



Human vs Chatbot: The Role of AI in Healthcare Marketing

Tanish Arora

Shiv Nadar School, Noida, Flat P1/04, Tower 2, Purvanchal Royal Park, Sector 137, Noida, Uttar Pradesh, India

E-mail: tanish.6564@gmail.com

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Abstract

With recent innovations in artificial intelligence (AI) and its increased usage in healthcare, medical chatbots have emerged as valuable tools in healthcare promotion. These chatbots, acting as conversational agents, can play a crucial role in addressing disparities in healthcare access, particularly in countries like India. This issue becomes even more complex when addressing stigmatised health concerns, such as those related to gynaecology and sexual health. While existing scholarship has explored factors like awareness, trust, and comfort influencing the uptake of chatbots, limited research has focused on using chatbots for healthcare marketing among socioeconomically marginalised groups. Against this backdrop, this study employs a quantitative approach with a structured survey to assess the general understanding and perceptions of reproductive health-related chatbots among vulnerable women, as well as the factors influencing both adoption and aversion. Additionally, this paper examines whether factors such as confidentiality, accuracy, physical and technological convenience, and anonymity impact the adoption of medical chatbots for sexual health information by economically vulnerable women. The findings reveal notable relationships between prior sexual health education and the willingness to use a chatbot for reproductive health information. Furthermore, the survey indicates that chatbots, due to their anonymity, confidentiality, neutral tone, and ease of access, are often preferred over gynaecologists and even search engines like Google.

Keywords: *AI, Artificial Intelligence; Chatbot; Sexual and Reproductive Health; Health Promotion; Marginalised Population; Vulnerable Groups*

Introduction

Over the last few decades, the healthcare sector in India has seen significant growth, driven by public and private investments in infrastructure, technology, and government-led initiatives such as the National Digital Health Mission (NDHM). The NDHM aims to provide universal health coverage and transform the healthcare sector through large-scale technological integration initiatives, such as electronic

health records (EHRs), which improve data management and patient care (Patel et al., 2022). Despite these advancements, a majority of the Indian population—especially in rural and remote areas—continues to suffer from inequitable access to essential healthcare services due to high costs, uneven facility distribution, and a shortage of healthcare professionals, particularly in underserved regions like the northeastern states (Kumar et al., 2021). The COVID-19 pandemic further highlighted logistical challenges, indicating the urgent need for a more resilient healthcare system to meet both routine and emergency needs (Agarwal et al., 2021).

Digital health technologies can help address many of these challenges. Hence, telemedicine and mobile health applications have emerged as innovative tools in healthcare delivery (Ganapathy & Ravindra, 2021). Telemedicine, for instance, has improved access by enabling remote consultations, significantly reducing the need to travel and the associated costs (Dinesen et al., 2016). Mobile health applications can also improve health outcomes by offering essential health education, medication reminders, and tools to manage chronic conditions, collectively reducing significant healthcare costs (WHO, 2020). Additionally, the rise of remote monitoring systems has further enhanced chronic disease management through continuous monitoring, allowing early issue detection and minimising hospital visits. Predictive analytics is also invaluable by helping healthcare providers forecast health trends and manage resources efficiently (Topol, 2019).

Among these recent health-tech innovations, artificial intelligence (AI) stands out due to its ability to analyse vast datasets, identify patterns, and provide actionable insights, thus improving overall clinical decision-making and patient outcomes (Esteva et al., 2019). AI has demonstrated performance that is on par with, and occasionally surpassing, human expertise in tasks such as interpreting radiology images and predicting disease progression (Rajpurkar et al., 2018). Applications of AI range from predictive analytics for disease prevention to diagnostic tools and patient monitoring systems, all of which enhance treatment accuracy and efficiency (Krittanawong et al., 2017). Additionally, AI's integration with blockchain technology addresses data security and integrity concerns, which are crucial in healthcare (Agbo et al., 2019). In radiology, AI-enhanced imaging quality reduces human error, while AI-supported robotic surgeries offer precision and minimally invasive solutions (Shen et al., 2021). Further, AI facilitates personalised treatment plans based on genetic, lifestyle, and medical data, leading to more effective and tailored healthcare solutions (Obermeyer & Emanuel, 2016). Moreover, AI-driven automation of administrative tasks, such as scheduling and record management, reduces the administrative burden on healthcare professionals, allowing for a greater focus on patient care (Jiang et al., 2017).

One of the most promising applications of AI in healthcare is the use of conversational AI agents or chatbots. Chatbots engage with patients in real time, provide information, answer queries, and even offer preliminary diagnoses based on reported symptoms, making them a valuable resource for healthcare access in underserved areas (Greer et al., 2022). Unlike traditional telemedicine, these chatbots offer 24/7 support and help ease the workload on healthcare professionals. Chatbots' potential to improve healthcare accessibility, especially in areas with limited medical resources, is a pivotal tool for India's healthcare future (Laranjo et al., 2018).

Despite this potential, significant challenges remain in using AI chatbots within healthcare. Studies highlight a lack of empathy and personalised interaction inherent to human healthcare providers and contribute to building patient trust (Liu & Sundar, 2018). While efficient in processing data, AI often fails to meet the nuanced emotional needs of patients, resulting in limited engagement with AI solutions (Bickmore et al., 2009). Accuracy and reliability of AI chatbots are also crucial; errors in AI recommendations can have serious consequences, and the "black-box" nature of many AI systems hinders the transparency needed to build trust with patients and providers (Tonekaboni et al., 2019). Additionally, AI systems may carry biases if trained on unrepresentative data, leading to disparities in healthcare

outcomes (Mehrabi et al., 2021). Ensuring data privacy is another critical challenge for AI-driven systems, especially given the sensitive nature of health data (Murdoch, 2021).

Acceptance of AI in healthcare also varies significantly across demographics. While younger, tech-savvy individuals are generally more receptive, older adults or those with limited technological proficiency may hesitate due to concerns over privacy, data security, and a perceived loss of human touch (Nadarzynski et al., 2020). Cultural factors and socioeconomic status further influence AI adoption; AI acceptance may be slower in communities with traditional healthcare preferences or limited access to digital tools (Winkler & Witte, 2021). Thus, addressing these concerns through user education, transparent communication, and robust data protection measures is essential to foster broader AI acceptance. Trust in AI is largely influenced by transparency and accountability, with users more likely to accept AI-driven solutions when these systems operate transparently and are accountable for any errors (Cabitza et al., 2017). Against this backdrop, this study aims to explore the feasibility and effectiveness of AI-driven chatbots to enhance healthcare access, particularly for underserved populations in India, by examining their potential benefits and limitations within the context of reproductive health.

Literature Review

Awareness of Digital Health Tools and Medical Chatbots

Awareness of chatbots as a tool for accessing healthcare information is essential for their adoption, especially in health sectors where technology use is still emerging. A recent survey of U.S. internet users found that 65% were aware of chatbots, with many having engaged with them for customer support or information retrieval. This engagement highlights a general familiarity with chatbot technology in non-health contexts, though awareness specific to health applications may still be lacking. Notably, younger users, particularly those aged 18-34, demonstrated the highest levels of awareness, likely reflecting their greater comfort and experience with digital technologies (Kennedy et al., 2023). This generational awareness disparity suggests that familiarity with chatbots for health information, particularly in sensitive areas like reproductive health, may require targeted outreach to bridge these gaps and promote adoption across demographics.

Artificial intelligence (AI) tools like chatbots have much potential for improving sexual and reproductive health accessibility, as highlighted in a recent World Health Organization (WHO) publication. However, according to the publication, a lack of awareness regarding AI applications in sexual and reproductive health remains a major barrier. Despite chatbots' promise for health screening and information delivery, low user awareness about a chatbot's reliability often leads to hesitancy. (World Health Organisation, 2024)

Building on this, limited awareness and familiarity with chatbots, especially for sensitive areas like sexual and reproductive health, pose significant barriers to their adoption. Studies suggest users may hesitate to engage with chatbots for unfamiliar purposes, especially in stigmatised health contexts. For example, a recent study found that users accustomed to banking or customer service chatbots were reluctant to use chatbots for sexual health due to their lack of awareness about chatbots specifically designed for this area. This unfamiliarity affected their perceptions of the chatbot's relevance and efficacy. The study also noted that prior non-health chatbot experiences fostered negative attitudes, as participants viewed health chatbots as overly mechanical and lacking the sensitivity required for nuanced health discussions. This lack of awareness about a chatbot's capabilities also led to concerns over its competence in handling complex, sensitive topics. (Nadarzynski et al., 2021)

While most studies deem public awareness campaigns, social media engagement, and informational outreach about the functioning and decision-making processes of chatbots a viable solution,

the issue of the stigma attached to sexual and reproductive health makes raising awareness for reproductive health chatbots uniquely difficult.

Accuracy of Information Delivery by Chatbots

Chatbot responses' reliability and perceived accuracy are also pivotal for their adoption, especially in sensitive topics such as healthcare or reproductive and sexual healthcare, where the chatbots may be compared to trusted healthcare professionals such as gynaecologists. However, studies indicate that accuracy is still a significant concern among users, often influencing their willingness to trust chatbots for complex health inquiries. For instance, a study focusing on self-diagnosis chatbots revealed that users were sceptical about diagnostic accuracy, particularly in cases requiring nuanced understanding and interpretation. Users doubted chatbots' competence to match the precision and personal care a human professional has to offer in assessing subtle symptoms; this affected their adoption of chatbots negatively. (Fan et al., 2021).

Perceived gaps in the information provided compound this hesitancy. Many health chatbots are seen as delivering overly generic or simplistic responses, lacking the depth required to address complex or highly specific health questions. In another study involving the sexual and reproductive health chatbot "SnehAI," users appreciated culturally resonant responses, which helped bridge information gaps and made the chatbot more accurate to the Indian cultural context. The cultural context improved the chatbot's credibility in users' eyes, especially in a stigmatised area like sexual and reproductive health, where trust is essential. (Kennedy et al., 2023)

Not only end-users but healthcare professionals also express concerns about the accuracy of information provided by health-related chatbots, as highlighted in studies exploring the professional perspective on digital health tools. Professionals noted that while chatbots offer substantial potential as supportive tools, there are inherent limitations in their ability to ensure high standards of accuracy without human oversight. This scepticism suggests that chatbots may function best as supplements and not replacements for professional consultations in sensitive health applications, where accuracy in diagnosis and nuanced guidance are essential (Wang et al., 2015).

While chatbots hold promise for providing accessible health information, their perceived accuracy can vary based on user expectations, cultural relevance, and professional validation. Addressing these concerns through transparency in information sourcing and contextual relevance could improve users' trust and adoption of chatbots as accurate resources for sexual and reproductive health.

Anonymity & Confidentiality of Users and Their Data

Given the stigmatised nature of sexual and reproductive healthcare, anonymity and confidentiality become central to engendering users' adoption of chatbots for sensitive health topics. The ability of sexual and reproductive health chatbots to provide private, nonjudgemental spaces for sharing concerns and gathering information has been shown to encourage users to seek information on topics they might otherwise hesitate to discuss in person. For example, studies highlight the confidential environments in chatbots that support users in freely disclosing personal health concerns, reducing the stigma associated with sexual and reproductive health queries (Mills et al., 2023). This promise of confidentiality helps users feel more secure when seeking advice on sensitive matters, essential for engagement in stigmatised health areas like sexual and reproductive health (Mohamad-Hani Temsah et al., 2023).

Anonymity and a lack of face-to-face consultation further improve user comfort and adoption of chatbots by providing a safe space that shields users from potential judgement, a benefit valued greatly in cultures where sexual and reproductive health discussions are socially restricted. Chatbots such as SnehAI in India leverage this feature by using accessible, non-intimidating language while ensuring user

anonymity. This feature is especially beneficial for the younger at-risk population, who are often most affected by sexual and reproductive health-related stigmas and who seek discreet ways to obtain accurate information without fear of physical consultations or fear of exposure (Wang et al., 2015).

However, while chatbots offer privacy and anonymity benefits, user trust is still influenced by concerns over data handling and storage. Studies have found that users remain cautious about the security of their health data and express hesitation about how information gathered by chatbots or other digital health tools is stored and utilised. Professionals within healthcare settings also share these concerns, noting that transparency around data privacy is crucial to bolstering confidence in chatbot usage, especially when preconceived notions about data privacy and data handling can significantly impact chatbots' adoption amongst users (Mohamad-Hani Temsah et al., 2023).

Hence, while chatbots can effectively support user anonymity and confidentiality, even more so than a physical consultation with a gynaecologist, balancing these benefits with transparent data practices and robust data privacy is essential for promoting the adoption of chatbots for the dissemination of sexual and reproductive health information.

Technological and Physical Convenience of Chatbots

Chatbots offer unique technological advantages even among other digital health solutions, making them a highly convenient alternative to traditional and other digital healthcare formats. Studies show that chatbots provide 24/7 accessibility to information, allowing users to obtain health information at their convenience without scheduling constraints, which are often prevalent in seeking in-person appointments. For example, a study found that the "SanIA" chatbot was especially beneficial during the COVID-19 pandemic, enabling users to access automated support remotely, thus bypassing the physical barriers to care, especially when many countries were put in a state of lockdown (Serra, 2021). This accessibility particularly benefits those who prefer independent health inquiries or face logistical challenges to in-person healthcare (Fan et al., 2021).

The quick response times provided by chatbots further improve user engagement by meeting users' expectations of immediate support and increasing physical convenience by eliminating the need to travel to a clinic for consultation or information. A study published in 2021 found that users preferred chatbots for minor health inquiries because of the rapid, on-demand responses, making chatbots an ideal first point of contact for low-stakes health questions that don't require healthcare provider's input (Nadarzynski et al., 2020). Likewise, another study highlighted that the "SnehAI" chatbot delivered prompt, reliable responses for sensitive health topics, which satisfied user needs for fast, private information retrieval (Wang et al., 2015).

Hence, chatbots in the healthcare domain demonstrate technological and physical convenience by offering immediate, accessible, and confidential responses that fulfil user needs for discreet, timely health information. However, studies also show that too-quick responses can often lead to interactions that feel too non-humane and mechanical. (Nadarzynski et al., 2020)

Confidence in the Responses and Information Given by a Chatbot

User confidence in the chatbot's ability to understand and respond accurately to sensitive health queries is a key factor in adoption. Studies have found that chatbots could deliver information comparable to that provided by physicians regarding user satisfaction and understanding of user intent. In a trial comparing chatbot answers to physician responses to breast cancer questions, users rated both sources of information as equally reliable, with a non-inferiority score indicating that the users felt the chatbots provided satisfactory, trusted information without sacrificing quality (Bibault et al., 2019).

Further, another study highlights that user confidence in AI-based chatbots improves significantly with anthropomorphic design elements, such as the chatbot's ability to simulate human-like understanding and responsiveness. The study's findings suggest that users are more likely to trust a chatbot if they perceive it as competent and responsive to nuanced health queries (Pillai & Sivathanu, 2020).

This confidence is not solely based on the information provided by the chatbot but also on the chatbot's perceived intelligence and adaptability. A study published in 2019 found that users felt more confident in chatbots that leveraged natural language processing to deliver well-structured and coherent responses. The study emphasised that chatbots designed to interpret context, offer specific guidance, and personalize responses were trusted more by users, as these characteristics made the chatbot feel more capable of understanding their unique health needs (Io & Lee, 2018).

Together, these findings suggest that while confidence in a chatbot is often linked to its ability to provide only accurate information, the confidence factor covers many other sub-factors, such as perceived competence and human-like interaction capabilities.

Comfort in Discussing Sexual Health Issues with a Chatbot

A key advantage of chatbots in sexual and reproductive health is their ability to engender comfort through a neutral tone, judgement-free interaction, and empathetic engagement, which are crucial when disseminating information about a stigmatised topic. Research indicates that users find chatbots more usable and approachable than their human counterparts for discussing sensitive health issues, largely due to the perceived lack of judgment. For example, a study shows that participants appreciated the chatbot's neutral stance and ability to allow disclosure without fear of stigma or embarrassment, which is often a barrier in face-to-face healthcare consultations. Users noted that this judgement-free environment facilitated more open and honest communication about their health concerns (Nadarzynski et al., 2021).

In addition to neutrality, empathy is essential for encouraging user comfort. Studies show how different types of empathetic expressions—cognitive empathy (understanding the user's feelings) and affective empathy (sharing the user's feelings)—impact user satisfaction. A study's findings indicate that users respond more positively and are more comfortable when chatbots express empathy, as it conveys attentiveness and understanding (Liu & Sundar, 2018).

The chatbot's perceived neutrality and empathy make it a valuable resource in sexual reproductive health; the same study found that while some users may feel an "uncanny" response to overly human-like empathy, most are comfortable with expressions of cognitive empathy. Users perceive this level of empathy as a facilitator for understanding and responding to their concerns without excessive personalisation. It allows for a balance between emotional support and professionalism, promoting ease in discussing intimate health topics.

These findings emphasise that chatbots designed for sexual reproductive health should prioritise neutral, nonjudgemental responses while incorporating cognitive empathy to ensure users feel comfortable and supported in discussing personal health issues.

Research Method

Study Design

The study employs quantitative analysis to explore the potential of chatbots for healthcare marketing, especially in the context of stigmatised healthcare topics such as sexual and reproductive

health and among a sample group that broadly suffers from a lack of sufficient access to regular and affordable healthcare services. Quantitative data was collected through structured, closed-ended survey questions, often including a Likert scale.

Participants and Sampling

The study's participants were women from weaker socioeconomic backgrounds, such as household helpers and school support staff. 64 participants were surveyed, representing various age groups, caste categories, education levels, and marital statuses. Participants were selected using convenience and snowball sampling.

Data Collection Process

The survey was conducted in person over a month. Each participant received specific instructions on how to complete the survey (see Appendix A). I provided a 10-minute demonstration of the Google Assistant chatbot, encouraging participants to engage by asking questions related to reproductive or sexual health. This demo allowed participants to understand the chatbot's functionality before responding to questions about their experience.

Following the chatbot demonstration, I administered a structured survey with Likert scale questions for quantitative analysis. To ensure clarity, I repeated questions in participants' native languages when necessary while taking care not to influence their answers.

Ethical Considerations

Verbal consent was obtained from all participants before conducting the survey. Participants were informed that their responses would remain anonymous and be used only for research purposes. Given the topic's sensitive nature, especially in India, volunteers were instructed to create a comfortable environment, ensuring participants felt at ease during the survey.

Variables Measured

The survey measured seven key variables related to chatbot usage in the context of stigmatised healthcare topics such as reproductive health;

1. **Awareness:** Awareness of the existence and functioning of a chatbot.
2. **Accuracy:** Confidence in the accuracy of information provided by chatbots, especially when compared to that provided by gynaecologists.
3. **Anonymity & Confidentiality:** Perceived level of privacy when using chatbots for sensitive health discussions, especially when compared to that during a consultation with a gynaecologist.
4. **Technological Convenience:** The ease of using chatbots, especially when compared to other methods of information retrieval such as web-engines and in-person consultations with a gynaecologist.
5. **Physical Convenience:** The comfort level when using chatbots in the absence of physical interactions.
6. **Confidence:** Overall confidence in the responses and information given by a chatbot, compared to that of gynaecologists.

7. Comfort: The ease of discussing sensitive sexual health topics via chatbots, compared to gynaecologists.

Assessment of Normality

The normality of all seven variables (awareness, accuracy, anonymity & confidentiality, physical convenience, confidence, comfort, and technological convenience) was tested using a combination of Shapiro-Wilk, Kolmogorov-Smirnov, and Anderson Darling tests. A p-value of less than 0.05 was taken to be significant, in which case the variable was considered to violate the assumption of normality, and non-parametric tests instead of parametric tests were applied for these variables for further analysis.

Statistical Tests Used

To analyse the influence of demographic factors (age, caste, religion, education, marital status) on the key variables;

- Parametric tests such as ANOVA and t-tests were used for normally distributed variables (Accuracy, Confidence, Comfort, Anonymity & Confidentiality)
- Non-parametric tests such as Kruskal-Wallis were applied to non-normally distributed variables (Awareness, Physical Convenience, Technological Convenience)

Depending on the normality of the variable, Mann-Whitney U tests and independent t-tests were used to compare two groups (e.g., married vs. unmarried participants).

The significant level was set at $p < 0.05$ for all statistical tests.

Data Analysis

Descriptive statistics such as mean, median, and standard deviation were calculated for each variable.

Descriptive Statistics

This section of the analysis presents the descriptive statistics for the demographic variables and the key variables measured in the study. For each demographic variable, the frequency counts and percentages were calculated to provide an overview of the various characteristics of the sample. Awareness of sexual health education was also considered in the demographic variables. The mean, median, standard deviation, minimum, maximum, and normality checks were calculated for each key variable. The quantitative responses for each variable were added to calculate the central tendencies and the variability.

By studying the central tendencies and variability of the variables, the study aims to provide insight into the overall distribution of responses, providing a foundation for further analysis.

Variable	Category	Frequency (n)	Percentage (%)
Age	18-25	21	32.81%
	26-35	20	31%
	36-45	17	27%
	46+	6	9%

Education Level	None of the above	21	32.81%
	Completed Class 8	12	18.75%
	Completed Class 10	18	28.13%
	Completed Class 12	12	18.75%
	Pursuing College	1	1.56%
Marital Status	Married	39	60.94%
	Unmarried	17	26.56%
	Widowed	4	6.25%
	Separated	2	3.13%
	Divorced	2	3.13%
Religion	Hindu	49	77%
	Muslim	10	16%
	Christian	5	7.81%
Caste	Don't want to specify	20	31.25%
	General	22	34.38%
	Scheduled Caste	10	15.63%
	Other Backward Classes	10	15.63%
	Scheduled Tribe	2	3.13%
Personal Phone Access	Yes	58	92.06%
	No	5	7.94%
Regular Internet Connection Access	Yes	40	62.50%
	No	24	37.50%
Awareness of sexual health education	0 (Not aware at all)	13	20.31%
	0.25	19	29.69%
	0.5	24	37.50%
	0.75	4	6.25%
	1 (Fully aware)	4	6.25%

As shown in *Table 1*, the sample exhibits a diverse range of demographic characteristics with particular concentrations in specific categories.

The age distribution shows that most participants are younger adults, with over 63.81% falling between 18 and 35, suggesting that the sample may be more accepting of digital health solutions. Most participants (79.69%) reported completing education up to Class 10 or less, with only a small portion (1.56%) pursuing higher education. Lower levels of formal education imply limited exposure to formal health education resources. A significant portion of the sample is married (60.94%), while unmarried individuals comprise about 26.56%, and the majority of respondents identify as Hindu (77%), with

smaller proportions identifying as Muslim (16%) and Christian (7.81%). Respondents are fairly distributed across caste categories, as seen in *Figure 1*.

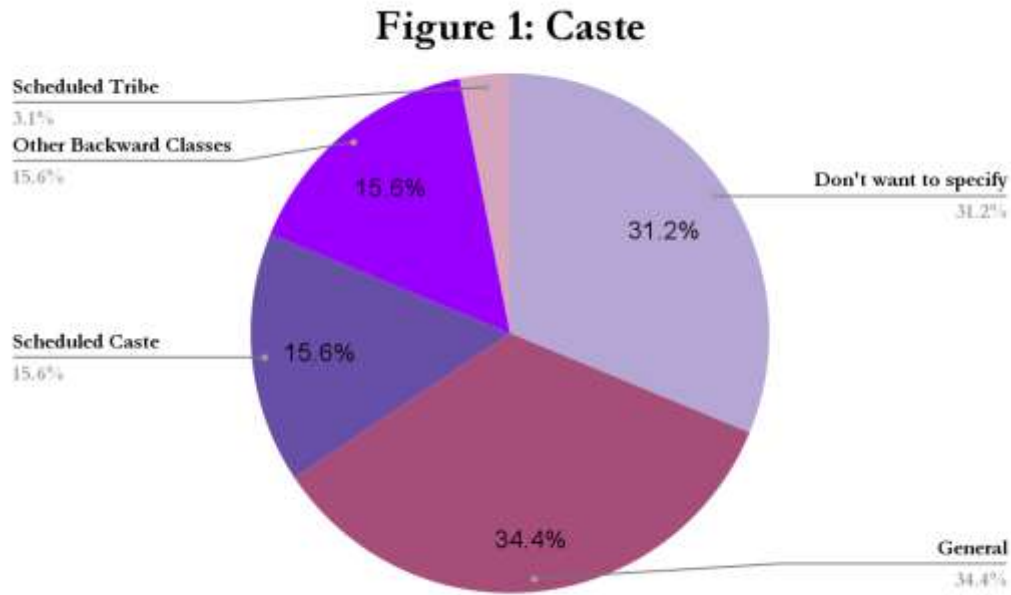


Figure1: Caste

Furthermore, most respondents (92.06%) report having access to a personal phone, and a majority (62.50%) have a regular internet connection. The high level of access to personal phones and internet connectivity is a positive indicator of the feasibility of implementing chatbot solutions. Levels of awareness of sexual health education vary greatly, with 37.5% indicating moderate awareness but a substantial proportion (20.31%) reporting no awareness at all. The varying levels of awareness are represented in *Figure 2*.

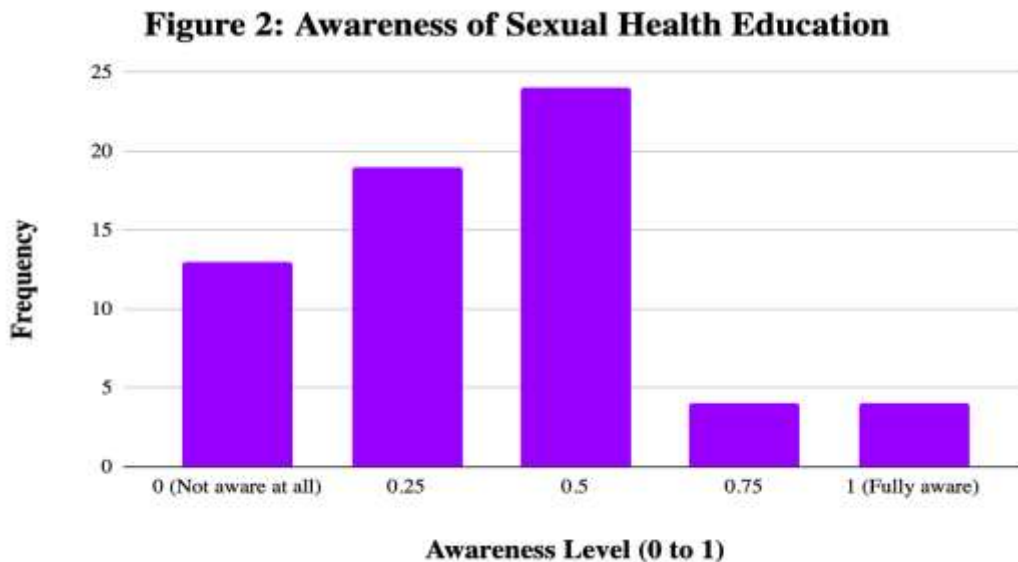


Figure 2: Awareness of Sexual Health Education

The analysis of the demographic profile reveals trends consistent with the typical characteristics of rural and vulnerable populations, particularly in terms of age, education, and access to healthcare resources. These insights provide a foundation for examining participants' perceptions and attitudes toward using chatbots in reproductive health.

TABLE 2: DESCRIPTIVE STATISTICS OF KEY VARIABLES

	Awareness	Accuracy	Anonymity & Confidentiality	Technological Convenience	Physical Convenience	Confidence	Comfort
Mean	0.19	0.49	0.61	0.72	0.65	0.56	0.56
Median	0.17	0.5	0.57	0.75	0.75	0.58	0.55
Std. Deviation	0.18	0.25	0.26	0.22	0.3	0.22	0.19
Minimum	0	0	0	0	0	0	0.1
Maximum	0.75	1	1	1	1	1	1
Mean ± Std.	0.19 ± 0.18	0.49 ± 0.25	0.61 ± 0.26	0.72 ± 0.22	0.65 ± 0.3	0.56 ± 0.22	0.56 ± 0.19
Normality (p-value)	<0.001	0.063	0.003	<0.001	<0.001	0.127	0.851

Following the demographic analysis, *Table 2* represents the descriptive statistics of the key variables central to this study: awareness, accuracy, anonymity & confidentiality, technological convenience, physical convenience, confidence, and comfort.

The descriptive statistics of the key variables reveal essential insights into participants' attitudes towards using chatbots in reproductive health. Awareness of chatbots had a notably low mean of 0.19 (SD = 0.18), indicating that participants are largely unfamiliar with existing chatbot services. Based on the respondents' usage of the chatbots before responding, the perceptions of the accuracy of chatbots were moderate (M = 0.49, SD = 0.25), indicating moderate variance and mixed opinions about the trust in the information provided by chatbots. Anonymity & confidentiality were rated relatively highly (M = 0.61, SD = 0.26), suggesting that participants believe the chatbot performs well in preserving user privacy—a crucial factor in the context of stigmatised topics like reproductive health. Participants rated the chatbot highly on technological convenience (M = 0.72, SD = 0.22) and physical convenience (M = 0.65, SD = 0.30), indicating that they perceive chatbots as easy to use and accessible, which is important when devising digital solutions for the rural population, which is not completely digitally literate. The physical convenience score also aligns with the lack of healthcare facilities in rural areas, increasing the barrier to accessing sexual health education and information from doctors in person. Confidence in the chatbot's performance was rated moderately (M = 0.56, SD = 0.22), as was comfort (M = 0.56, SD = 0.19). These findings indicate that while participants generally perceive chatbots as somewhat effective, there is room for improvement in how confident and comfortable users feel when engaging with chatbot technology for reproductive health.

The descriptive statistics analysis provides valuable insight into participants' perceptions of chatbot use in reproductive health, highlighting areas of strength and opportunities for improvement. While participants rated chatbots highly regarding technological and physical convenience, awareness of chatbot services remains low, indicating a need for increased outreach of possible digital health solutions

to gaining sexual health information. Additionally, the favourable perceptions of anonymity & confidentiality suggest that chatbots hold the potential for addressing sensitive topics like reproductive health. However, moderate scores for accuracy, confidence, and comfort indicate a need for further refinement of chatbot services to build greater user trust and ease of use among users.

Demographic Influence

Building on the descriptive statistics, this section of the analysis examines how demographic factors such as age, education, marital status, and religion, as well as access to phones and the internet and level of awareness about sexual health education, influence participants' perceptions of chatbots in reproductive health. Through hypothesis testing, we explore where there are significant differences in key variables across demographic groups. This analysis aims to uncover whether certain demographic factors are critical in shaping how individuals perceive and engage with chatbots, especially in stigmatised contexts.

Marital Status

Drawing from the results of a Kruskal-Wallis test (*Table 3*), there is a significant difference in perceptions of anonymity and confidentiality based on marital status ($H(4) = 11.02, p = 0.026$). Married participants reported higher perceptions of anonymity & confidentiality (median = 0.63) compared to unmarried (median = 0.53), widowed (median = 0.32), and separated (median = 0.56) participants. Divorced participants, however, rated anonymity & confidentiality the highest (median = 0.81). These results suggest that marital status plays a role in how participants perceive the privacy offered by chatbots, with divorced and married individuals perceiving higher levels of anonymity & confidentiality in chatbots for reproductive health.

Independent Variable	Dependent Variable	Test	Sample sub-group	Median	H(4)	p-value
Marital Status	Anonymity & Confidentiality	Kruskal-Wallis	Married	0.63	11.02	0.026
			Unmarried	0.53		
			Separated	0.56		
			Widowed	0.32		
			Divorced	0.81		

Religion

An ANOVA (*Table 4*) revealed significant effects of religion on both accuracy ($F(2, 61) = 3.28, p = 0.044, \eta^2 = 0.1$) and comfort ($F(2, 61) = 3.43, p = 0.039, \eta^2 = 0.1$). Hindu participants perceived chatbot accuracy more favourably ($M = 0.49, SD = 0.25$) compared to Christian participants ($M = 0.23, SD = 0.14$), while Muslim participants rated accuracy highest ($M = 0.56, SD = 0.21$).

Comfort with chatbot use followed a similar pattern, as shown by an ANOVA (*Table 4*). Muslim participants reported the highest comfort ($M = 0.67, SD = 0.19$), followed by Hindu participants ($M =$

0.54, SD = 0.19) and Christian participants (M = 0.42, SD = 0.12). These findings suggest that religious background influences both perceived accuracy and comfort when using chatbots for reproductive health.

TABLE 4: Influence of Religion

Independent Variable	Dependent Variable	Test	Mean ± Std (Hindu)	Mean ± Std (Muslim)	Mean ± Std (Christian)	F(2)	p-value	Effect Size (η^2)
Religion	Accuracy	ANOVA	0.49 ± 0.25	0.56 ± 0.21	0.23 ± 0.14	3.28	0.044	0.1
	Comfort		0.54 ± 0.19	0.67 ± 0.19	0.42 ± 0.12	3.43	0.039	0.1

Regular Internet Connection Access

As per the results of a t-test (*Table 5*), participants with regular internet access perceived chatbots as more accurate (M = 0.26, SD = 0.04) compared to those without regular internet access (M = 0.21, SD = 0.04), with a statistically significant difference ($t(61) = 2.46, p = 0.017, d = 0.64$).

Additionally, the Mann-Whitney U test results (*Table 5*) indicated that participants with regular internet access rated anonymity and confidentiality higher (median = 0.63) compared to those without regular internet access (median = 0.50; $U = 321, z = -2.09, p = 0.037, r = 0.26$). These results suggest that individuals who frequently use the internet trust chatbots' accuracy and privacy features more.

TABLE 5: Impact of Regular Internet Connection

Independent Variable	Dependent Variable	Test	Mean ± Std (Yes)	Mean ± Std (No)	t(61)	p-value	Effect size (Cohen's d)
Regular Internet Connection Access	Accuracy	t-test	0.26 ± 0.04	0.21 ± 0.04	2.46	0.017	0.64
			Median (Yes)	Median (No)	U-Value (z)	p-value	Effect size (r)
	Anonymity & Confidentiality	Mann-Whitney U-test	0.63	0.5	321(-2.09)	0.037 (exact: 0.039)	0.26

Awareness of Sexual Health Education

A Kruskal-Wallis test (*Table 6*) revealed that participants with higher awareness scores rated anonymity and confidentiality more positively ($H(4) = 11.54, p = 0.021$), with those scoring 0.75 on the awareness scale reporting the highest anonymity (median = 0.94).

Additionally, an ANOVA (*Table 6*) found a significant effect of awareness on perceptions of accuracy ($F(4, 61) = 2.92, p = 0.029, \eta^2 = 0.17$), with higher awareness linked to higher accuracy ratings (M = 0.75, SD = 0.07 for awareness score of 0.75).

Table 6 further shows that confidence was also significantly affected by awareness ($F(4, 61) = 3.47, p = 0.013, \eta^2 = 0.19$), with participants who had greater awareness of sexual health reporting higher confidence in chatbot use (M = 0.81, SD = 0.21 for an awareness score of 0.75). These findings indicate that greater awareness of sexual health education enhances participants' perceptions of chatbot accuracy, anonymity, and confidence.

TABLE 6: Impact of Awareness of Sexual Health Education

Independent Variable	Dependent Variable	Test	Median (0)	Median (0.25)	Median (0.5)	Median (0.75)	Median (1)	H(4)	p-value	
Awareness of sexual health education	Anonymity & Confidentiality	Kruskal-Wallis	0.5	0.63	0.5	0.94	0.81	11.54	0.021	
			Mean ± Std (0)	Mean ± Std (0.25)	Mean ± Std (0.5)	Mean ± Std (0.75)	Mean ± Std (1)	F(4)	p-value	Effect Size (η ²)
	Accuracy	ANOVA	0.38 ± 0.21	0.43 ± 0.22	0.5 ± 0.25	0.75 ± 0.07	0.69 ± 0.36	2.92	0.029	0.17
	Confidence		0.54 ± 0.19	0.48 ± 0.25	0.57 ± 0.16	0.81 ± 0.21	0.79 ± 0.31	3.47	0.013	0.19

The analysis reveals that demographic factors such as marital status, religion, internet access, and awareness of sexual health education significantly impact perceptions of chatbot use in reproductive health. Moreover, age, education, and caste seemingly do not affect the participants' perceptions. The analysis shows that married and divorced participants viewed chatbots as offering more anonymity & confidentiality. At the same time, religion influenced perceptions of accuracy and comfort, with Muslim participants generally reporting higher comfort levels. Regular internet access was associated with positive perceptions of chatbot accuracy and privacy. Finally, participants with higher awareness of sexual health education consistently related chatbot performance—especially accuracy, anonymity, and confidence—more favourably. These findings suggest that demographic factors play a critical role in shaping attitudes towards chatbot use and highlight the importance of tailoring interventions to meet the needs of different population groups.

Correlation Analysis

This section explores the relationships between key variables using correlation analysis. By examining the strength and direction of these relationships, significant associations can be found, providing insight into how different aspects of chatbot use in reproductive health influence one another.

Table 7 represents the significant results of a correlation analysis between all variables.

Table 7: Correlation Analysis				
Variable 1	Variable 2	Correlation Coefficient	p-value	Test Type
Accuracy	Confidence	0.66	<0.001	Pearson
Confidence	Comfort	0.58	<0.001	Pearson
Technological Convenience	Physical Convenience	0.7	<0.001	Spearman
Technological Convenience	Confidence	0.55	<0.001	Spearman
Physical Convenience	Confidence	0.64	<0.001	Spearman
Physical Convenience	Comfort	0.59	<0.001	Spearman

Accuracy and Confidence

A strong positive correlation exists between accuracy and confidence ($r = 0.66$, $p < 0.001$), indicating that participants who perceive chatbots as more accurate tend to feel more confident using them. Ensuring that chatbots provide reliable and accurate information is crucial for increasing user confidence.

Confidence and Comfort

Confidence and comfort are positively correlated ($r = 0.58$, $p < 0.001$), suggesting that participants who feel more confident in the chatbot's functionality are also more comfortable using them. Improving user confidence could help increase overall comfort with chatbot use.

Technological Convenience and Physical Convenience

Technological and physical convenience also have a strong positive correlation ($r = 0.70$, $p < 0.001$). Participants who find chatbots easy to use from a technical perspective also tend to find them physically convenient to access, suggesting that both forms of convenience serve as critical factors for the effective adoption of chatbot services.

Confidence and Convenience (Technological and Physical)

Confidence in using chatbots strongly correlates with both technological convenience ($r = 0.55$, $p < 0.001$) and physical convenience ($r = 0.64$, $p < 0.001$). This indicates that participants who find chatbots easy to use and access are more confident using them. Improving both technological and physical convenience and accessibility is, hence, pivotal for building user confidence in chatbots.

Physical Convenience and Comfort

A strong positive correlation exists between physical convenience and comfort ($r = 0.59$, $p < 0.001$). Participants who perceive chatbots as physically easy to access also feel more comfortable using them.

The correlation analysis highlights key relationships between variables that influence chatbot adoption. The increased frequency of convenience (both physical and technological) and confidence signifies the importance of optimising these variables the most to ensure increased accessibility of chatbots and increase users' confidence in the service's functionality.

Predictors of Willingness to Use Chatbot

This analysis section examines how the key variables predict participants' willingness to use and interact with chatbots for reproductive health purposes. A series of regression analyses were conducted to assess the individual contributions of each predictor variable (awareness, accuracy, anonymity & confidentiality, physical convenience, technological convenience, confidence, and comfort) to participants' willingness to use chatbots. By identifying the most influential predictors, the analysis aims to provide insight into which features are crucial for improving user adoption and engagement in reproductive health contexts, particularly among populations with limited healthcare access.

Table 8 provides the model summary statistics for each predictor, showing the proportion of variance in willingness explained by each variable (R^2) and the statistical significance of each predictor's model (F-value and p-value). A higher R^2 value suggests that the predictor is more relevant in understanding and predicting willingness, while a significant F-value indicates that the predictor's relationship with willingness is statistically meaningful.

Table 9 presents the regression coefficients for each predictor, detailing the strength and direction of their relationships with willingness to use chatbots. The B coefficients show the expected change in willingness with a one-unit increase in each predictor. In contrast, the Beta coefficients provide a standardised measure to compare the relative importance of each predictor.

Table 8 provides an overview of the model summary statistics

TABLE 8: Model Summary				
Predictor	R square	Adjusted R square	F(1,63)	p-value
Awareness	0.06	0.05	4.07	0.048
Accuracy	0.24	0.23	19.49	<.0001
Anonymity & Confidentiality	0.2	0.19	15.32	<.01
Technological Convenience	0.26	0.25	21.76	<0.001
Physical Convenience	0.38	0.37	37.5	<0.001
Confidence	0.34	0.33	31.73	<0.001
Comfort	0.32	0.31	28.93	<0.001

Table 9 represents the findings in the form of regression coefficients of the regression analysis

TABLE 9: Regression Coefficients					
Predictor	B	Beta	SE	t	p-value
Awareness	0.36	0.25	0.18	2.02	<0.001
Accuracy	0.51	0.49	0.12	4.41	<0.001
Anonymity & Confidentiality	0.45	0.45	0.12	3.91	<0.001
Technological Convenience	0.62	0.51	0.13	4.66	<0.001
Physical Convenience	0.55	0.61	0.09	6.12	<0.001
Confidence	0.69	0.58	0.12	5.63	<0.001
Comfort	0.79	0.56	0.15	5.38	<0.001

Awareness

Awareness has an R^2 of 0.06, explaining only 6% of the variance in willingness. The F-value of 4.07 and a p-value of 0.048 suggest that awareness is a statistically significant predictor, but its impact on willingness is relatively small.

The B value of 0.36 indicates that a one-unit increase in awareness leads to a 0.36 increase in willingness. The beta coefficient of 0.25 and p-value (<0.001) confirm that awareness is statistically significant but less impactful than other predictors. This suggests that, while awareness of chatbots contributes to willingness, it is not as influential as other factors like convenience or confidence.

Accuracy

Accuracy has an R^2 of 0.24, explaining 24% of the variance in willingness. The F-value of 19.49 and a p-value < 0.001 confirm that accuracy is a statistically significant predictor of willingness.

The unstandardised coefficient ($B = 0.51$) implies that a one-unit increase in perceived accuracy is associated with a 0.51 increase in willingness. With a standardised Beta of 0.49, accuracy notably impacts willingness, and the significant p-value ($p < 0.001$) reinforces this finding. This suggests that users are more willing to engage with chatbots they perceive as providing accurate information, emphasising the importance of trustworthy content.

Anonymity & Confidentiality

Anonymity and confidentiality explain 20% of the variance in willingness, with an R^2 of 0.20. The F-value of 15.32 and p-value < 0.01 indicate that anonymity and confidentiality are significant predictors.

With an unstandardised coefficient ($B = 0.45$), an increase in perceived anonymity and confidentiality is associated with a 0.45 increase in willingness. The Beta of 0.45 highlights its impact, and the p-value < 0.001 confirms its significance. This finding underscores the importance of privacy in chatbot technology, particularly for sensitive areas like reproductive health.

Technological Convenience

Technological convenience has an R^2 of 0.26, meaning it explains 26% of the variance in willingness. The F-value of 21.76, with a p-value < 0.001 , indicates that technological convenience is a statistically significant predictor of willingness.

The B coefficient of 0.62 suggests a strong positive association, with willingness increasing by 0.62 units for each one-unit increase in technological convenience. The standardised Beta of 0.51 confirms that technological convenience is an influential predictor, and the p-value < 0.001 supports its significance. These results indicate that enhancing the ease of use of chatbots could encourage a greater willingness to adopt chatbot technology.

Physical Convenience

Physical convenience has an R^2 of 0.38, indicating it explains 38% of the variance in willingness to use chatbots, the highest among all predictors. This high R^2 value suggests that physical convenience is a significant factor in users' willingness to engage with chatbots. The F-value of 37.5, with a p-value < 0.001 , further supports that physical convenience is a highly statistically significant predictor of willingness.

The unstandardised coefficient ($B = 0.55$) indicates that for every one-unit increase in physical convenience, willingness to use chatbots increases by 0.55 units. The standardised Beta coefficient of 0.61 confirms that physical convenience has the strongest influence on willingness among all predictors. This significant p-value ($p < 0.001$) underscores the importance of accessible chatbot design, especially for populations facing physical barriers to healthcare.

Confidence

Confidence has an R^2 of 0.34, explaining 34% of the variance in willingness to use chatbots. This substantial R^2 value indicates that confidence is a major contributor to willingness. The F-value of 31.73, with a p-value < 0.001 , shows that confidence is a highly significant predictor in the model.

With an unstandardised coefficient ($B = 0.69$), confidence has a strong positive effect on willingness, meaning each one-unit increase in confidence raises willingness by 0.69 units. The standardised Beta of 0.58 highlights the importance of confidence relative to other predictors, with a significant p-value ($p < 0.001$) confirming its influence. These findings suggest that fostering confidence in chatbot use could significantly enhance adoption.

Comfort

Comfort explains 32% of the variance in willingness, with an R^2 of 0.32. The F-value of 28.93, accompanied by a p-value < 0.001 , indicates that comfort is a statistically significant predictor of willingness.

The unstandardised coefficient ($B = 0.79$) shows that a one-unit increase in comfort corresponds to a 0.79 increase in willingness, indicating a strong positive relationship. With a Beta value of 0.56, comfort has a meaningful impact on willingness, reinforced by its highly significant p-value ($p < 0.001$). This suggests that improving the comfort of chatbot interactions may promote user willingness to engage with chatbots.

By examining each predictor in this integrated approach, we see that physical convenience, confidence, comfort, and technological convenience are the most influential factors in determining willingness to use chatbots. These findings emphasise that accessibility, user confidence, comfort, and ease of use are essential for increasing chatbot adoption in reproductive health. Factors like accuracy and privacy also play significant roles, while awareness appears to have a relatively limited effect. These insights suggest that focusing on convenience, trust, and user experience could greatly improve user willingness to adopt chatbot technology.

Discussion

This study investigated the potential of chatbots as an alternative to gynaecologists for disseminating reproductive health information in India, especially among underserved populations who experience inequality in accessing medical professionals while simultaneously bearing the existing social stigma associated with any discussions over reproductive, menstrual or sexual health information. Findings reveal that chatbots offer substantial benefits in reproductive health contexts by providing accessible, confidential solutions where physical and societal barriers restrict healthcare access. Such results align with Mills et al. (2023) and Mohamad-Hani Temsah et al. (2023), who found that AI-driven tools are particularly effective in addressing health needs in stigmatised areas by creating a private user environment. However, a critical need remains for improvement in user awareness, trust, and chatbot accuracy, especially in the context of reproductive health, where users frequently prefer trustworthy and culturally resonant information sources (Fan et al., 2021; Kennedy et al., 2023).

The study identifies physical convenience, confidence, and comfort as significant predictors of chatbot adoption for reproductive health inquiries, with physical convenience emerging as the most influential factor. This underscores chatbots' potential to bridge accessibility gaps, especially in rural or underserved areas lacking healthcare infrastructure. Given that the sample comprises mainly vulnerable populations with limited access to traditional healthcare, it is unsurprising that physical convenience is prioritised. This insight resonates with Serra (2021), who highlighted the role of chatbots and other digital health tools in overcoming logistical barriers during the COVID-19 pandemic when physical healthcare access was widely restricted. Here, both technological and physical convenience were essential; this aligns with Bibault et al. (2019), who emphasise that digital health solutions must be designed for seamless usability to maximise adoption. Further, the strong correlation between technological and

physical convenience in this study suggests that developing a user-friendly interface with intuitive navigation is critical, especially for populations with low digital literacy, as noted by Io and Lee (2018).

Anonymity and confidentiality also emerged as important predictors, affirming prior findings that privacy is pivotal when engaging with digital health tools for sensitive topics like reproductive health (Mills et al., 2023; Mohamad-Hani Temsah et al., 2023). Specifically, married and divorced participants in this study valued anonymity highly, possibly reflecting a cultural sensitivity to discussing sexual health within marital or social contexts where such discussions are often taboo. This observation echoes Wang et al. (2015), who found that chatbots promoting nonjudgmental interactions can improve user comfort significantly, especially in societies where sexual health discussions are sensitive. Interestingly, this study also observed that participants with regular internet access rated anonymity and confidentiality higher, indicating that familiarity with digital tools may enhance trust in data privacy—a finding consistent with Pillai and Sivathanu's (2020) research on the importance of privacy in fostering comfort with AI-based health tools.

Despite these strengths, the moderate ratings for chatbot accuracy and user confidence highlight persistent hesitancy regarding informational reliability. Research by Nadarzynski et al. (2021) found similar scepticism, with participants questioning whether AI-driven chatbots could provide health advice comparable to human doctors, particularly for complex or nuanced issues. To address these concerns, integrating culturally adapted, precise responses—such as those utilised in the SnehAI chatbot—could help improve user confidence by making information more relevant and trustworthy (Kennedy et al., 2023). The SnehAI chatbot demonstrated that tailoring responses to local dialects and cultural norms increases perceived relevance, suggesting that incorporating culturally sensitive design elements could significantly improve user satisfaction and trust. This aligns with Bibault et al. (2019), who observed that chatbots rated highly by users often simulate human-like interactions and use language and tones adapted to their target audience.

The study further provides actionable implications for improving chatbot utility in reproductive health. First, beyond accessibility, enhancing convenience through robust usability and trustworthiness features is crucial for user adoption. This includes embedding strong data privacy protocols and culturally tailored responses, which could address the needs of individuals hesitant to seek help for stigmatised topics in face-to-face settings (Fan et al., 2021). For instance, highlighting chatbots' anonymity in digital health campaigns could reinforce trust, particularly in settings where sexual health discussions remain taboo (Nadarzynski et al., 2020). Emphasising privacy features may also reduce hesitation among internet-regular users, who likely have heightened expectations for digital confidentiality (Pillai & Sivathanu, 2020).

Moreover, this study underscores confidence as a critical factor influencing adoption. Previous studies, such as Liu and Sundar (2018), show that chatbots incorporating natural language processing and human-like responsiveness can enhance user comfort, fostering a more engaging experience for users who initially feel sceptical of AI-driven health tools. Enhancing these human-like elements, particularly for reproductive health contexts, aligns with findings from SnehAI and similar chatbots that employ culturally resonant and non-judgmental language to ease users into sensitive discussions (Kennedy et al., 2023). This study supports the notion that digital health developers should prioritise features that balance empathetic engagement with professionalism, as this fosters user comfort without risking the perception of the chatbot as overly human-like or intrusive (Liu & Sundar, 2018).

Limitations

While this study provides valuable insights, some limitations should be considered. The small sample size and demographic focus, limited to women from weaker socioeconomic backgrounds, may restrict the generalizability of these findings. Additionally, as self-reported data forms the basis of the

analysis, there is a risk of response bias. Lastly, as the study depends completely on quantitative analysis, a thematic analysis of open-ended questions is lacking. Further research with a larger and more diverse sample and alternative data collection methods would enhance the robustness of the results.

Conclusion

In conclusion, this study suggests that chatbots can be a convenient, confidential, and potentially transformative tool for reproductive health in India, where reproductive health is often considered taboo. By focusing on features that enhance privacy, accuracy, and cultural relevance, chatbots could address significant gaps in reproductive health accessibility. As digital health technology continues to evolve, chatbots' application for sensitive health areas could significantly improve healthcare access and engagement, particularly in regions where traditional healthcare options remain limited.

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