

Information and Communication Technology to Help Identify Women With Symptoms of Polycystic Ovary Syndrome

Vaishnavi Mardolker¹, Dr. Aisha Fernandes²

¹Student, Dept. of Information Technology and Engineering, Goa College of Engineering, Farmagudi, Goa, India

²Associate Professor, Dept. of Information Technology and Engineering, Goa College of Engineering, Farmagudi, Goa, India

Abstract - Information and Communication Technology (ICT) has massively transformed healthcare by improving daily access to care, enhancing communication, and empowering individuals. This paper focuses on the development of a mobile application as an ICT tool aimed at assisting the women of Goa in identifying symptoms and facilitating the diagnosis of Polycystic Ovary Syndrome (PCOS). By using the power of ICT, we aim to empower women with knowledge about PCOS and help them to take proactive steps towards managing their health. This tool has been tailored to the local context of Goa.

Key Words: Polycystic Ovary Syndrome, Information and Communication Technology, Mobile Application, Questionnaire, Survey.

1. INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is an endocrine disorder characterized by the presence of ovarian cysts, anovulation, and hormonal fluctuations that significantly impact a woman's life. This condition occurs when the ovaries produce elevated levels of androgens, disrupting the normal hormonal balance. The imbalance in reproductive hormones such as LH (luteinizing hormone), FSH (follicle-stimulating hormone), estrogen, and testosterone can disrupt the regular menstrual cycle. Consequently, women with PCOS may experience various symptoms, including irregular periods, excessive hair growth (hirsutism), acne, and difficulties with weight management.

PCOS is a common condition affecting the ovaries, and its exact cause is not fully understood. However, insulin resistance and genetics are believed to play significant roles in its development. Insulin resistance can lead to elevated insulin levels, which in turn contribute to increased androgen production by the ovaries. This androgen excess can result in the formation of ovarian cysts and the manifestation of PCOS symptoms. The impact of PCOS extends beyond its reproductive aspects, as it is associated with an increased risk of various health issues, such as type 2 diabetes, cardiovascular disease, and infertility. Additionally, the condition may have psychological implications, affecting a woman's mental health and well-being.

According to the World Health Organization (WHO) estimation revealed over 116 million women (3.4%) are affected by PCOS worldwide. PCOS is diagnosed with hyperandrogenism, menstrual irregularities, and varying size of cysts in ovaries, however ample of variations exist amongst individuals. This diverse condition initially develops during adolescents who are at high risk for the emergence of several symptoms including obesity, type II diabetes, infertility, endometrial dysplasia, cardiovascular disorders, and psychotic disorders.

PCOS is a multifaceted disorder, and the symptoms can vary widely from person to person. Hyperandrogenism, characterized by elevated levels of male hormones like testosterone, contributes to the distinctive features of PCOS, such as hirsutism (excessive hair growth) and acne. Menstrual irregularities, including irregular or absent periods, are common due to disruptions in the normal hormonal balance. Adolescents with PCOS face increased susceptibility to health challenges, making early detection and intervention crucial. The potential complications associated with PCOS, such as obesity and type II diabetes, highlight the importance of comprehensive healthcare and lifestyle management. Additionally, the risk of cardiovascular disorders underscores the need for a holistic approach to address both the reproductive and overall health aspects of individuals with PCOS.

Various PCOS awareness programs exist globally to educate and inform the public about Polycystic Ovary Syndrome. These programs often include online resources, community events, and social media campaigns aimed at raising awareness about the symptoms, risks, and management strategies associated with PCOS. Additionally, healthcare organizations conduct awareness campaigns to encourage regular health check-ups for early diagnosis. Regarding self-diagnosis tools, numerous online questionnaires are available for individuals to assess their symptoms and likelihood of having PCOS. These questionnaires typically inquire about menstrual irregularities, hirsutism, acne, and other common PCOS indicators. However, relying solely on self-diagnosis tools can have drawbacks, as symptoms can be diverse and may overlap with other conditions. Misinterpretation or incomplete understanding of the questions may lead to inaccurate self-diagnosis.

The effectiveness of online PCOS awareness campaigns and diagnostic tools is indeed limited by factors such as internet access and healthcare infrastructure, particularly in rural areas. In regions with limited connectivity, women may face challenges accessing the wealth of information provided by online campaigns, hindering their ability to understand and recognize the symptoms of PCOS. Limited healthcare infrastructure may also result in delayed detection and treatment, potentially leading to the exacerbation of symptoms and increased health risks for women with PCOS in rural communities. Community-based initiatives, outreach programs, and partnerships with local healthcare providers can help bridge the gap in knowledge dissemination and ensure that women in rural areas have access to the necessary information and medical services for the effective management of PCOS.

The effective method tentatively proposed involves the development of a mobile application as an innovative ICT tool aimed at assisting the women of Goa in identifying symptoms and facilitating the diagnosis of Polycystic Ovary Syndrome (PCOS). By leveraging the power of ICT, this tool aims to empower women with knowledge about PCOS, providing them with a user-friendly interface and interactive features for self-assessment. The application has been meticulously designed to cater specifically to the local context of Goa, incorporating culturally sensitive content and considering the unique healthcare landscape of the region. Through this initiative, the goal is to bridge the information gap, promote health awareness, and enable women in Goa to take proactive steps towards managing their well-being.

The paper follows the subsequent structure: Section II provides a brief overview of all the referenced papers and provides details of conducted survey. Section III in detail elaborates on the proposed methodology. Section IV concludes the paper.

2. RELATED WORK

2.1 Literature Survey

PCOS affects women worldwide, causing various physical and mental challenges. The use of the internet to spread awareness about PCOS and develop various ICT tools has significantly aided women in understanding and managing the condition. Online resources provide accessible information, helping women recognize symptoms and seek timely medical advice. Internet awareness and ICT tools, like mobile apps, have helped women understand and manage PCOS, promoting proactive health management and wellbeing. Upon analyzing various papers on PCOS and ICT tools, incorporating different approaches, findings from each paper can be summarized as follows.

This paper addressed Polycystic Ovary Syndrome (PCOS), a multifaceted endocrine disorder characterized by ovarian

cysts, an ovulation, and hormonal variations affecting women [1]. The World Health Organization estimated that 3.4% of women worldwide, totaling over 116 million, were affected by PCOS. The disorder's development was influenced by predisposing risk factors, including genetics, neuroendocrine issues, lifestyle/environment, and obesity. The pathophysiological aspect of PCOS focused on hormonal dysfunction, insulin resistance, and hyperandrogenism, resulting in impaired folliculogenesis and increasing the risk of associated comorbidities such as endometrial cancer and type II diabetes. The review provided a concise overview of the risks and pathophysiological aspects of PCOS, emphasizing hormonal dysfunction and insulin resistance. Additionally, it explored the use of drugs to address an ovulation, infertility, and clinical symptoms associated with PCOS.

In the world of growing health apps, especially those for tracking menstruation, a study looked at something important that often got missed: checking how well these apps helped with managing pain and symptoms [2]. The goal was to understand the features of these apps, like how engaging they were, how well they worked, and how they looked. The study checked 119 menstrual apps from the Apple App Store and found that 64% of them helped track pain and menstrual symptoms. However, only a few let you make detailed charts of pain symptoms over different cycles. While these apps were okay in general (according to the Mobile App Rating Scale), they didn't do much to help manage pain and symptoms. Only 10% of these apps included ways to deal with pain, showing there was more research needed to make these apps better for users.

Researchers wanted to understand how a common condition in women, called Polycystic Ovary Syndrome (PCOS), affects their quality of life[3]. They felt that the current ways of measuring this impact might not be very good, so they decided to create a new tool. In the United Kingdom, they worked with 714 women who have PCOS to develop and test a 35-question scale called the Polycystic Ovary Syndrome Quality of Life Scale (PCOSQOL). This scale looked at different aspects of life, like how PCOS affects their mood, fertility, hirsutism (excessive hair growth), and the overall impact of the condition. The results showed that this new scale could be a helpful way to understand how PCOS affects women's lives, and it could be useful for both doctors and researchers in the future.

This paper comprehensively reviewed past marketing research on mobile apps, exploring how these apps shaped customer experiences and value across different customer journeys [4]. It focused on instances where apps were linked to existing brands and situations where the app itself served as the brand. Through integrating various conceptual bases, the researchers crafted a unified framework, simplifying insights from an analysis of 471 studies.

2.2 Survey Conducted

A survey was conducted on Polycystic Ovary Syndrome (PCOS) in the local area of Mardol, Goa and was made as part of our research initiative. Mardol, a developing small town in North Goa, has both rural and urban populations residing there. The aim was to explore the specific experiences of women in this unique setting, where cultural experiences, lifestyle, and healthcare accessibility varied. By focusing on Mardol, the research intended to bridge the gap between general knowledge about PCOS and the circumstances faced by women in this town. The survey was designed to capture insights into the prevalence of PCOS and the challenges encountered by women in Mardol, offering a more accurate representation of their experiences.

To understand how women in Mardol, Goa, experience Polycystic Ovary Syndrome (PCOS), a survey was conducted with a carefully designed questionnaire. The questions were like a friendly chat, asking about different parts of their lives. We wanted to know their age, to see if PCOS is different for women in different age groups. We also asked if they were trying to conceive because that can be important. The survey delved into lifestyle habits, such as how much time they spent looking at screens, what kind of food they ate—whether they preferred healthy vegetables or not-so-healthy junk food and more.

The questionnaire had two versions to make it easy for everyone to take part. One version was on paper, and we handed it out in the town, making it accessible to those who might not use the internet much. The other version was online through Google Forms, allowing people to participate from the comfort of their homes. By using both methods, we could talk to more women and get a better picture of how PCOS affects different aspects of their lives.

The survey aimed at understanding the prevalence and impact of Polycystic Ovary Syndrome (PCOS) focused on a specific area with a total female population of 330. Out of this population, 145 responses were obtained through traditional manual surveys conducted directly within the town, showcasing local females' active engagement in sharing their experiences related to PCOS. In parallel, an online approach using Google Forms gathered 34 responses, contributing to the digital dimension of the survey. Additionally, a targeted manual survey was conducted in the girls' hostel of Goa Engineering College, collecting data on women's wellness and PCOS. This specific survey yielded 66 responses, providing valuable insights into the experiences of hostel residents. The combination of manual and online survey methods ensured a diverse and inclusive representation of the female population, enhancing the overall reliability and depth of the gathered information regarding PCOS in the area.

To enhance the comprehensibility of the survey results, we have incorporated tables illustrating the distribution of

responses for each question in both the manual questionnaires (held at Mardol and girls hostel at Goa Engineering College) and the Google Forms submissions.

3. SURVEY ANALYSIS

3.1 Analysis of Town Survey

After analyzing the manually filled forms within the town, the distribution of age groups among females was as follows: 37.2% were aged 41 and above, 28.3% fell within the 26 to 40 age range, and 34.5% were females aged 13 to 25. When asked about family history of PCOS, 6.9% responded yes, 75% said no, and 17.2% were unsure. Regarding the timing of their menstrual cycles, 77.9% reported having regular periods, 8.3% mentioned a cycle length of 35 days or more, 11% indicated menopause, and 2.1% mentioned experiencing months without menstruation. Of those surveyed, 2.1% reported unsuccessful attempts to conceive, while 97.9% are not actively trying to get pregnant. When queried about struggles in weight maintenance, 55.2% responded negatively (no), while 44.8% affirmed that they were facing challenges with weight management (yes). Concerning skin problems, 33.8% acknowledged facing such issues, while the remaining 66.2% reported not experiencing skin problems. In relation to headaches and breast pain, 55.9% reported no issues, while the majority indicated experiencing these symptoms. Regarding alcohol and tobacco consumption, 4.8% indicated occasional use, while the vast majority (95.2%) reported abstaining from these substances. Concerning regular exercise, 32.4% responded affirmatively, while the remaining participants indicated they do not engage in regular exercise. In terms of regular health checkups, 55.2% responded negatively (no), while 44.8% affirmed that they undergo regular health examinations. When asked about frequent urination and thirst, 80% responded negatively (no), while 20% indicated experiencing these symptoms. For hirsutism, 4.8% acknowledged facing this condition, with the remaining (95.2%) respondents confirming the absence of such symptoms. Regarding a diet rich in fruits and vegetables, 80.7% affirmed following such a diet, while the remaining participants denied adhering to it. Concerning the consumption of processed foods, 14.5% acknowledged a diet including processed foods, while the majority (85.5%) reported not incorporating processed foods into their diet. In response to inquiries about feeling lethargic, 34.5% confirmed experiencing lethargy, while the majority (65.5%) reported not feeling lethargic. Regarding the level of stress in life, 71.7% reported experiencing moderate stress, 22.8% acknowledged extreme stress, and 5.5% indicated no stress. When asked about their sleeping hours, 31.3% responded affirmatively, while the majority (68.8%) indicated not meeting their desired sleeping hours. The final survey question inquired about screen time, revealing that 32.4% of respondents occasionally spend

extended hours on screens, 29% do not, and 38.6% mentioned they do not.

3.2 Analysis of Hostel Survey

Below is the table (Refer Table 1) that illustrates the results of the survey conducted at the girls' hostel of Goa Engineering College in Goa of 66 responses.

The data presented in the table provides insights into women's wellness and the prevalence of Polycystic Ovary Syndrome (PCOS) among the hostel residents, contributing to a more understanding of the issue within the context of the college environment.

3.3 Analysis of Online Survey

The second phase of the survey was conducted using an online Google Form, resulting in responses from 34 females of Goa. The detailed responses are elaborated in the table format below. Refer Table 2.

In summary, the dual approach of employing both online and traditional survey methods in all three targeted locations has proven invaluable in gaining profound insights into the experiences and symptoms of PCOS among women in Goa. Through careful analysis of the collected data, a discernible pattern emerges, indicating that females, particularly in the age brackets of adolescence and 26-40 years, who experience delays in periods along with other noticeable symptoms, are more likely to be susceptible to PCOS. This situation underscores the need for raising awareness and proactive healthcare measures. As such, it is strongly recommended that individuals falling within these composition, displaying potential signs of PCOS, promptly consult with a healthcare professional for accurate diagnosis and timely intervention.

From the study, we can understand that if females have access to proper facilities, awareness initiatives, and leverage ICT tools for education, it can significantly enhance their understanding and self-education about PCOS.

4. PROPOSED METHODOLOGY

The diversity in lifestyle and geographical disparities in Goa present a considerable barrier for women, especially in rural areas, to educate themselves about conditions like PCOS. Limited access to education facilities and the internet creates a significant hurdle, preventing many from gaining essential knowledge about reproductive health. In these regions, the absence of adequate educational infrastructure often leads to a lack of awareness about prevalent health issues. Additionally, the challenging topography and remote locations make it difficult for healthcare initiatives to reach every corner of the state, leaving a significant portion of Goan females without the necessary facilities and

information to address PCOS. Bridging this gap requires targeted efforts that consider the unique challenges posed by Goa's diverse landscape, ensuring that educational resources and healthcare awareness programs are made accessible even in the most remote and underserved areas.

The current methodology involves developing a specialized mobile application to empower women in Goa to educate themselves and identify PCOS symptoms. This ICT tool is being customized with recorded awareness programs presented in the local language of Goa. The mobile application features a user-friendly interface offering educational content on PCOS symptoms, risk factors, and relevant health information. Users can engage with recorded awareness programs, ensuring that the information is delivered in a culturally sensitive and easily understandable manner. Additionally, interactive features allow women to self-assess and input personal health information, facilitating the identification of potential PCOS symptoms. This ongoing and localized approach aims to bridge information gaps, promote awareness, and empower women in Goa to make informed decisions about their reproductive health through the use of modern ICT tools.

Opting for a mobile application as the primary ICT tool is a strategic choice driven by its accessibility, widespread use, and user-friendly nature. Smart phones have become ubiquitous in today's society, and their prevalence ensures that a significant portion of the population, regardless of geographical location or educational background, possesses these devices. By developing an app, we leverage the convenience and familiarity that individuals have with their smart phones.

5. IMPLEMENTATION

The second phase of the project involved the development of a comprehensive application, for which a strategic selection of tools was made. Node.js served as the foundational server-side JavaScript runtime, ensuring the creation of scalable and high-performance server applications. React Native, a versatile JavaScript framework, played a pivotal role in crafting a cross-platform mobile experience. The editor used was Visual Studio Code.

Enclosed below are the screenshots of the developed mobile application named "PCOS HELP APP". The initial screen depicted in the Figure 1 below serves as the welcome screen for application. Figure 2 represents the menu screen of the application. Figure 3 provides information about the application through an "About Us" section. Figure 4 shows the "Know PCOS" section that illustrates what is PCOS. Figure 5 shows the "Hear from doctor" screen that contains the video of medical experts talking on PCOS to raise awareness about the same. Figure 6 is the "Take the test" screen that have questionnaires for user for self assessment. Figure 7 shows nearby Doctor's contacts.

Table -1: Analysis of hostel survey

Questions	Options	Count(%)
What is your age	13 to 25	100%
	26 to 40	0
	41 and above	0
Have any PCOS family history	Yes	4.5%
	No	95.5%
	Don't know	0
How often do you get your menstrual cycle	Regular	95.5%
	Every 20 days or less	1.5%
	Every 35 days or more	0
	Months without cycle	3%
	Menopause	0
Do you face difficulties in pregnancy	Not trying	100%
	More than a year without success	0
	Miscarriages.	0
Have Problem Maintaining body weight	Yes	36.4%
	No	63.6%
Have skin problems	Yes	25.8%
	No	74.2%
Do you notice Headaches / Abdominal Pain/ Breast Pain	Yes	25.8%
	No	74.2%

Consume Alcohol or Tobacco	Yes	0
	No	100%
	Occasionally	0
Do you regularly exercise	Yes	27.3%
	No	72.7%
Do you go for regular health checks	Yes	22.7%
	No	77.3%
Notice frequent urination/thirst	Yes	12.1%
	No	87.9%
Notice excessive hair growth on face	Yes	10.6%
	No	89.4%
Is your diet rich in fruits and vegetables	Yes	69.7%
	No	30.3%
Is your diet high in processed food and sugars	Yes	27.3%
	No	72.7%
Do you feel lethargic	Yes	50%
	No	50%
How would you define the level of stress in your life	Not stressful	3.0%
	Moderate	72.7%
	Extremely stressful	24.2%
Notice prolonged periods of sleeping	Yes	45.5%
	No	54.5%
Do you spend a lot of time in front of the screen	Yes	36.4%
	Occasionally	47.0%
	No	16.7%

Table -2: Analysis of Online Survey

Age	13 to 25	5.9%
	26 to 40	23.5%
	41 and above	70.6%
PCOS family history	Yes	26.5%
	No	52.9%
	Don't know	20.6%
Menstrual cycle	Regular	82.4%
	Every 20 days or less	0
	Every 35 days or more	11.8%
	Months without cycle	2.9%
	Menopause	2.9%
Difficulties in pregnancy	Not trying	100%
	More than a year without success	0
	Miscarriages.	0
Problem Maintaining body weight	Yes	41.2%
	No	58.8%
skin problems	Yes	38.2%
	No	61.8%
notice Headaches / Abdominal Pain/ Breast Pain	Yes	52.9%
	No	47.1%
Alcohol or	Yes	0

Tobacco	No	88.2%
	Occasionally	11.8%
regularly exercise	Yes	23.5%
	No	76.5%
regular health checks	Yes	32.4%
	No	67.6%
frequent urination/thirst	Yes	17.6%
	No	82.4%
excessive hair growth on face	Yes	17.6%
	No	82.4%
diet rich in fruits and vegetables	Yes	76.5%
	No	23.5%
diet high in processed food and sugars	Yes	35.3%
	No	64.7%
feel lethargic	Yes	29.4%
	No	70.6%
the level of stress in your life	Not stressful	5.9%
	Moderate	73.5%
	Extremely stressful	20.6%
prolonged periods of sleeping	Yes	32.4%
	No	67.6%
spend a lot of time in front of the screen	Yes	44.1%
	Occasionally	41.2%
	No	14.7%

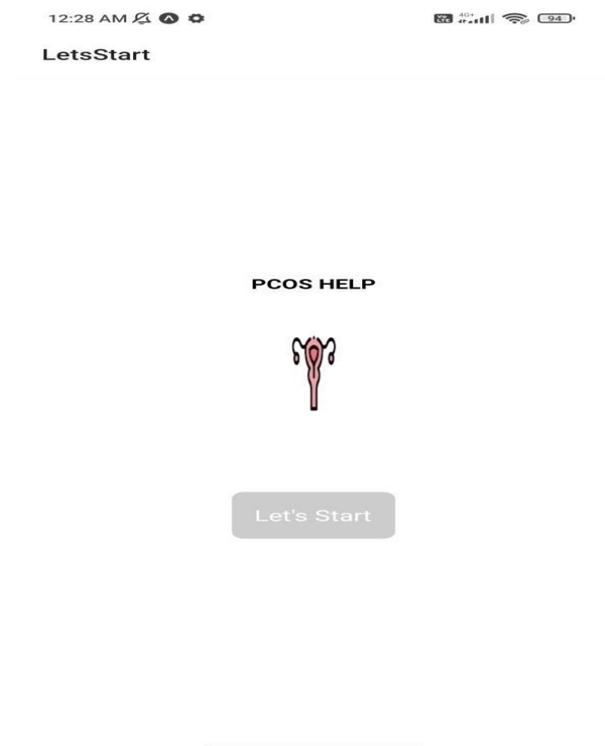


Fig -1: Welcome screen

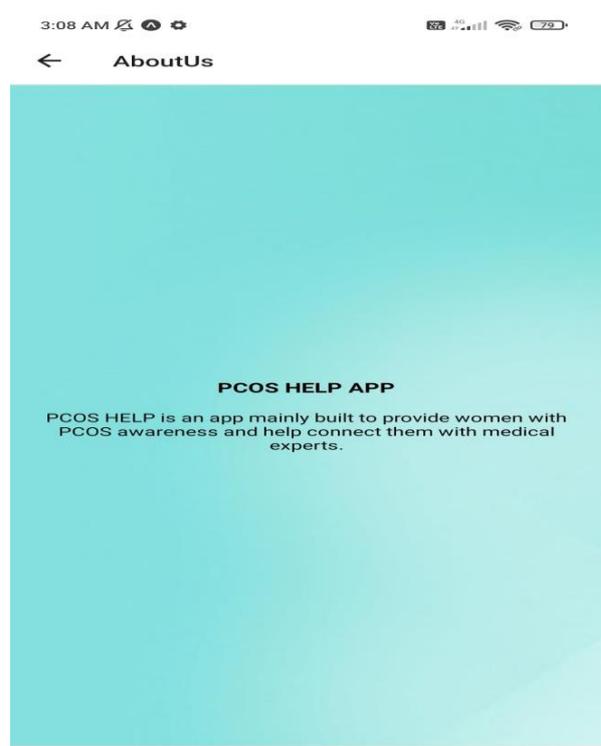


Fig -3: About Us screen

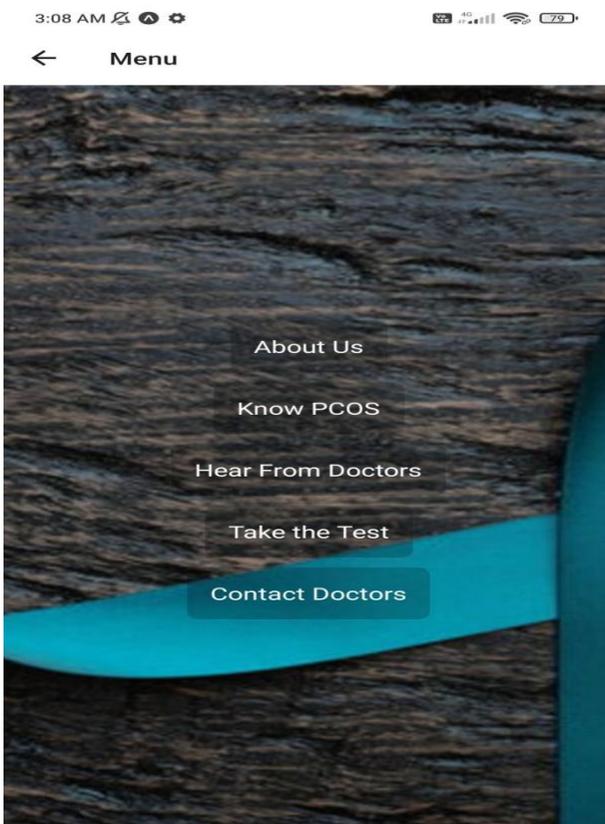


Fig - 2: Menu Screen

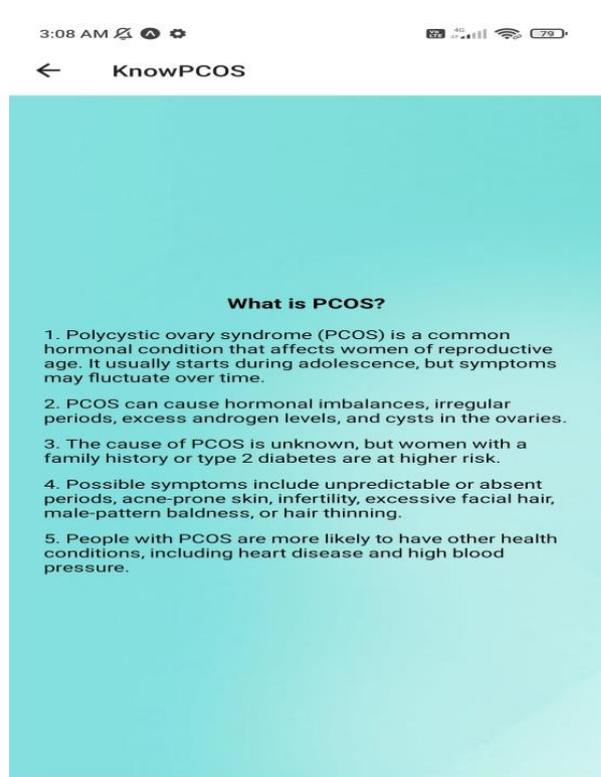


Fig -4: Know PCOS screen

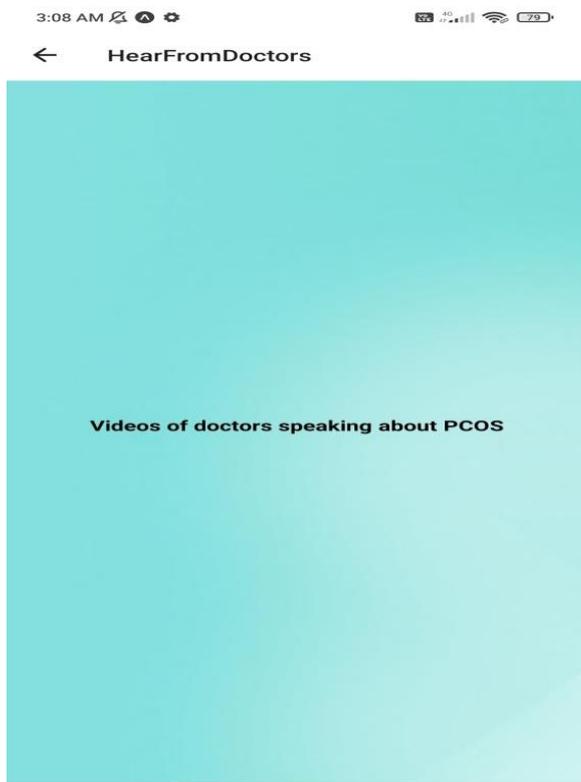


Fig -5: Hear from Doctors Screen

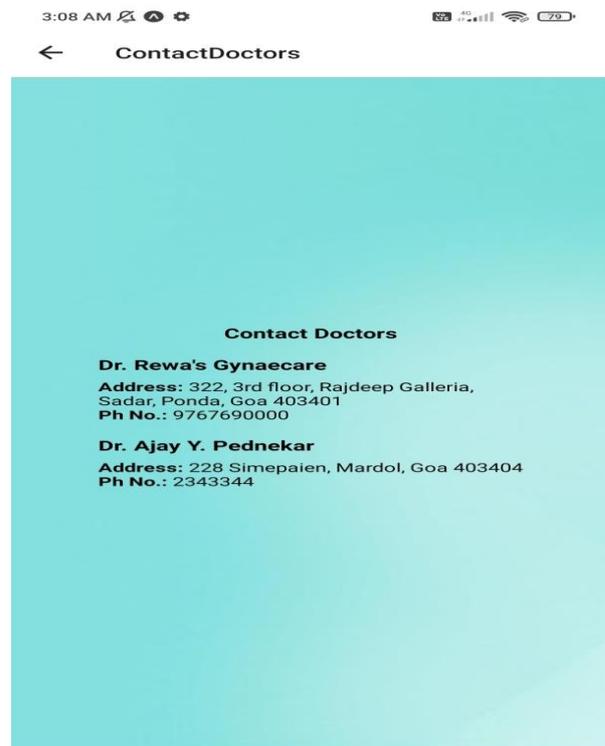


Fig - 7: Doctors Contact Screen

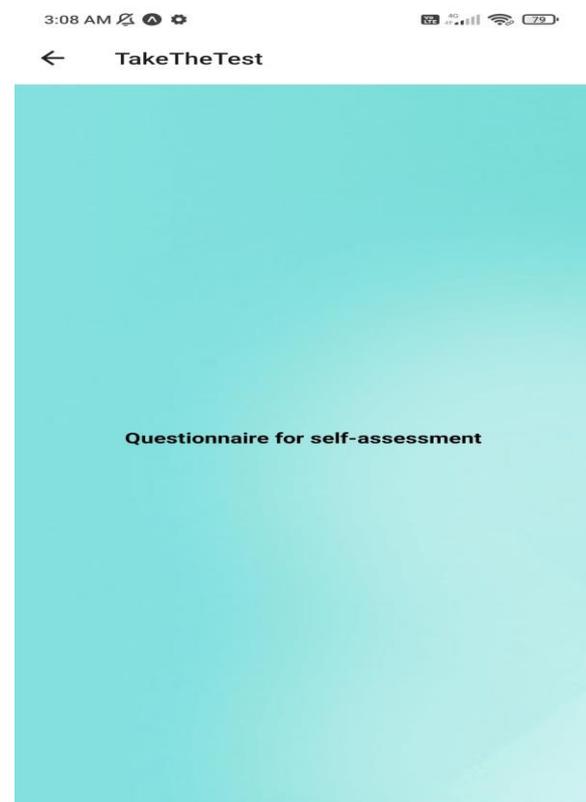


Fig -6: Take the Test Screen

In the app, there are currently some incomplete sections that we plan to address in our next course of action. One of the pending areas is the questionnaire section, where we are in the process of incorporating specific questions related to Polycystic Ovary Syndrome (PCOS). This enhancement aims to gather more targeted and relevant information from users. Additionally, we have a planned feature called the "Hear from Doctor" screen, which will involve healthcare professionals sharing insights and raising awareness about PCOS. This section is designed to provide users with credible and informative content, contributing to a holistic understanding of PCOS and promoting overall women's health. These upcoming developments are part of our ongoing actions to improve the app's functionality and user experience.

6. CONCLUSION

In conclusion, the aim of this research was two-fold: first, to educate and raise awareness among women in Goa about PCOS; and second, to develop a mobile app for identifying symptoms and disseminating crucial information. The survey, conducted both in town and online, provided valuable insights into the current situation of females in Goa regarding PCOS. However, the effectiveness of the survey was somewhat hampered by a lack of responses, highlighting the need for further outreach strategies. Nevertheless, the study highlights the need for proactive efforts to improve awareness, education, and healthcare accessibility for women in Goa, ensuring better understanding and management of PCOS.

The mobile application developed will help women in both rural and urban Goa to understand PCOS symptoms and guide them to seek necessary healthcare facilities, fostering proactive engagement in managing their reproductive health once the application is fully functioning to provide solutions.

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