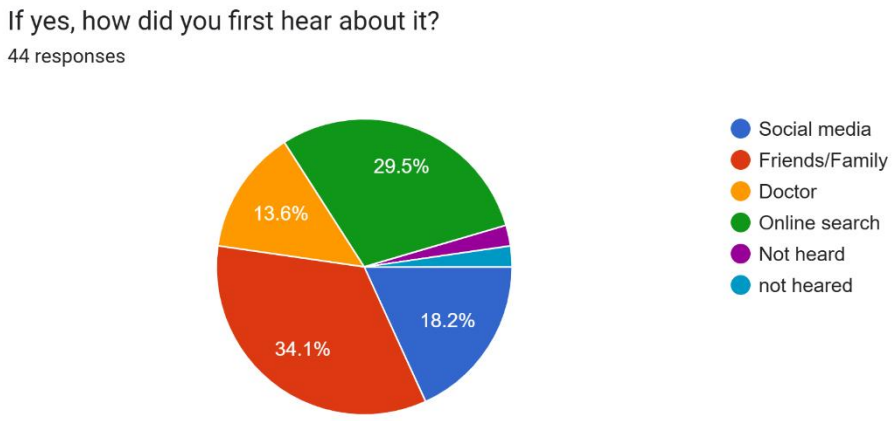


Figure 32 : pie chart on the sources through which respondents first heard about Mira

Response

- Social media: 10 participants (22.7%)
- Friends/Family: 17 participants (38.6%)
- Online search: 11 participants (25%)
- Doctor: 5 participants (11.4%)
- Not heard: 2 participants (4.5%)

Discussion:
Many respondents first heard about Mira through friends or family (38.6%), indicating strong word-of-mouth influence. Social media and online searches also played a significant role (22.7% and 25%, respectively), showing the importance of digital channels in awareness. Only a small proportion learned about Mira through doctors (11.4%) or had not heard of it at all (4.5%). This suggests that outreach via healthcare professionals could be strengthened to reach more potential users.

Word-of-mouth and social media dominate, indicating that peer influence strongly shapes awareness. The low proportion learning from doctors suggests underutilized clinical endorsement.

Participants to Question 8: 44 participants.

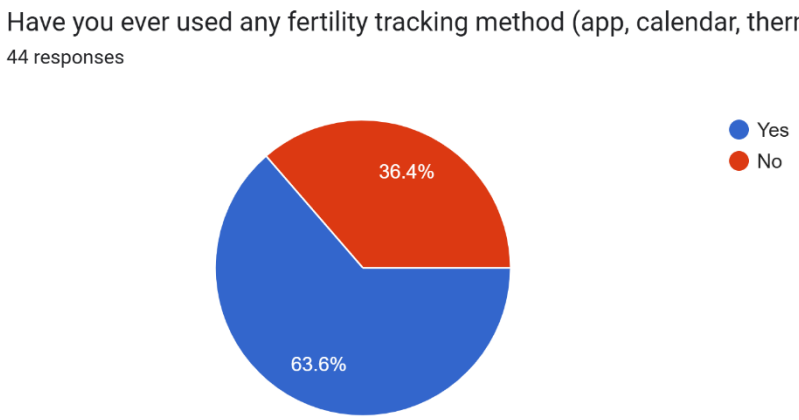


Figure 33 : pie chart on fertility tracking method usage

Response

- Yes: 28 participants (63.6%)
- No: 16 participants (36.4%)

Interpretation: Most respondents (63.6%) have used some form of fertility tracking method in the past, such as apps, calendars, or thermometers. This suggests that a significant portion of the population is already familiar with tracking fertility, which could make adoption of tools like Mira easier. However, over one-third of participants have never used any fertility tracking method, indicating there is still a group that may need guidance or education to start monitoring their fertility effectively. Familiarity with other tracking methods suggests readiness to adopt digital tools, but over one-third without prior experience may face learning barriers, requiring user-friendly interfaces and guidance.

Participants to Question 9: 44 participants.

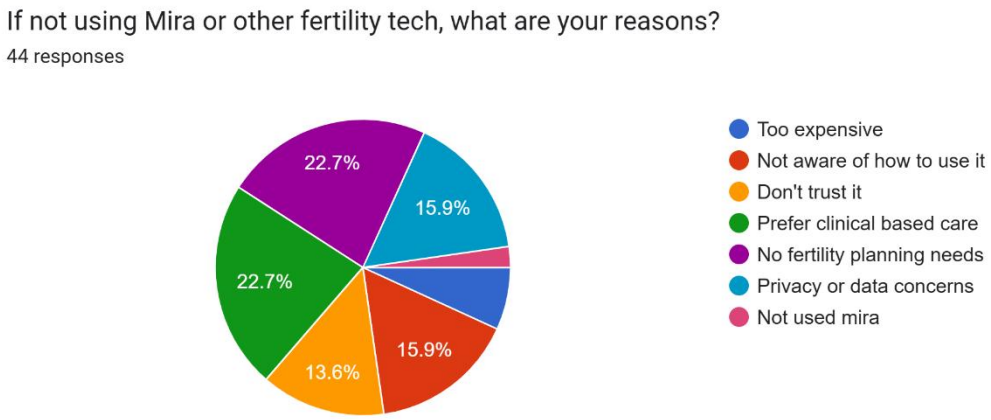


Figure 34 : Pie chart on the reasons for not using Mira or other fertility technology

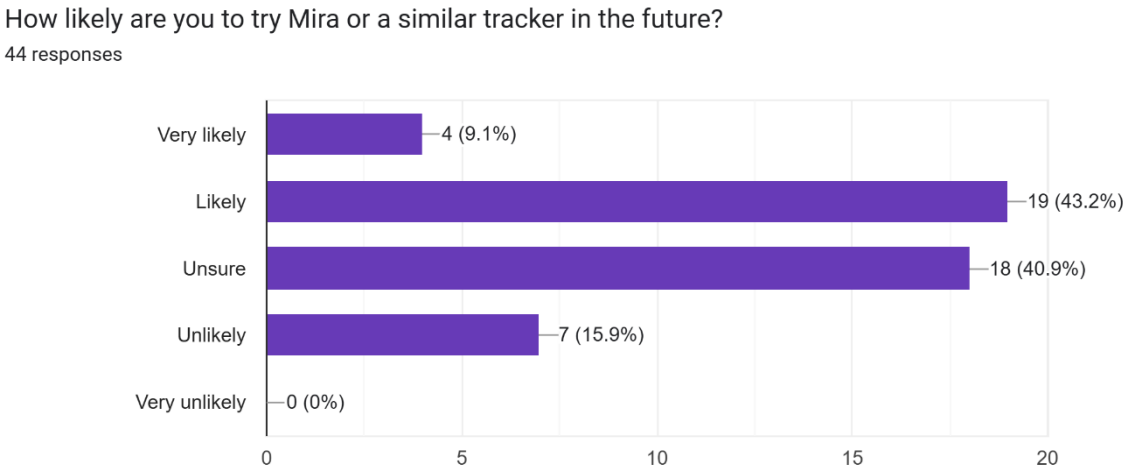
Responses summary:

Reason	Number of Participants	Percentage
No fertility planning needs	11	25%
Prefer clinical-based care	12	27%
Privacy or data concerns	7	16%
Do not trust it	6	14%
Not aware of how to use it	5	11%
Too expensive	3	7%
Not used Mira (miscellaneous)	1	2%

Table 3 :: Reasons for not using Mira or other fertility technology

The primary reasons for not using Mira or other fertility technology are preference for clinical-based care and no fertility planning needs, indicating that many women either rely on traditional healthcare or do not currently require fertility tracking.

Privacy and trust concerns (combined 30%) are also significant barriers, suggesting that for wider adoption of fertility tech, developers need to focus on data security, transparency, and trust-building. Preference for clinical care and no fertility planning needs indicate that perceived necessity drives adoption. Privacy, trust, and cost concerns reflect barriers identified in technology adoption frameworks (e.g., TAM—Trust and Perceived Ease of Use). Addressing these barriers is essential for uptake.



Participants to Question 10: 44 participants.

Response	Number	Percentage
Very likely	5	11%
Likely	14	32%
Unsure	15	34%
Unlikely	3	7%
Mixed (Likely, Unlikely)	4	9%
Mixed (Unsure, Unlikely)	3	7%

Figure 35 : Likert scale on respondents' likelihood of trying Mira.

Table 4 : Respondents' likelihood of trying Mira

Interpretation:43% of respondents (Very likely + Likely) are open to trying Mira, showing interest if barriers like cost and trust are addressed.,34% are unsure, indicating a need for more information or reassurance about the device. Affordability and medical endorsement strongly influence adoption intention. This confirms literature showing that price sensitivity and professional recommendation are critical for health technology uptake in low- and middle-income contexts.

Participants to Question 11: 44 participants.

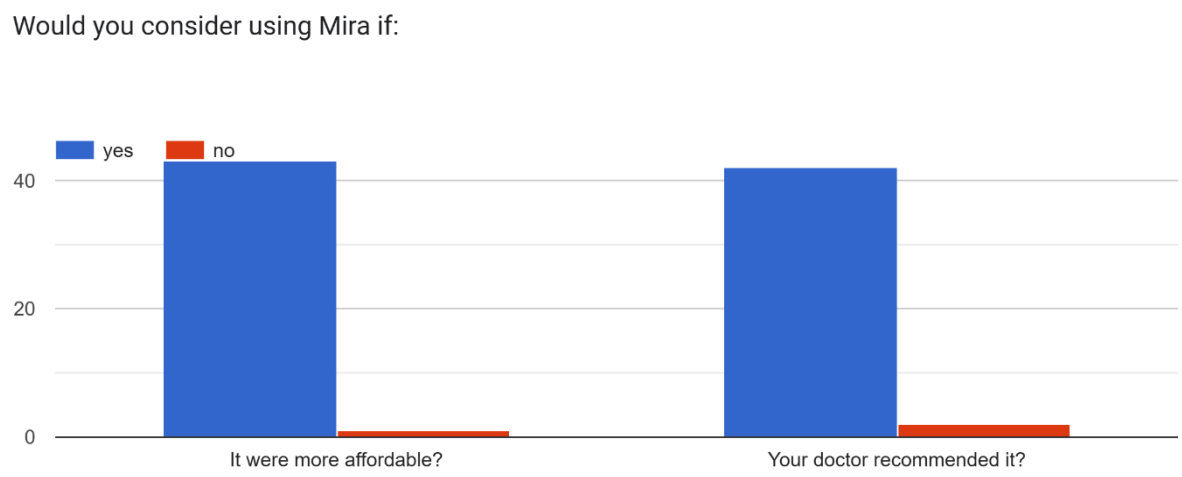


Figure 36 : bar chart(categorical) on proportion of participants in each category.

Response:

It was more affordable.

- Yes: 41 participants (≈93%)
- No: 3 participants (≈7%)

Cost is a significant factor. Most non-users indicated they would consider Mira if it were more affordable, showing price is a key barrier to adoption.

2. Your doctor recommended it?
    - Yes: 42 participants (≈95%)
    - No: 2 participants (≈5%)

Medical endorsement strongly influences willingness to use Mira. All respondents indicated that a doctor's recommendation would make them consider the device, highlighting trust in healthcare professionals.

.

Participants to Question 12: 44 participants.

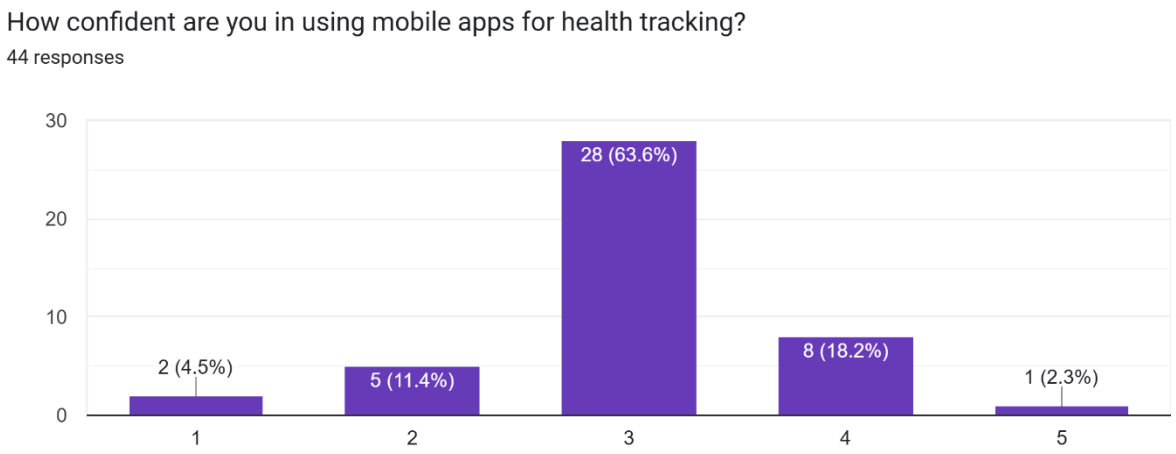


Figure 37 : Likert scale on confidence in fertility app

Response:

- 1 (Not confident): 2 participants
- 2: 5 participants
- 3 (Moderate confidence): 26 participants
- 4: 9 participants
- 5 (Very confident): 1 participant

Discussion

Most participants (≈59%) report moderate confidence (3/5), indicating familiarity but not full comfort with health apps. A smaller group (≈23%) are quite confident (4/5), showing potential for technology adoption. Very few participants are either not confident (1–2) or highly confident (5), highlighting opportunities for education, guidance, and user-friendly app design to increase adoption and effective use. Moderate confidence suggests potential for adoption but indicates a need for intuitive design, tutorials, and technical support to build competence and reduce anxiety, consistent with Self-Efficacy theory in digital health.

Participants to Question 13: 44 participants.

What benefits do you see in using fertility tracking tools like Mira?

Theme / Benefit Category	Example Responses / Notes	Frequency (approx.)
Cycle & Fertility Tracking	Track dates, ovulation, fertile window, irregular cycles, PCOS support	15
Hormone & Health Monitoring	Detect hormone imbalances, multiple hormones (LH, PdG, FSH), understand cycle pattern	10
Convenience & Ease of Use	Home testing, app-based, user-friendly, non-invasive, reduces clinic visits	8
Family Planning & Conception Support	Plan pregnancy, natural contraception, increase chances of conception	7
Personalization & Insights	Personalized cycle insights, learns from past cycles, tailored recommendations	6
Professional / Reliability	Doctor-backed, similar accuracy to blood tests, trusted by specialists	4
Cost & Accessibility	Affordable, cost-efficient, reduces treatment costs	3

Table 5 : Benefits of using fertility tracking tools like Mira

Interpretation: Users value personalized cycle insights, hormone tracking, convenience, and clinical reliability. This aligns with studies showing that perceived usefulness and control over reproductive health strongly motivate femtech adoption. Convenience is seen as reducing clinic visits and time burden, a key driver in resource-constrained settings.

Participants to Question 14: 44 participants.

What concerns do you have about using these kinds of tools?

Concern Category	Example Responses / Notes	Frequency / Notes
Privacy / Data Security	Privacy, data breaches, storing reproductive health data in the cloud, AI trust concerns	Many responses mention privacy or cloud risks
Accuracy / Reliability	Device accuracy, data misinterpretation, credibility of results, accuracy variation, may miss ovulation	Frequent concern
Cost / Expense	High cost, expensive test wands, packaging costs, buying device	Several participants
Complexity / Usability	Confusion interpreting app readings, hormone numbers, limited guidance, daily effort required	Moderate concern
Medical Limitations	Not a replacement for doctors, not a full fertility health diagnosis, risky if relied on solely	Several responses
Time / Effort	Testing time (15–20 mins per reading), collecting samples, syncing with app	Some responses
Other / Miscellaneous	Overwhelming data, internet access issues in rural areas, pressure to track numbers daily	Few responses

Table 6: concerns about fertility tools

Interpretation: Privacy, accuracy, cost, usability, and medical limitations are major barriers. These concerns highlight the need for trust-building, transparency, and clear communication about device capabilities—factors emphasized in the Unified Theory of Acceptance and Use of Technology (UTAUT).

Participants to Question 15: 44 participants.

Responses:

- **Yes:** 33 participants (75%)
- **Maybe:** 8 participants (18%)
- **No:** 3 participants (7%)

Discussion

Most participants (75%) expressed clear interest in attending a workshop or demo, showing strong curiosity and willingness to engage with fertility tracking tools. This suggests that practical guidance could improve adoption and correct usage.

About 18% were unsure ("Maybe"), indicating openness but a need for more information on the workshop format, duration, or relevance. With targeted communication or trial sessions, these individuals could be converted to active users.

A small portion (7%) were not interested, due to lack of fertility tracking needs, comfort with current methods, or perceived complexity,

While workshops may not appeal to everyone, they would still reach most potential users. Strong interest suggests hands-on guidance is critical to convert awareness into adoption. Workshops could address knowledge gaps, improve confidence, and mitigate technical or psychological barriers, consistent with adult learning and behavioural adoption theories.

Introduction to interview findings and analysis

This study examined the outlooks and experiences of the major stakeholders about the use of femtech equipment, with focus on Mira Fertility Tracker for PCOS management. Interviews were held with two primary groups: gynaecologists, representing clinical care, and health teachers, represent community and educational support. The interaction provided intensive information in the familiarity of the participants with femtech, perceived effectiveness, purpose, psychological and behavioural effects, adopting barriers and strategies to integrate these devices into professional practice. thematic analysis was used to organize data in clear subjects and sub-topics, which highlights patterns and contradictions between clinical and educational approaches. Participants include direct quotes to preserve references and authenticity. The following segment offers a detailed thematic analysis, providing a comparative understanding of how the gynaecologists and health teachers experience and attach to PCOS.

Theme 1: Awareness & Familiarity of Femtech Devices

Definition: Professional experience-based awareness and knowledge of femtech devices.

Clinical Exposure / Community Exposure:

Gynaecologists: "I have patients that use Mira, and I read research to find out what it is used for." – Gynaecologist 2

Health educators: "Patients ask me about these devices, so that keeps me updated." – Health Educator 5

Professional Motivation / Facilitating Awareness

Gynaecologists: "It is important to learn about them because they are incorporated in the care of patients."– Gynaecologist 3

Health educators: "Our role is to educate women in order to be able to use them."– Health Educator 6

Theme 2: Perceived Effectiveness & User Empowerment

Definition: Femtech device utility for PCOS management and motivational impact.

Gynaecologists mentioned tracking hormone patterns and ovulation but noted limitations:

"It assists with cycle watching but does not substitute for ultrasounds and bloods." – Gynaecologist 4

"It enables patients to be in charge of their fertility journey." – Gynaecologist 3

Health educator assistance and facilitation of self-efficacy were the health educator's top priority:

"It's more about trends than exact numbers." – Health Educator 7

"Women are being told to eat well and minimize stress." – Health Educator 5

Theme 3: Challenges, Psychological & Behavioural Impact (Merged Theme)

Definition: Barriers to adoption and emotional/behavioural consequences of femtech device use.

Gynaecologists identified biological limitations and psychological distress:

"PCOS patients' cycles are so unpredictable that predictions might be wrong." – Gynaecologist 2

"Some women get anxious when they realize the erratic patterns." – Gynaecologist 4

Health educators identified cultural stigma, unawareness, and possible anxiety:

"Most women are not aware of PCOS or are shy talking about it." – Health Educator 6

"Some may worry unnecessarily when trends alter." – Health Educator 7

Insight: Professional intervention and explanation are needed to prevent misinterpretation and worry.

Theme 4: Accuracy, Guidance & Professional Oversight (Merged Theme)

Definition: Need for prioritization of trends over accurate diagnoses and professional intervention.

Gynaecologists: "It indicates trends well but cannot be substituted for laboratory tests." – Gynaecologist 2

Health educators: "We need to explain results to prevent worry." – Health Educator 5

Theme 5: User Experience & Design

Definition: Interface design and visualization effects on adherence and engagement.

Gynaecologists: "If the app is confusing, patients will stop using it." – Gynaecologist 3

Health educators: "Easy-to-read charts make it less intimidating." – Health Educator 5

Theme 6: Barriers & Integration into Practice

Definition: Financial, cultural, and technological barriers; integration strategies.

Gynaecologists: "I suggest this to patients who are responsible enough for the tech." – Gynaecologist 2

Health educators: "We incorporate devices into health education classes for higher impact." – Health Educator 7

Insight: Multistakeholder collaboration between clinics, educators, and device developers enables adoption and trust.

Supporting Themes in Appendix X

Theme 7: Recommendations (PCOS-specific algorithms, professional/educational guidelines)

Theme 8: Research Participation (Collaborative studies, evidence-based adoption)

Comparative thematic analysis

Theme	Definition	Gynecologists (2,3,4)	Health Educators (5,6,7)
1. Familiarity & Awareness	**Exposure to femtech and motivation to engage.**	**Moderate–high via patients/literature. *"I see patients using Mira, and I read studies to understand its applications."***	**Mainly via patient queries/public health discussions. *"Patients often ask about these devices, which keeps me aware."***
2. Perceived Effectiveness	**Complementary tool for tracking and empowerment.**	**Useful for tracking cycles/hormones, not a replacement for tests. *"It helps track cycles but doesn't replace ultrasounds or blood tests."***	**Educational and motivational, promoting self-monitoring. *"It's more about understanding patterns than exact numbers."***
3. Psychological & Fertility Challenges	**Emotional, social, and biological barriers.**	**Variable cycles and anxiety risk. *"Some women feel anxious when seeing unexpected patterns."***	**Awareness gaps, stigma, potential worry. *"Many women don't know enough about PCOS or feel shy discussing it."***
4. Accuracy & Guidance	**Trend focus and need for professional mediation.**	**Trend tracking valued; clinical oversight needed. *"It shows trends well but cannot replace lab tests."***	**Guidance essential to prevent misinterpretation. *"We need to explain results clearly to prevent worry."***
5. User Experience & Design	**Usability and visual clarity affect engagement.**	**Intuitive interface and charts aid adherence. *"If the app is confusing, patients will stop using it."***	**Clear visuals motivate use. *"Easy-to-read charts make it less intimidating."***
6. Barriers & Integration	**Financial, cultural, and systemic challenges.**	**Barriers: cost, digital literacy, stigma. Integration via selective patient use. *"I suggest this for patients who can manage tech responsibly."***	**Barriers: cost, tech skills, cultural norms. Integration via community programs. *"We combine devices with health education sessions for better impact."***

Table 7 : comparative thematic analysis of qualitative data

Chapter 5

Summary and recommendation

Summary of key findings from survey 1(Mira users)

The 8 users (20–40 years, primarily 26–30) reported positive experiences with Mira following 2–3 months of usage. The app was easy to use and visually simple, although some had trouble with syncing data, comprehending results, and maintaining testing as a habit. Confidence was strong in hormone tracking and AI predictions, but only half indicated behavior change in health. This suggests that while Mira works well for awareness and surveillance, it has limited effect on behavior modification. Ease of use, being cost-effective, and Mira being suitable for semi-urban and rural women were critical if digital literacy, smartphone access, and affordability are addressed.

Key Insight: Trust in forecasts (75%) need not always go together with behavior change (50%), indicating that awareness itself cannot necessarily induce lifestyle changes.

Summary of key findings from Survey 2 – Non-Users

Out of 44 women aged 20–40 years (70% aged 20–30 years, 54.5% semi-urban), awareness regarding Mira was moderate, mostly through social networks and internet sources, with 11.4% learning through doctors. Cost, privacy concerns, culture stigma, and gaps in awareness were the barriers identified. But 43% were ready to adopt Mira, and doctor recommendations were the strongest driver of adoption. Most respondents (59%) had moderate belief in health apps. Workshops or demonstrations were appealing to 75%, indicating that guided learning plays a crucial role in adoption.

Implication: Adoption requires the settling of trust, affordability, and education, particularly in rural and semi-urban women with PCOS.

Summary of key findings of interview

This study explored how gynaecologists and health educators perceive and experience the use of femtech devices, focusing on the Mira Fertility Tracker for PCOS management. Interviews examined their familiarity with femtech, its perceived benefits, psychological and behavioural impacts, adoption barriers, and ways to integrate these devices into their practice. Thematic analysis was used to organize responses into key themes and sub-themes, highlighting similarities and differences between clinical and community-based perspectives, while retaining direct participant quotes for authenticity.

Gynaecologist and health educator interviews highlighted:

Familiarity and Awareness: Gynaecologists rely on clinical practice and literature; educators prioritize community awareness and empowerment.

Perceived Effectiveness: Devices help learn and self-monitor but cannot substitute for clinical evaluation.

User Experience: Easy-to-use interfaces and comprehensible visualizations are required for interaction.

Trust and Guidance: Following trends is valued over precise measurement; professional interpretation prevents anxiety.

Barriers: Cost, cultural norms, and digital literacy constrain mass uptake.

Integration and Recommendations: Experts recommend integrating femtech with workshops, counselling, and culturally modified advice; both parties support cooperative research for assurance of effectiveness.

Comparative Insight: Gynecologists are concerned with clinical precision, while health educators are concerned with community empowerment. Both hope to see future potential for behavior change but emphasize the importance of advice and support.

Summary of the key findings aligned with my research questions.

1.Usability and design perception: Women usually find Mira fertility trackers easily and visually clear, with simple navigation and charts that make it easier to interpret hormone trends. Clear visuals and engaging interfaces reduce stress and improve frequent use. Gynaecologist and health teachers emphasized that misleading layouts or complex features may discourage regular use. Implications: Designed clarity and user-friendship are important for adoption among women with PCOS in Kerala.

2. Influence on fertility related health behaviours and knowledge: The use of the device helps women monitor their cycles, understand hormonal patterns, and track the trend of ovulation. Provides a sense of empowerment, encouraging changes in behaviours, better diet, stress management and medical advice. Health educators highlighted that the tracker supports learning and self-efficiency, which increases confidence in personal health decisions. Implications: Mira facilitates both knowledge acquisition and positive health behavioural

3.Cultural, digital literacy, and economic factors affecting adoption

Economic factors: The cost of the device is a significant obstacle for some women.

Digital literacy: Smartphone and app affects comfort with navigation; Women less familiar with technology can struggle.

Cultural factor: Social stigma around PCOS and breeding tracking can discourage open use. Implications: Adoption is affected not only by the functionality of the device but also by socio -economic and cultural contexts.

4. Trust in hormone data and AI predictions: Women rely on the device to identify trends rather than accurate hormone levels. Gynaecologist and health teachers emphasized the need for professional guidance to accurately interpret the results. Anxiety can occur when unexpected results appear, suggesting that support and consultation are important for the construction of the trust. Implications: Faith is moderate and conditional; Users rely on the device for trend insights, but not as replacement for clinical evaluation.

5.Perceived value and cost-effectiveness: The device is valuable for strengthening women and providing an insight into breeding patterns. However, income is a matter of concern. Users see benefits in self-monitoring and potential long-term cost savings (e.g., less unnecessary clinical visits) but can limit the advance cost widely. Implications: While the alleged value is high, cost-effectiveness is relative and affected by financial capacity.

Comparison with Existing Literature

Theme 1: PCOS and Fertility Monitoring Challenges

Existing literature highlights that women with PCOS face irregular ovulation, making traditional fertility tracking tools unreliable (Peña et al., 2020; Knight, 2017). Your survey results align with these findings: many respondents reported difficulty in predicting fertile windows using conventional methods like BBT or OPKs. Interview insights complement this, with participants emphasizing frustration over inconsistent results and the stress of repeated failed attempts to track ovulation. Compared to prior studies, your findings extend understanding by showing how these challenges are experienced in Kerala, where cultural expectations and local healthcare access shape coping strategies.

Theme 2: Femtech as a Solution to Self-Managed Fertility

Literature suggests femtech empowers women to take control of reproductive health but notes adoption barriers in non-Western contexts (Lupton, 2017; Frost & Sullivan, 2018). Survey data from your research indicate moderate-to-high interest in femtech among women with PCOS in Kerala, while interviews reveal nuanced concerns: participants appreciated autonomy but worried about relying solely on technology in a culturally conservative environment. This corroborates prior research that adoption is influenced not just by access but also by social norms and stigma, highlighting a more context-specific perspective.

Theme 3: Usability and Interface Design of Digital Health

Prior studies underline that intuitive design, onboarding, and clear visualizations increase adherence to health devices (Nielsen, 1994; Park et al., 2024). Survey results show users rated Mira's interface positively in learnability but reported challenges in interpreting complex AI-generated hormone graphs. Interviewees confirmed these findings, expressing a desire for step-by-step guidance and simplified explanations. These results echo global findings but provide a localized lens, illustrating the importance of usability for populations with high literacy but limited digital health experience.

Theme 4: Trust in AI and Data-Driven Health Tools

Trust in AI depends on transparency, accuracy, and perceived reliability (Unver & Asan, 2022). Survey responses suggest women moderately trust Mira's predictions but express scepticism about the "black box" nature of AI. Interviews deepen this understanding: participants emphasized that repeated validation through consistent results builds trust, and that privacy concerns are real barriers in the Indian context (Sharma et al., 2024). These insights reinforce

prior literature but highlight how cultural and digital literacy factors specifically shape trust in Kerala.

Theme 5: Perceived Cost and Market Availability in India

Literature identifies cost as a critical barrier to femtech adoption in India (Mishra et al., 2024). Your survey indicates that while many women see long-term value in Mira, the initial price (~₹20,000) is prohibitive for middle-income users. Interview data show some participants rely on peer recommendations and social networks to justify the expense. These findings confirm existing studies but contextualize them for Kerala, illustrating that social validation and perceived effectiveness interact with financial constraints in shaping adoption decisions.

Practical Recommendations

1. **Improve Usability and User Interface**

Make AI-generated charts and hormone trend displays more intuitive for users with different levels of digital literacy. Provide interactive tutorials, tooltips, and educational content within the app to explain fertility and PCOS-related concepts.

2. **Build Trust and Ensure Transparency**

Clearly communicate how the AI interprets hormone data and generates fertility predictions. Include features that allow users to verify predictions and guarantee data security in line with Indian digital health standards.

3. **Address Cultural and Social Factors**

Design messages and features that are sensitive to local cultural norms and reduce stigma around fertility. Offer community support options or connections to healthcare providers to increase user confidence.

4. **Enhance Affordability**

Consider flexible pricing, rental, or subscription plans to make the tracker accessible to middle-income users. Explore collaborations with clinics, pharmacies, or insurers to lower costs.

5. **Encourage Continued Use**

Implement reminders, goal-setting tools, and feedback mechanisms to promote regular tracking. Link the app with broader women's health platforms for comprehensive reproductive health guidance.

6. **Support Policy and Future Research**

Work with local healthcare authorities to promote femtech adoption for PCOS management. Conduct long-term studies combining surveys and interviews to examine user experiences, adoption trends, and health outcomes in Indian contexts.

Contributions of study

This study provides a nuanced understanding of how women with PCOS in Kerala perceive and use the Mira Fertility Tracker, integrating insights from both surveys and interviews. By examining usability, interface design, and AI-generated hormone predictions, it highlights factors that influence user engagement, satisfaction, and trust, extending beyond clinical accuracy to real-world application. The research also uncovers cultural, economic, and digital literacy considerations that affect adoption and sustained use, emphasizing the importance of local context in shaping femtech acceptance. Furthermore, by exploring perceived value and cost-effectiveness, the study illuminates financial and social barriers to technology uptake in middle-income Indian households. Addressing gaps in existing literature—largely focused on Western contexts and technical performance—this research foregrounds the lived experiences and perceptions of Indian women, offering practical insights for designers, healthcare providers, and policymakers. Ultimately, the study informs culturally sensitive, user-centred approaches to digital reproductive health interventions in resource-constrained or socially complex settings.

Suggestions for future academic research

Long-Term Impact Studies

Explore the sustained use of fertility trackers like Mira and their influence on menstrual regulation, fertility outcomes, and health-related behaviours in women with Possesses adherence patterns and behavioural changes over extended periods that short-term studies cannot reveal.

Regional and Socioeconomic Comparisons

Conduct research across various Indian regions and socio-economic groups to understand how cultural norms, digital literacy, and economic conditions affect femtech adoption. Use findings to design culturally sensitive interventions and improve equitable access to reproductive health technology.

AI Accuracy and User Trust

Examine how AI-generated fertility predictions influence users' decision-making and confidence, particularly among women with irregular cycles. Investigate the impact of transparent interfaces, educational support, and explainable predictions on trust and anxiety levels.

Psychological and Social Influences

Study the emotional effects of fertility tracking, including stress or worry linked to AI predictions. Analyse how family, partner, or peer influence affects adoption and engagement in contexts where reproductive health discussions are sensitive.

Economic Feasibility and Market Insights

Explore price sensitivity, perceived value, and financial barriers to adopting femtech among middle-income Indian women. Provide evidence for public health strategies, pricing policies, and potential subsidy programs.

Culturally Informed Design Recommendations

Identify usability and design adjustments to align with local cultural practices, literacy levels, and digital familiarity. Support the creation of user-centred, context-appropriate femtech solutions for emerging markets.

References

Algorithms, Allyship, and Advice: A Qualitative Analysis of Fertility Tracker Marketing - Kate Sheridan Clay, Sue Ziebland, John Powell, 2025. Available at: https://journals.sagepub.com/doi/full/10.1177/20552076251356395 (Accessed: 23 August 2025a).

Bacchus, L.J. et al. (2019) 'Using Digital Technology for Sexual and Reproductive Health: Are Programs Adequately Considering Risk?' Global Health: Science and Practice, 7(4), pp. 507–514. DOI: 10.9745/GHSP-D-19-00239.

Bilal Unver, M., and Asan, O. (2022) 'Role of Trust in AI-Driven Healthcare Systems: Discussion from the Perspective of Patient Safety'. Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care, 11(1), pp. 129–134. DOI: 10.1177/2327857922111026.

Bouchard, T.P. et al. (2025) 'Validating At-Home Urinary Hormone Measurements in Postpartum and Perimenopause Fertility Transitions'. Women's Health Reports, 6(1), pp. 369–376. DOI: 10.1089/whr.2024.0157.

Brown, E.A. (2021) 'The Femtech Paradox: How Workplace Monitoring Threatens Women? S Equity.' Jurimetrics, 61(3), pp. 289–330.

Chen, T. (2025) 'The New Patriarchal Digitality? Understanding Gendered Power Dynamics through a Systematic Review of Femtech Apps in China.' Gender, Technology and Development, 29(2), pp. 263–286. DOI: 10.1080/09718524.2025.2503561.

Cromack, S.C. and Walter, J.R. (2024) 'Consumer Wearables and Personal Devices for Tracking the Fertile Window'. American Journal of Obstetrics and Gynecology, 231(5), pp. 516–523. DOI: 10.1016/j.ajog.2024.05.028.

Devi, J.T.T. and A.T. (2025a) 'Prevalence of Polycystic Ovary Syndrome among College Students in Thrissur, Kerala: A Cross-Sectional Study'. Southeastern European Journal of Public Health, pp. 2810–2820. DOI: 10.70135/seejph.vi.5005.

Devi, J.T.T. and A.T. (2025b) 'Prevalence of Polycystic Ovary Syndrome among College Students in Thrissur, Kerala: A Cross-Sectional Study'. Southeastern European Journal of Public Health, pp. 2810–2820. DOI: 10.70135/seejph.vi.5005.

Hod, M. et al. (2023) 'The Femtech Revolution—A New Approach to Pregnancy Management: Digital Transformation of Maternity Care—The Hybrid e-Health Perinatal Clinic Addressing the Unmet Needs of Low- and Middle-Income Countries'. International Journal of Gynecology & Obstetrics, 163(1), pp. 4–10. DOI: 10.1002/ijgo.15032.

International Evidence-Based Guideline for the Assessment and Management of Polycystic Ovary Syndrome – 2023. (2023) REPRODUCTIVE ENDOCRINOLOGY, (69), pp. 59–79. DOI: 10.18370/2309-4117.2023.69.59-79.

Joshi, B. et al. (2014) ‘A Cross-Sectional Study of Polycystic Ovarian Syndrome among Adolescent and Young Girls in Mumbai, India’. Indian Journal of Endocrinology and Metabolism, 18(3), p. 317. DOI: 10.4103/2230-8210.131162.

Lewis, D.V. (2024) Reproductive Endocrinology and Infertility. CRC Press.

Lupton, D. (2017) ‘Self-Tracking, Health and Medicine’. Health Sociology Review, 26(1), pp. 1–5. DOI: 10.1080/14461242.2016.1228149.

Mayring, P. (2001) ‘Combination and Integration of Qualitative and Quantitative Analysis’. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 2(1). DOI: 10.17169/fqs-2.1.967.

Mehrnezhad, M. and Almeida, T. (2021) ‘Caring for Intimate Data in Fertility Technologies’. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems. CHI ’21. New York, NY, USA: Association for Computing Machinery, pp. 1–11. DOI: 10.1145/3411764.3445132.

Menon, S. et al. (2016) ‘Development and Evaluation of a Multi-Antigen Peptide ELISA for the Diagnosis of Chlamydia Trachomatis-Related Infertility in Women’. Journal of Medical Microbiology, 65(9), pp. 915–922. DOI: 10.1099/jmm.0.000311.

Mira Partners With Glow to Empower Women Trying to Conceive. Mira Fertility Shop. Available at: https://shop.miracare.com/en-eu/blogs/resources/mira-partners-with-glow-to-empower-women-trying-to-conceive (Accessed: 14 August 2025b).

Mira’s Medical Studies, Papers, and Peer-Reviewed Publications. (2022) Available at: https://www.miracare.com/science-and-research/ (Accessed: 16 August 2025).

Mishra, P. et al. (2024) ‘Femtech Apps and Quantification of the Reproductive Body in India: Issues and Concerns’. Current Sociology, 72(7), pp. 1340–1359. DOI: 10.1177/00113921231206491.

Mishra, P., Singh, N.P. and Farooq, A. (2025) ‘Regulatory Disruptions in the Indian Telecommunication Industry’. International Journal of Innovation and Technology Management. DOI: 10.1142/S0219877024300076.

Norman, R.J. et al. (2007) ‘Polycystic Ovary Syndrome’. Lancet (London, England), 370(9588), pp. 685–697. DOI: 10.1016/S0140-6736(07)61345-2.

Paranjape, K. et al. (2019) ‘Introducing Artificial Intelligence Training in Medical Education’. JMIR Medical Education, 5(2), p. e16048. DOI: 10.2196/16048.

Park, Y.-E. et al. (2024) ‘User Experience and Extended Technology Acceptance Model in Commercial Health Care App Usage Among Patients with Cancer: Mixed Methods Study’. Journal of Medical Internet Research, 26(1), p. e55176. DOI: 10.2196/55176.

Patel, V. et al. (2016) ‘Addressing the Burden of Mental, Neurological, and substance use disorders: Key Messages from Disease Control Priorities, 3rd Edition’. The Lancet, 387(10028), pp. 1672–1685. DOI: 10.1016/S0140-6736(15)00390-6.

(PDF) The Digital Revolution in India: Bridging the Gap in Rural Technology Adoption. (2025) ResearchGate. DOI: 10.1186/s13731-024-00380-w.

Powered by AI: Examining How AI Descriptions Influence Perceptions of Fertility Tracking Applications | Request PDF. ResearchGate. DOI: 10.1145/3631414.

Sharma, P. et al. (2024) 'Barriers and Facilitators for the Use of Telehealth by Healthcare Providers in India—A Systematic Review'. PLOS Digital Health, 3(12), p. e0000398. DOI: 10.1371/journal.pdig.0000398.

Su, H. et al. (2017) 'Detection of Ovulation, a Review of Currently Available Methods'. Bioengineering & Translational Medicine, 2(3), pp. 238–246. DOI: 10.1002/btm2.10058.

Taherdoost, H. (2022) 'What Are Different Research Approaches? Comprehensive Review of Qualitative, Quantitative, and Mixed Method Research, Their Applications, Types, and Limitations.' Journal of Management Science & Engineering Research, 5(1), pp. 53–63. DOI: 10.30564/jmser. v5i1.4538.

Wiederhold, B.K. (2021) 'Femtech: Digital Help for Women's Health Care Across the Life Span'. Cyberpsychology, Behavior, and Social Networking, 24(11), pp. 697–698. DOI: 10.1089/cyber.2021.29230.editorial.

Williamson, K., and Johanson, G. (2017) Research Methods: Information, Systems, and Contexts. Chandos Publishing.

World Bank Open Data. World Bank Open Data. Available at: https://data.worldbank.org (Accessed: 16 August 2025d).

World Bank Open Data. World Bank Open Data. Available at: https://data.worldbank.org (Accessed: 12 August 2025e).

Zokaityte, A. (2025) 'FemTech Assets'. Feminist Legal Studies. DOI: 10.1007/s10691-025-09570-7.

Appendices

Appendix X: More Thematic Findings

The following themes came up during the interviews but have been added here to supplement the main findings. They provide further context, suggestions, and professional advice.

Theme 7: Suggestions

Definition: Suggestions for improved device design, performance, and professional guidance.

Gynecologists (2,3,4):

PCOS-Specific Algorithms: Specific functionality for abnormal cycles.

Quote: "Apps must consider PCOS variations." – Gynecologist 2

Professional Training: Clear instructions materials for clinicians and patients.

Quote: "We need clear protocols for interpreting results." – Gynecologist 4

Health Educators (5,6,7):

Educational Enhancement: Local instructions, visual aids, culturally appropriate guidance.

Quote: "Instructions in local languages improve understanding." – Health Educator 6

Supportive Materials: Simple explanation of results to prevent confusion.

Quote: "Women need guidance on interpreting trends correctly." – Health Educator 7

Theme 8: Research Participation

Definition: Willingness to engage in joint studies and enable evidence-based adoption.

Gynecologists (2,3,4):

Collaborative Studies: Open to clinical trials for validation.

Quote: “We’re willing to participate in clinical studies for evidence-based adoption.” – Gynecologist 3

Health Educators (5,6,7):

Collaborative Studies & Evidence-Based Adoption: Emphasize validated, practical implementation.

Quote: “Research ensures safe and effective use.” – Health Educator 6

GC APPLICATION AND CONSENT FORM

Innopharma education

GRIFFITH COLLEGE

Ethics Application & Declaration Form

DISSERTATION TITLE: **"Exploring Usability and Trust in Fertility Tracking**

Technology: A Study of Mira Tracker Use Among Women with PCOS in

Kerala, India"

RESEARCHER'S NAME: ANAGHA NANDAN

PROGRAMME OF STUDY:MS-MDT

SUPERVISOR'S NAME: MOHAMMED GANGAT

DECLARATION:
The information in this application form is accurate to the best of my knowledge. I undertake to abide by the principles outlined by Inno pharma/Griffith College ethics policy in my research dissertation. I confirm that I have completed a full ethics assessment for my research dissertation as per the college guidelines. I will not begin my primary research until such approval from my supervisor and/or ethics Committee has been obtained.
I pledge to carry out my research according to the Inno pharma/Griffith College academic integrity standards. Any results presented in my dissertation will be from my own, original research, I will reference and/or acknowledge any material or sources used in its preparation and I will not plagiarise the work of anyone else.

For Student:
STUDENT SIGNATURE:

DATE:07/07/25

The research contained within this research dissertation proposal has been approved.

For Supervisor:
Ethics Committee Approval Required: Yes ☐ No ☒ X

SUPERVISOR SIGNATURE:

DATE: 08/07/2025

For Ethics Committee (if required):

Ethics Committee Approval Given:	Yes		No	

ETHICS COMMITTEE MEMBER SIGNATURE:

DATE:

NOTE: Supervisors are responsible for ensuring their students fill in this form correctly and that all ethical areas have been considered.

SECTION 1: DESCRIPTION OF RESEARCH STUDY

1.1 Purpose and objectives of research

Purpose and Objectives of Research

This research aims to investigate how women with Polycystic Ovary Syndrome (PCOS) in Kerala experience and perceive the Mira Fertility Tracker, with a focus on its usability and the trust they place in the technology. PCOS is a common hormonal disorder that significantly impacts fertility and overall health, and while Kerala has relatively high digital literacy and healthcare awareness, many women still face challenges such as social stigma, limited access to specialized care, and financial limitations. In this setting, advanced Fem tech devices like Mira could offer a convenient and empowering way to monitor reproductive health at home.

The Mira Tracker stands out for its ability to measure four essential fertility hormones—luteinizing hormone (LH), estrone-3-glucuronide (E3G), pregnanediol glucuronide (PdG), and follicle-stimulating hormone (FSH)—providing clinical-grade, personalized data. While Mira has gained popularity globally, little research has been done to understand its impact and user experience in middle-income regions like Kerala. This study intends to fill that gap by exploring how women interact with the device and what factors influence their willingness to adopt and trust it.

The study is guided by the following key objectives:

- To assess user interactions with the Mira Tracker, specifically focusing on its ease of use, user interface, and general usability among women with PCOS in Kerala.
- To explore the impact of using the Mira Tracker on fertility awareness and related health behaviors, while identifying social, economic, and digital barriers to its broader use and recommending ways to overcome these challenges.
- To examine the level of trust users, place in the Mira Tracker's hormone analysis and fertility predictions, as well as their views on its affordability and overall value in a resource-limited Indian context.

1.2 Research methodology: [*300 words maximum/ detail how you will acquire your primary data (focus groups/interviews/online surveys etc). Proposed questions for questionnaires and/or interviews* ***must be included*** *in the appendix].*

This study adopts a mixed-methods design, integrating both quantitative and qualitative techniques to thoroughly investigate the experiences and attitudes of women with PCOS toward the Mira Fertility Tracker in Kerala. The **quantitative component** involves administering structured online surveys to women aged 20 to 40, residing in Kerala, who self-report a PCOS diagnosis. Separate surveys will be used for current users and non-users of the Mira Tracker to gather diverse perspectives. Survey questions focus on app usability, trust, behavioural changes, accessibility, and perceived challenges. This method allows for the collection of uniform data from a larger group, facilitating identification of common trends.

The **qualitative aspect** consists of semi-structured interviews with two distinct groups: gynaecologists and health educators involved in reproductive health education. These interviews aim to explore in detail their views on the device's usability, credibility, cultural acceptance, and potential integration within clinical and educational frameworks.

Interviews will be conducted either face-to-face or via online platforms, recorded with participants' consent, and transcribed for detailed thematic analysis.
Participants will be recruited through purposive and convenience sampling methods via professional contacts, social media, and health centres in Kerala. Invitations will be sent by email and through online communities, accompanied by information on the study's objectives and assurances of confidentiality.
By combining these methods, the research allows for triangulation, enhancing the robustness and validity of the findings by comparing quantitative data with qualitative insights. The full list of survey questions and interview guides is included in the appendix to ensure clarity and reproducibility.

SECTION 2: POSSIBLE ETHICAL ISSUES

Answer 'yes' or 'no' to the following questions.

SUBJECT MATTER

Does the research proposal involve:

Research into specific company activities that would be deemed sensitive or confidential	No
Research into politically and/or racially/ethnically and/or commercially sensitive areas	No
Sensitive, personal, professional, or corporate issues	No

RESEARCH PROCEDURES

Does the research proposal involve:

Research that might damage the reputation of companies or participants	No
Research that may negatively affect the reputation of Griffith College/Innopharma	No
Use of personal records without consent	No
Use of company data without consent	No
The offer of any inducements to participate	No
Audio or visual recording without consent	No
Using a language other than English	No

PARTICIPANTS

Does the research proposal involve:

People who are not competent and/or fluent in English	No
Does your research group include any of the following vulnerable groups	No

(Adults with psychological impairments; Adults with learning difficulties; Adults under the protection/control /influence of others (e.g. in care/prison); Relatives of ill people (e.g. parents of sick children); Hospital or GP participants recruited in a medical facility; persons under the age of 18)

<u>If you have answered NO to ALL questions, please go straight to Section 4.</u>

<u>If you have answered YES to ANY question in SECTION 2, you must fill in SECTION 3.</u>

SECTION 3: STEPS TAKEN TO AVOID ETHICAL ISSUES

[Only fill in this section if you answered YES to ANY of the questions in Section 3. For example, if you answered yes to including participants who are not fluent in English, you might put forward a plan that offers your survey in two languages to take this into account. Another example could be a study where the researcher wants to include information about the care received by children with a long-term condition, but it would not be ethical to approach the children directly, but it might be acceptable to instead ask parents questions about their child's care. If these plans are acceptable to your supervisor, you may not need to apply for ethical approval from the Ethics Committee].

3.1. If your ethics relates to ***Subject Matter***, outline your action plan to work around any sensitive issues.
3.2. If your ethics relates to ***Research Procedures***, outline your action plan to deal with possible ethical issues in your research procedures.
3.3. If your ethics relates to ***Participants***, outline how you will protect vulnerable persons or those that do not have English as their first language.

SECTION 4: ABOUT YOUR PARTICIPANTS

4.1. Outline your participant profile and why you have chosen them for this study *[Do not provide names except where it is deemed impossible to conceal identity].*

1. Women with PCOS Who Use the Mira Fertility Tracker:
These women are the primary users of the Mira Tracker and offer direct insights into the device's ease of use, reliability, convenience, and impact on their health behaviors. Their experiences help evaluate the effectiveness and accessibility of the tracker for managing PCOS-related fertility issues. Their feedback highlights the benefits, challenges (such as cost or digital literacy), and how the device influences their confidence in fertility management.

2. Women with PCOS Who Do Not Use the Mira Fertility Tracker:
This group includes women diagnosed with PCOS who have not adopted the Mira Tracker. Understanding their viewpoints is essential to uncover obstacles to usage, including lack of awareness, financial constraints, cultural attitudes, mistrust of technology, or other hesitations. Investigating these factors helps identify barriers and opportunities to improve the outreach and acceptance of fertility tracking tools.

3. Gynaecologists and Specialists in Reproductive Health:
Healthcare professionals involved in PCOS diagnosis and treatment provide valuable expert opinions on the clinical reliability and usefulness of home-based fertility trackers like Mira. Their perspectives inform the assessment of the device's accuracy, patient experiences, and the potential role such technologies could play alongside or in place of traditional clinical methods. They also offer insight into the healthcare system's capacity to integrate digital fertility tools.

4. Health Educators and Community Health Workers:
Those engaged in women's health education, such as school or college staff and NGO workers, play a key role in raising awareness about reproductive health. Their understanding of PCOS, digital health technologies, and societal attitudes influences how tools like Mira are perceived. They contribute important viewpoints on how femtech can be introduced through educational programs and the challenges related to digital literacy and cultural acceptance in Kerala.

4.2 How do you plan to gain access to/contact/approach your participant(s).

Women with PCOS (both Mira Tracker users and non-users):
Participants will be approached through social media platforms such as Facebook, Instagram, and WhatsApp, specifically targeting groups and communities focused on women's health and PCOS in Kerala. Posts and invitations will clearly outline the study's objectives, eligibility criteria, and the importance of participant contributions.
Additionally, collaboration with local women's health organizations and support groups will be sought to disseminate the survey and encourage participation.

Gynaecologists and Health Educators:
Healthcare professionals and educators will be contacted via professional networks including LinkedIn, as well as through direct communication with clinics, hospitals, and educational institutions in Kerala. Personalized invitations explaining the study's aims will be sent to solicit their involvement in the qualitative interviews. Purposive sampling will be used to select participants with diverse clinical and educational backgrounds relevant to the study.
Throughout the recruitment process, participants will be provided with detailed information about the study, ensuring informed consent and voluntary participation, while maintaining confidentiality and ethical standards.

SECTION 5: INFORMATION, CONSENT AND CONFIDENTIALITY

5.1 **Participant Information Letter (PIL) for participants**

[You must submit an information letter for participants with this application, as part of your appendices document. For online surveys, it is sufficient to include a paragraph summarising and explaining the purpose of the research at the beginning of the survey. In all other research e.g. interviews, phonecalls, a PIL should be provided to each participant before they are asked for their consent to take part. A template PIL is available in Moodle].

Please confirm below that your information letter covers:

Description of the research topic and method	N/A
Details of what participation will involve	N/A
Rights to anonymity	N/A
Confidentiality	N/A
Rights to withdraw from the research	N/A
The contact details of the researcher and supervisor (if necessary)	N/A

5.2 **Informed Consent Form (ICF) for participants**

[Informed consent is required for most research. For online surveys, it is sufficient to get the participant to tick two boxes at the beginning of the survey – one to state they understand the research and one to give consent. In all other research e.g. interviews, phonecalls, a signed consent form is required. If the data is gathered online e.g. zoom, a signed consent form can be scanned and sent to the researcher. A template ICF is available in Moodle. The signed ICFs, along with the surveys, audio files or interview notes etc. must be stored in the primary data folder on moodle and can be accessed by Innopharma staff for the purposes of verifying the authenticity of the research carried out and the data collected].

Please indicate below if your research requires a signed consent form by selecting the relevant option only:

Yes: my research requires signed consent, and I have attached an ICF in the appendices of my application.
No: my research study involves an online survey only and/or does not require signed consent

SECTION 6: STORAGE OF DATA

[Please ensure that you are abiding by GDPR and the national Data protection laws https://www.hrb.ie/funding/gdprguidance-for-researchers/gdpr-and-health-research/).

*The student is responsible for storage of data, and this will be handed over to the college in an electronic format as part of the thesis submission i.e. primary data and completed ICFs where applicable will be added to the primary data folder on moodle. The rationale is to keep data **if it is still useful** and there is an intention to use it further **for research** so if this is not the case then this can be stipulated here and a shorter retention period given.]*

6.1. How will you store the research data and for how long? How will you manage data protection issues? All collected research data—including survey responses and interview recordings or transcripts—will be securely stored on a password-protected laptop to ensure confidentiality. To avoid potential data loss, a backup copy will also be saved on a secure, encrypted cloud platform such as OneDrive.

The research data will be retained for up to two years after the completion of the study and the awarding of the qualification. This retention period complies with data protection regulations and allows for any necessary future review or analysis. After this timeframe, all data will be permanently and securely deleted.

Measures to safeguard participant data include:

1. **Anonymization:** Any identifiable details (such as names or contact information) will be removed and replaced with unique codes to protect participants' privacy throughout data handling and analysis.
2. **Password Security:** All electronic files containing research data will be secured with strong passwords known only to the researcher.
3. **Controlled Access:** Access to raw data will be limited solely to the researcher. Anonymized data will be submitted to the university's platform (e.g., Moodle) as part of the thesis requirements.
4. **Encryption:** Both the laptop and cloud storage backups will be encrypted to prevent unauthorized access and maintain data integrity.

SECTION 7: NON-DISCLOSURE AGREEMENT & STUDENT CONSENT

7.1 **Non-Disclosure Agreement (NDA)**
Will the final dissertation contain any information pertaining to any source what would warrant the use of a non-? Disclosure Agreement (NDA) e.g. industry-based research?

No

7.2 **Student consent**
If a Non-Disclosure Agreement (NDA) is not required, does the student consent to allow their completed dissertation to be held/published by Innopharma/Griffith College?

yes

SECTION 8: RECORDING AND RETENTION OF DISSERTATION VIVA

8.1 **Viva Recording**
The Dissertation viva will be recorded. This recording may be used to facilitate assessment by Innopharma staff, a third reader if necessary and/or if requested by the external examiner for the Programme. The recording will be held in line with current GDPR guidelines and will not be made publicly available.

SECTION 9: DOCUMENT CHECKLIST

NOTE: Applicants must attach the following documents in electronic format to the appendix.

Which documents are added to the appendix? Please tick N/A if not applicable:
9.1 Participant Information Letter (PIL) for participant YES

9.2 Informed Consent Form (ICF) for participant	YES
9.3 Questions/survey for interviewees/focus groups etc *(can be in draft form)*	Yes
9.4 Any other documents e.g. Non-Disclosure Agreement	N/A

I confirm that this application is complete, and all required documents are included in the appendix.

For Student:
STUDENT SIGNATURE:

DATE:07/07/25

SECTION 10: APPENDIX

10.1: SURVEY

I am conducting research to understand how women with PCOS who actively use the Mira Fertility Tracker manage their fertility and engage with this technology. Your feedback on usability, benefits, challenges, and overall experience with Mira is essential.
The survey will take 10 to 15 minutes, and all your responses will remain confidential. Your input will help improve the device's accessibility and effectiveness for women like you in Kerala.

SURVEY 1: Participants will be:

Women between 20–40 years

- Residing in Kerala
- Self-reporting PCOS diagnosis
- Not undergoing current clinical fertility treatment
- Having used the Mira Fertility Tracker for at least two months

1. What is your age?

   ☐ 20–25 ☐ 26–30 ☐ 31–35 ☐ 36–40

2. How long have you been using the Mira Fertility Tracker?

   ☐ 2–3 months ☐ 4–6 months ☐ 7–12 months ☐ More than 1 year

3. How often do you use the Mira Tracker?

   ☐ Daily ☐ Few times a week ☐ Weekly ☐ Occasionally

4. How easy was it to set up the Mira Tracker the first time?

   1 – Very Difficult 2 3 4 5 – Very Easy

5. How user-friendly is the app interface?

1 – Not at all 2 3 4 5 – Extremely

6. What aspects of the app or device are most difficult for you to use?
7. Which of the following features have you used in the Mira Tracker app?

   ☐ Hormone charting ☐ Fertility prediction ☐ Cycle logging
   ☐ Educational tips
8. Has using Mira led to changes in your health behavior (e.g., exercise, diet, stress management)?

   ☐ Yes ☐ No
9. If yes, what changes have you made?
10. Mira has improved my understanding of my menstrual and hormonal patterns.

    ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree
11. I feel more confident managing my fertility after using Mira.

    ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree
12. How confident are you in the accuracy of Mira's hormone tracking?

    1 – Not at all 2 3 4 5 – Very confident
13. I trust the predictions provided by the Mira app.

    ☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree
14. Compared to clinic visits, how convenient is using Mira?

    ☐ Much less convenient ☐ Less convenient ☐ Same ☐ More convenient ☐ Much more convenient
15. How would you rate Mira's value for money?

    1 – Poor 2 3 4 5 – Excellent
16. What challenges have you faced with Mira?

☐ Cost ☐ Internet access ☐ Understanding data ☐ App usability ☐ No challenges

17. Do you think Mira is suitable for women in semi-urban or rural Kerala?

☐ Yes ☐ No ☐ Not sure

18. Please explain your answer.
19. What could Mira improve to make it more accessible or trustworthy?
20. Would you recommend Mira to other women with PCOS?

    ☐ Yes ☐ No ☐ Maybe

SURVEY 2 – Non-Users of Mira Fertility Tracker

I am also interested in hearing from women with PCOS who do not currently use the Mira Fertility Tracker. I want to understand any reasons for not using such technology, concerns you may have, and your general perceptions of fertility tracking tools.

The survey will take around 10 to 15 minutes, and your answers will be kept confidential. Your participation will provide valuable insights to help address barriers and improve fertility management solutions for women in Kerala.

Target participants:

- Women aged 20–40
- Residing in Kerala
- Self-reported PCOS diagnosis
- Not currently using the Mira Tracker

1. **What is your age?**
   ☐ 20–25 ☐ 26–30 ☐ 31–35 ☐ 36–40
2. **Where do you live?**
   ☐ Urban Kerala
   ☐ Semi-urban Kerala
   ☐ Rural Kerala
3. **What is your highest education level?**
   ☐ Below 10th grade
   ☐ 10th–12th grade
   ☐ Graduate degree
   ☐ Postgraduate or higher
4. **Do you have a confirmed diagnosis of PCOS (Polycystic Ovary Syndrome)?**
   ☐ Yes
   ☐ No
   ☐ Not sure
5. **Have you heard of fertility tracking tools like the Mira Tracker?**
   ☐ Yes

☐ No

6. **If yes, how did you first hear about it?**

   ☐ social media

   ☐ Friends/family

   ☐ Doctor

   ☐ Online search

   ☐ Other (please specify): _____

7. **Have you ever used any fertility tracking method (app, calendar, thermometer, etc.)?**

   ☐ Yes

   ☐ No

8. **If not using Mira or other fertility tech, what are your reasons?** (Select all that apply)

   ☐ Too expensive

   ☐ Not aware of how to use it

   ☐ Don't trust it

   ☐ Prefer clinic-based care

   ☐ No fertility planning needs

   ☐ Privacy or data concerns

   ☐ Other: _____

Section 3: Perceptions & Openness

9. **How likely are you to try Mira or a similar tracker in the future?**

   ☐ Very likely

   ☐ Likely

   ☐ Unsure

   ☐ Unlikely

   ☐ Very unlikely

10. **Would you consider using Mira if:**

- It was more affordable. ☐ Yes ☐ No
- Your doctor recommended it? ☐ Yes ☐ No

11. **How confident are you in using mobile apps for health tracking?**
    1 – Not confident at all
    2

3
4
5 – Very confident

12. **What benefits do you see in using fertility tracking tools like Mira?** (Open text)
13. **What concerns do you have about using these kinds of tools?** (Open text)
14. **Would you be interested in a workshop or demo on how to use tools like Mira?**
    ☐ Yes
    ☐ No
    ☐ Maybe

INTERVIEW: 1 FOR GYNECOLOGIST

I am inviting gynecologists to share their professional insights on fertility tracking technologies like Mira, particularly their role in supporting women with PCOS. Your views on device accuracy, usability, cultural acceptance, and clinical integration are very valuable.
The interview will last 30 to 45 minutes and can be done in person or online at your convenience. Your responses will be kept confidential and will contribute to advancing fertility care approaches in Kerala.

Objectives on the usability, behavior impact, and trust in the Mira Fertility Tracker

7. How familiar are you with the Mira Fertility Tracker and similar fertility tracking technologies?
8. In your opinion, how effective are at-home fertility trackers in supporting women with PCOS?
9. Based on your experience, what are the most common challenges women with PCOS face in understanding and managing their fertility?
10. How would you rate the importance of user-friendly design and interface in a device like Mira for women with PCOS?
    1 – Not important 2 3 4 5 – Extremely important
11. Have any of your patients used Mira or similar femtech devices? If so, what feedback have you received from them?
12. Do you believe that using Mira can positively influence a patient's health behavior or fertility awareness? Please explain your view.
13. How confident are you in the accuracy of hormone-based tracking done by at-home devices like Mira?
    1 – Not at all 2 3 4 5 – Very confident

14. What are your thoughts on the reliability of AI-powered predictions in consumer fertility tools?
15. Do you think tools like Mira can complement or potentially replace traditional clinical methods for certain aspects of PCOS monitoring?
16. In your opinion, what cultural or socioeconomic barriers might limit the adoption of fertility tracking devices among women in Kerala?
17. How do you see the role of digital literacy in the successful use of devices like Mira?
18. Would you recommend Mira Tracker to your PCOS patients? Why or why not?
19. What improvements would you suggest for Mira to make it more acceptable and trustworthy in a clinical context?
20. How affordable do you think Mira is for middle-income patients in Kerala?
    1 – Not affordable 2 3 4 5 – Very affordable
21. How important is it for doctors to be involved in guiding the use of such femtech devices?
22. Have you observed any psychological or emotional benefits in women who use fertility tracking tools to manage their PCOS?
23. What kind of educational support do you think women need before using devices like Mira?
24. How do you think Mira and similar technologies could be better integrated into India's reproductive health ecosystem?
25. Would you be open to participating in a collaborative study or clinical trial involving femtech for PCOS? Why or why not?
26. Any final thoughts or concerns you would like to share about femtech adoption among PCOS patients in your practice?

INTERVIEW 2: for educators (e.g., health educators, school/college staff involved in women's health awareness)

I seek to understand how health educators perceive fertility tracking technologies such as Mira and their potential role in education and awareness for women with PCOS.
The interview will take about 30 to 45 minutes, either face-to-face or via video call. Your insights will be confidential and will help shape educational programs and promote digital health literacy in Kerala.

1. What is your current role and how are you involved in women's health or education?
2. Are you aware of fertility tracking technologies like the Mira Tracker? If yes, how did you come to know about them?
3. In your opinion, how important is it to integrate fertility and reproductive health awareness into educational settings?

4. How familiar are your students or the community you work with, with conditions like PCOS?
5. Have you encountered students or women who use self-monitoring fertility tools like Mira? What are your observations?
6. How do you perceive the usability of such technologies among young women, especially those with PCOS?
7. What barriers do you think women in Kerala may face in adopting tools like Mira — in terms of awareness, education, or access?
8. How can educators or institutions help improve digital literacy around women's health technology?
9. Do you believe Mira Tracker could be a useful tool in promoting fertility awareness among women in educational institutions? Why or why not?
10. What cultural or societal factors do you think might influence trust in using such devices?
11. Do you think students or young women in your network trust digital health tools for reproductive planning? Why?
12. What improvements would you suggest for integrating Femtech devices like Mira into health education or outreach programs?
13. How would you evaluate the cost-effectiveness of using Mira compared to traditional health education or clinical consultations?
14. In what ways could Mira Tracker be adapted or better presented to make it more accessible to the educational community?
15. Would you be willing to incorporate information about Mira or similar tools into your health education curriculum?
16. What kind of support or training would educators need to confidently discuss and promote such technologies?
17. How do you think parents or caregivers might respond to the inclusion of fertility tracking education in schools or colleges?
18. Do you believe there's stigma or hesitation in discussing PCOS and fertility tools in formal education environments?
19. Can you share any successful experiences or case studies where students benefited from learning about fertility awareness tools?
20. What role do you think the education sector should play in shaping trust in digital fertility and health technologies?

10.2 Sample Size Calculations

Cochranes Formula

$N = z^2 \times P(1-P)$

e^2 N = Sample Size

Z = Confidence Level

P = Population Proportion

E = Margin of Error

MIRA USERS: 8

This study focuses on women aged 20–40 residing in Kerala, who have a self-reported diagnosis of PCOS and have been using the Mira Fertility Tracker for at least two months. As Mira is a new and specialized femtech product, its adoption among women in Kerala remains limited. To reflect this niche usage realistically in the sample size calculation, the population proportion was conservatively estimated at 0.5% (i.e., P = 0.005)
This low value accounts for the restricted availability, cost factors, and limited awareness of the device within the target population.

n = (1.96) ² × 0.005 × 0.995 /
(0.05) ² n = 3.8416 × 0.004975
/ 0.0025 n = 0.01911896 /
0.0025
n = 7.65
Therefore, the required sample size is approximately **8 participants**.

MIRA NON-USERS
For women who meet the same demographic and clinical criteria—aged 20–40, residing in Kerala, and self-reporting PCOS—but **are not currently using the Mira Fertility Tracker**, a higher population proportion was p=9.13% (Devi, 2025). Non-users represent a broader segment of the population, especially considering the low market penetration of femtech in semiurban and rural India. This ensures parity in calculation and reflects the relative difficulty in accessing and engaging with this specific subgroup for primary data collection.

- $Z = 1.96$ (for 95% confidence level)
- $P = 0.0913$ (population proportion of 9.13%)
- $E = 0.05$ (margin of error of 5%) Calculation:

$N = (1.96^2 \times 0.0913 \times (1 - 0.0913)) / 0.05^2$

$N = (3.8416 \times 0.0913 \times 0.9087) / 0.0025$
$N = 0.3185 / 0.0025$
$N = 127.4$
Therefore, the required sample size is approximately **128 participants**.

PARTICIPANT INFORMATION LETTER

TEMPLATE - Participant Information Letter

Please pay attention to:

- The **content** of the letter particularly the importance of using plain English.
- The **appearance** of the letter particularly the font and font size used.
- The National Adult Literacy Agency provide useful advice to ensure the letter is suitable for your target audience and is available at www.simplyput.ie.

Exploring Usability and Trust in Fertility Tracking Technology: A Study of Mira Tracker Use Among Women with PCOS in Kerala, India

I would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or if you would like more information. Take time to decide whether to take part.

WHO I AM AND WHAT THIS STUDY IS ABOUT

I am conducting a research study titled **"Exploring Usability and Trust in Fertility Tracking Technology: A Study of Mira Tracker Use Among Women with PCOS in Kerala, India."** This study focuses on how women living with Polycystic Ovary Syndrome (PCOS) engage with digital fertility tracking tools, specifically the Mira Fertility Tracker.

Purpose of the Study:
The primary goal of this research is to investigate how women between the ages of 20 and 40 in Kerala experience and interact with the Mira Fertility Tracker. The study will examine the levels of usability and trust in the device, while also considering how access, awareness, and digital skills impact the adoption and usage of such technologies. By placing user feedback in the context of broader trends, the research aims to support the development of more inclusive and accessible femtech solutions for diverse populations, particularly in semi-urban and rural areas of India.

WHAT WOULD TAKING PART INVOLVE?

If the participant agrees to take part in this study, they will be invited to participate in an onion-one interview lasting 30 to 45 minutes. The interview will explore the participant's experience using the Mira Fertility Tracker—how easy or difficult it is to use, the level of trust placed in the device, and how it fits into daily life while managing PCOS.
With the participant's permission, the interview will be audio-recorded. This is solely for the purpose of accurately transcribing the discussion later. All recordings will be stored securely and treated as confidential. They will be used only for research purposes and deleted once the study is complete.

Participation is entirely voluntary. The participant may choose not to answer specific questions or may withdraw from the interview at any time, without needing to provide a reason. It is understood that fertility and health are sensitive topics, and all efforts will be made to ensure the participant feels comfortable, respected, and safe throughout the process.

No names or identifying details will appear in any reports or publications resulting from this research. All responses will be anonymized. The participant's contribution will help improve fertility tracking technologies and make them more accessible and supportive for other women with PCOS, particularly in regions like Kerala.

WHY HAVE YOU BEEN INVITED TO TAKE PART?

The participant has been invited to take part in this study because they meet the inclusion criteria—women aged 20 to 40, residing in Kerala, who self-report a diagnosis of Polycystic Ovary Syndrome (PCOS). These characteristics are central to the study's focus on understanding the experiences and perceptions of women with PCOS in relation to the Mira Fertility Tracker.

Participants were identified through purposive and convenience sampling methods. Recruitment took place via professional contacts, health centres, social media platforms, and online communities focused on women's health and PCOS. All individuals who meet the eligibility criteria were provided with information about the study's purpose, procedures, and confidentiality measures.

This research adopts a mixed-methods approach, incorporating both quantitative and qualitative techniques. The quantitative component involves structured online surveys distributed to eligible participants, with separate questionnaires for Mira Tracker users and non-users. These surveys assess usability, trust, behavioural changes, accessibility, and perceived challenges related to the device.

The qualitative component consists of semi-structured interviews conducted with selected participants, as well as reproductive health professionals, including gynaecologists and health educators. These interviews explore in greater depth the perceived credibility, usability, cultural relevance, and potential integration of the Mira

Tracker into clinical and educational contexts. Interviews are audio-recorded with consent and transcribed for thematic analysis.

This combination of methods allows for data triangulation, enhancing the depth and validity of the study by comparing broader trends with detailed individual experiences.

DO YOU HAVE TO TAKE PART?

[Note clearly that participation is completely voluntary and that the person has the right to refuse participation, refuse any question and withdraw at any time without any consequence whatsoever.]
Example:

Please note.

- that participation is **voluntary**.
- that a decision not to consent will have **no adverse consequences**.
- that consent can be withdrawn **at any time.**
- If you need to withdraw, please contact, i.e. *contact XXX on 01-XXXXXX*
-

WHAT ARE THE POSSIBLE RISKS AND BENEFITS OF TAKING PART?

Benefits:
Participants may benefit from contributing to research that aims to improve fertility tracking technologies and support for women with PCOS. Insights from this study could help develop better tools and healthcare approaches tailored to women's needs, especially in Kerala. Participants may also gain a better understanding of their own health and the technology they use.

Risks:
The risks associated with participation are minimal. However, discussing personal health and fertility experiences may cause some emotional discomfort or stress. Confidentiality will be strictly maintained to protect participants' privacy, but as with any research involving personal information, there is a small risk of data breach despite robust security measures.

If a participant experiences distress during the study, the researcher will pause or stop the interview and provide information on relevant support services. Participants can withdraw at any time without any negative consequences.

Overall, the study aims to ensure participant safety while generating valuable knowledge to benefit the broader community.

WILL TAKING PART BE CONFIDENTIAL?

All information shared by participants will be kept strictly confidential. Identifiable details such as names and contact information will be removed or replaced with codes to ensure anonymity in any reports, publications, or presentations. All data will be stored securely on encrypted, password-protected devices, accessible only to the research team.

If the study uses any confidential data from companies or institutions, permission will be sought in advance to access and use this information. Such data will be handled according to the agreed confidentiality terms.

Confidentiality will only be breached if there is a significant concern that the participant or someone else is at serious risk of harm. This includes situations such as abuse (physical, emotional, or sexual), child protection issues, self-harm, suicidal thoughts, or involvement in criminal activities. In these cases, the researcher is obligated to report concerns to the appropriate authorities to protect individuals' safety.
Participants should also understand that some non-anonymized data—such as signed consent forms and audio recordings—will be collected during the study. These will be stored securely and destroyed after the research concludes, following data protection guidelines.

HOW WILL INFORMATION YOU PROVIDE BE STORED AND PROTECTED?

Signed consent forms and original audio recordings will be retained in will be securely stored on a password-protected laptop to ensure confidentiality. To avoid potential data loss, a backup copy will also be saved on a secure, encrypted cloud platform such as OneDrive.until after my degree has been conferred. A transcript of interviews in which all identifying information has been removed will be retained for a further two years after this. Under freedom of information legalisation, you are entitled to access the information you have provided at any time.'

WHAT WILL HAPPEN TO THE RESULTS OF THE STUDY?

The results of this study will be submitted as part of a postgraduate dissertation and will be accessible in the college library. Where applicable, the dissertation may also be published online in the college's digital repository or academic journals. Key findings might be shared at conferences or in peer-reviewed publications related to reproductive health and digital health technologies. Anonymized data may also be used for teaching purposes to support education in relevant fields. Throughout all dissemination efforts, participant confidentiality will be maintained, and no personal information will be included in any reports, presentations, or publications.

WHO SHOULD YOU CONTACT FOR FURTHER INFORMATION?

Anagha Nandan
Master's Student, Medical Device Technology and Business
Griffith College

email:

anagha.nandan@student,Griffith.ie

phone:0894031817

CONSENT FORM

Consent to take part in research.

"Exploring Usability and Trust in Fertility Tracking Technology: A Study of Mira Tracker Use Among Women with PCOS in Kerala, India"

[This template is designed primarily for those doing qualitative interviews with adults from non-vulnerable populations and dealing with non–sensitive topics] The researcher retains one copy signed by both them and the participant. The participant should also receive a copy of consent form as a record of what they have signed up to.

- I [*insert participant name*] voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my [*interview/survey*] within two weeks after the interview, in which case the material will be deleted.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves…. [*describe briefly and simply what participation involves*]
- I understand that I will not benefit directly from participating in this research.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- [*if conducting interviews by Skype/Zoom etc*.] I agree to my interview being audio recorded.
- I understand that disguised extracts from my interview may be quoted in *[list. everywhere that you plan to use the data from the participant: dissertation, conference presentation, published papers, ejournals, library etc.].*
- If data is coming from within one company or specifically pertaining to the one company -*I understand that I will adhere to all the codes of conduct and*

employee confidentiality for company XXX and there is no expectation to breach these by partaking in this research. Include a signed confidentiality statement between researcher and company if deemed necessary.

- I understand that if I inform the researcher that myself or someone else is at risk of harm, they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
- I understand that signed consent forms and original audio recordings will be retained in *[state location security arrangements and who has access to data* - until *[specific relevant period -for students this will be until the exam board confirms the results of their dissertation]*