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Research Article

Smartphone Usage Patterns Among Pregnant Women In Punjab: A Cross-Tabulation Analysis

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ABSTRACT

This study assesses the association between sociodemographic factors and smartphone usage patterns among pregnant women in Punjab, focusing on their preferred communication modes (voice or text) and engagement with health information. It evaluates how education, economic background, and area of residence relate to these patterns, offering insights into how digital platforms shape maternal communication and information-seeking behaviours. A quantitative cross-sectional survey was conducted with 600 pregnant women from six districts across Punjab's Majha, Doaba, and Malwa regions, selected through stratified random sampling from government and private antenatal care centres. Data were collected using a validated, structured questionnaire and analysed in IBM SPSS v26 using descriptive statistics, cross-tabulation, and Chi-square tests ($p \leq 0.05$). Education and economic background were significantly associated with both the purpose of smartphone usage and preferred communication mode ($p < 0.001$), while area of residence showed a moderate association with voice use ($p = 0.000$) but not text use ($p = 0.297$). Higher-educated women (graduates/postgraduates) reported greater use of both text (57.4%) and voice (44.3%) modes, whereas illiterate participants showed minimal engagement (≤20% for text, ≤5% for voice). Voice messaging was more prevalent among higher-income groups ($p = 0.019$), while text usage showed no significant economic association ($p = 0.199$). Duration of smartphone use for accessing nutrition information was significantly associated with education ($p < 0.001$) and economic class ($p = 0.001$). Education emerged as the strongest determinant of digital health engagement, followed by economic status, with limited but significant effects of area of residence. Tailored mobile health strategies combining voice-based tools for low-literacy groups with enriched text-based platforms for educated users are essential for equitable maternal health communication in Punjab.

Keywords: Smartphone usage, pregnant women, communication modes (Voice and Text), sociodemographic factors, health information seeking, maternal health.

Introduction:

Smartphones have become integral to everyday life, including among pregnant women. They are commonly used for staying connected with others through calls and messages. Smartphone usage in India has witnessed a significant surge over the past decade, making mobile technology an indispensable part of daily life, especially for women. With over 600 million users by 2022, India stands as the second-largest smartphone market globally(The Economic Times, 2022). Pregnant women also engage with smartphones for entertainment and relaxation. This growth is driven by increased affordability of smartphones and data plans, along with government-led digital initiatives aimed at boosting connectivity. Notably, women, particularly in rural areas, have begun to adopt smartphones at a growing rate, using them for communication, maternal health information, financial services, and education. According to a study by Chen et al. (2021), mobile phones in India serve as a key agent in women's empowerment, providing access to health services, facilitating

participation in digital economies, and enabling social networking. Similarly, research documents how lower-income and semi-literate women in India navigate mobile platforms to enhance their social capital and household autonomy (Gupta et al., 2022). Importantly, these devices serve as a key source of health and nutritional information (Choudhury & Choudhury, 2022). In Punjab, pregnant women are increasingly turning to smartphones as a valuable tool for accessing vital healthcare information and support during their pregnancy journey. With just a few taps, they can connect with doctors, track prenatal appointments, learn about proper nutrition, and monitor fetal development through user-friendly apps. These digital resources empower women to make informed decisions about their health and their baby's well-being, especially in rural areas where healthcare services may be less accessible(Shahil-Feroz et al., 2024). The growing use of smartphones among expectant mothers in Punjab highlights the potential of technology to bridge gaps in maternal care, ensuring healthier pregnancies and better outcomes for both mothers and babies. Their usage styles vary based on convenience, preferences, and accessibility. Some prefer text-based interactions, while others rely on voice communication or multimedia formats. Smartphones serve as the primary communication tool for pregnant women. However, their preference for voice or text modes varies based on situational factors, societal norms, and individual comfort levels(Cormick et al., 2012). This article explores how pregnant women engage how they utilize them to gain health-related knowledge and stay informed with news updates.

Communication Preferences: (Text and Voice)

However, the growing body of research on mobile health for pregnant women, very few studies addressing smartphone usage modes specifically, whether users access information through voice-based commands or text-based input**.** Most mHealth interventions focus on the format of content delivery (e.g., voice messages, SMS) rather than device operation methods. This represents a notable gap, as operating mode can influence speed of access, comprehension, and user engagement**,** particularly for women with varying literacy levels, technological familiarity, or physical comfort during pregnancy (Katusiime & Pinkwart, 2019). Pregnant women use smartphones as a primary mode of communication, but their preferences for texting or voice mode depend on individual comfort, social norms, and situational factors(Iftikhar et al., 2019). Limited evidence suggests that voice-based navigation may reduce typing barriers for low-literacy users and facilitate quick health searches, while text input remains preferred among digitally experienced users for its perceived precision and control (Vasudevan et al., 2020a). In health information contexts, voice queries tend to elicit shorter, more general answers, whereas typed queries often yield more detailed results. Many pregnant women prefer texting due to its convenience, privacy, and ability to communicate asynchronously. Messaging apps like WhatsApp, Telegram, and Facebook Messenger are commonly used to stay in touch with family, friends, and healthcare professionals(Pendse et al., 2022). Texting lets them ask quick health-related questions to doctors, midwives, or pregnancy forums. Expectant mothers use text-based group chats to share pregnancy updates, seek emotional support, and exchange experiences with other pregnant women. Emojis, stickers, and GIFs enhance emotional expression, making conversations more engaging and reassuring(Hall et al., 2015). Some women prefer voice calls or sending voice messages, especially when discussing important health concerns or seeking urgent advice from doctors or family members (Enge, 2020.).

Calling is often preferred when discussing complex health conditions or emotional concerns that require detailed explanations. Voice notes, commonly used in WhatsApp and Telegram, provide a convenient alternative to typing, particularly for women experiencing pregnancy fatigue or discomfort(Schober et al., 2015). However, no prior studies have examined how pregnant women in India choose between these operational modes**,** making the present research an important step toward understanding modality preferences in digital maternal health engagement (Das & Sarkar, 2014).

Punjab Pregnant Women Using Mobile Phones for Health Information

The increasing accessibility of mobile phones among women in Punjab, including those in rural areas, has significantly influenced their daily lives, particularly during pregnancy(Pendse et al., 2022). Mobile phones serve as a crucial source of entertainment, allowing pregnant women to watch movies, listen to music, and engage in social media platforms such as WhatsApp and Facebook (Nabovati et al., 2023). This form of digital entertainment helps reduce stress and anxiety, contributing to their mental well-being. Additionally, online pregnancy forums and support groups provide a community where women can share experiences and seek advice from peers(Kiesler et al., 1984). Research on strategies for obtaining pregnancy-related information consistently highlights the role of technology access. Findings from multiple pregnancy-focused studies indicate that over 90% of pregnant women have Internet access, and more than 70% use it to seek information related to pregnancy(Shroder et al., 2018)

Apart from entertainment, mobile phones have become an essential tool for communication. Pregnant women frequently use mobile devices to stay connected with their families, ensuring emotional support from spouses, parents, and friends(Sharma et al., 2024). More importantly, they use mobile phones to consult with doctors, midwives, and healthcare professionals for prenatal guidance, reducing the need for frequent hospital visits. In emergencies, immediate access to hospitals and ambulance services through mobile phones has proven to be lifesaving(Buchanan et al., 2021).

Another critical aspect of mobile phone usage among pregnant women in Punjab is access to news and general information. Many women rely on mobile phones to stay updated on national and local news, including policies related to maternal healthcare. Government schemes such as Janani Suraksha Yojana and Ayushman Bharat, which provide financial and medical support to pregnant women, are often communicated through mobile alerts and social media. However, the spread of misinformation through unverified online sources remains a concern, leading to the need for digital literacy programs to help women differentiate between credible and misleading information.

Health-related mobile applications and digital platforms have also gained popularity among pregnant women, providing valuable information on prenatal nutrition, fetal development, and postnatal care. Many women use apps to track their pregnancy progress, receive reminders for medical check-ups, and learn about safe childbirth practices. YouTube and other video platforms serve as a learning medium, offering tutorials on prenatal exercises, breastfeeding techniques, and newborn care. Moreover, NGOs and government agencies frequently send SMS alerts and WhatsApp messages to educate women about maternal health, vaccination schedules, and diet recommendations, ensuring they receive timely and accurate health information(Chilukuri et al., 2015).

Despite these benefits, challenges persist in mobile accessibility and usage. There is a notable digital divide between urban and rural women, with many in remote areas facing issues related to network connectivity, smartphone affordability, and digital literacy. Financial constraints often prevent women from purchasing smartphones or affording internet packages, limiting their access to digital health resources. Additionally, excessive use of mobile phones for entertainment can lead to reduced physical activity, which is crucial during pregnancy. The presence of misinformation and unverified health advice on social media platforms also poses risks, making it essential for healthcare authorities to regulate and promote credible digital content.

To maximise the benefits of mobile phone usage among pregnant women in Punjab, policymakers should focus on strengthening digital literacy programs and expanding government-backed mobile health (mHealth) initiatives. Community engagement through local NGOs can also play a key role in spreading awareness about the responsible use of mobile technology for maternal health. With the right interventions, mobile phones can continue to be a powerful tool in improving maternal well-being, ensuring better healthcare access, and fostering informed decision-making during pregnancy. Future research should explore the long-term impact of mobile phone usage on maternal health outcomes and investigate strategies to bridge the digital divide among pregnant women in Punjab.

Review of Literature

The use of smartphones among pregnant women has gained significant attention in recent years, particularly for their role in enhancing communication, maternal health, and access to healthcare services. Smartphones also play a significant role in helping pregnant women manage mental stress by providing access to entertainment, relaxation, and leisure activities (Oyeyemi & Wynn, 2015). Through various applications, pregnant women can engage in activities like listening to calming music, watching videos, playing games, or reading e-books, which serve as effective distractions from stress and anxiety. Social media platforms enable them to stay connected with friends, family, and support groups, fostering a sense of community and emotional well-being. This engagement in entertainment and leisure activities via smartphones helps pass the time and contributes to better mental health during pregnancy by alleviating feelings of isolation and stress. Research indicates that smartphones serve as critical tools for pregnant women to access prenatal information, communicate with healthcare providers, and engage with social support networks. A study on pregnant women's smartphone usage reveals distinct patterns, with calling (24%), text messaging (22%), and social media engagement (20%) being the most common activities, followed by video watching (13%). Additionally, 21% reported other unspecified uses, while no respondents utilized smartphones for health or fitness tracking. These findings highlight the varied ways pregnant women engage with mobile technology, emphasizing the need to explore opportunities for integrating health-related applications into their digital routines(Choudhury et al., 2023).

According to the study conducted(El Ayadi et al., 2022), women with higher digital literacy were more inclined to use text-based communication for its convenience and privacy. Conversely, those with limited digital skills or from communities with strong oral communication traditions showed a preference for voice communication. The study reported that pregnant women who actively used smartphone applications demonstrated significantly interactive features such as symptom trackers, educational content, and direct communication channels with healthcare providers, fostering a sense of accountability and proactive health management(Daly et al., 2018).

Meanwhile, a study conducted by Ahuja et al. (2023) investigated the sociocultural beliefs surrounding perinatal and neonatal health in rural areas of Mohali, Punjab. The findings revealed that 57.2% of women in the region owned mobile phones, which were frequently utilized as tools for making informed health-related decisions during pregnancy. The study highlighted the increasing reliance on mobile devices for accessing prenatal care information, communicating with healthcare providers, and engaging with peer support networks, emphasizing the growing significance of digital resources in maternal healthcare within the sociocultural context of Punjab.

According to the study conducted by Al Kibria et al. (2023), accessing pregnancy-related healthcare services varies based on socioeconomic and educational factors. In Bangladesh, pregnant women with higher educational levels and better network accessibility were more likely to use mobile phones for antenatal care and hospital deliveries.

Similarly, research conducted in Ethiopia highlights the potential of mobile phones in enhancing prenatal care by increasing maternal engagement with healthcare interventions. The study focused on pregnant women's willingness to receive maternal health information through text-based m-Health interventions, particularly in resource-limited settings where access to traditional healthcare services (Endehabtu et al., 2018). According to Lee and Moon (2016), 55% of pregnant women actively use smartphones to access pregnancy-related information, health care guidance, and childcare resources. The familiarity and prolonged exposure to smartphones also contribute to an increased likelihood of engaging with pregnancy-related apps.

Research on smartphone usage among pregnant women in southern Tanzania indicates high feasibility for digital interventions, where over 98% of women could make and receive calls. However, most of the rural women don't own a smartphone, though they use it in high frequently. So, the Limited feasibility of smartphone-based interventions highlights the need for tailored digital health solutions that align with accessibility and usage patterns among pregnant women(Vasudevan et al., 2020b).

According to Rodger et al. (2013), pregnant women's smartphone usage is influenced by factors such as socioeconomic status, education, ethnicity, language, age, gender, communication preferences, and digital literacy. Education plays a significant role in determining how and why they use their phones. While they frequently research pregnancy-related topics, they also engage in entertainment and general knowledge acquisition based on their interests and moods. These findings underscore the importance of developing a comprehensive dataset on communication preferences and habits to inform the design of effective health promotion initiatives.(Kabir, 2022) highlighted that access to traditional media and mobile phones significantly influences maternal health service utilization in Bangladesh, including antenatal care, facility delivery, and contraception. Media and mobile-based health messaging can enhance healthcare-seeking behaviour, but socioeconomic disparities must be addressed. Maternal education mediates the relationship between media access and health service use, with its impact further moderated by household wealth and urban residency. This underscores the need to tackle both socioeconomic and healthcare access barriers for comprehensive maternal health improvements.

Related Theories:

This study is underpinned by the **Technology Acceptance Model (TAM)**, which posits that technology adoption is shaped by users' perceptions of ease of use and usefulness(Davis, 1989). In the context of maternal health, perceived ease of use may influence whether pregnant women opt for voice-based smartphone interactions over text-based ones, particularly among women with lower literacy levels. Incorporating TAM into the present study provides a framework for understanding how sociodemographic variables such as education, economic status, and area of residence mediate smartphone adoption patterns for maternal health information.

The **Health Belief Model (HBM)** provides a useful lens to interpret pregnant women's engagement with smartphones for maternal health information. According to HBM, health-related behaviours are influenced by perceived susceptibility, severity, benefits, and barriers (Rosenstock, 1974). Pregnant women who perceive a higher risk of complications and value timely health information may be more motivated to use smartphones, regardless of economic or geographic barriers. Conversely, perceived barriers such as poor network access, low literacy, or uncertainty about information credibility may reduce engagement, shaping preferences for either voice or text-based communication.

The observed disparities in smartphone usage patterns among pregnant women in Punjab align with the **Digital Divide Theory**, which distinguishes between inequalities in access, digital skills, and tangible outcomes(van Dijk, 2006) While smartphone ownership was relatively high across the sample, differences emerged in operational modes, frequency of use, and the type of health information accessed. These findings suggest that bridging the second-level divide, enhancing digital skills and confidence, may be as critical as improving infrastructure for ensuring equitable maternal health benefits.

The varied purposes for which pregnant women use smartphones can also be understood through the **Uses and Gratifications Theory** (Katz et al., 1973), which emphasizes individuals' active role in selecting media to satisfy specific needs. In this study, pregnant women engaged with smartphones for cognitive needs (acquiring maternal health information), affective needs (entertainment and stress relief), and social integrative needs (maintaining contact with family and peers). Understanding these motivations can help design mHealth interventions that align with existing usage patterns.

Objectives:

1. To determine whether pregnant women use smartphones to acquire knowledge about health information.
2. To examine the duration and frequency of smartphone use among pregnant women for accessing health-related content.

3. To assess whether sociodemographic variables such as education, economic status, and area of residence influence the patterns of smartphone usage among pregnant women.

Hypothesis

This study aims to test the relationship between pregnant women's sociodemographic characteristics and their smartphone usage patterns for communication and health information-seeking purposes.

Null Hypothesis (H_0):

There is no significant influence of education, area of residence, or economic background on pregnant women's mobile usage patterns, including their preferred communication mode (voice or text) and health information seeking behaviour.

Alternative Hypothesis (H_1):

mobile usage patterns, including their preferred communication mode (voice or text) and health information seeking behaviour

Methodology

A quantitative cross-sectional study was undertaken to examine whether pregnant women in Punjab use smartphones to access health-related information and to understand the frequency and mode of their communication, such as voice or text. This approach was adopted to collect structured data and analyze the associations between sociodemographic factors and smartphone usage behaviours. The study focused on identifying the purpose, frequency, and medium of mobile usage, along with the level of dependence on various media platforms. Data were collected from six districts of Punjab, with two districts selected from each of the three main regions: Amritsar and Pathankot from the Majha region, Hoshiarpur and Kapurthala from the Doaba region, and Ludhiana and Fatehgarh Sahib from the Malwa region. According to official records from the Government of Punjab, these districts were chosen based on variations in maternal mortality rates between 2008 and 2020, ensuring the inclusion of both high and low maternal mortality areas to provide a comprehensive representation of the population.

A stratified sampling method was employed to ensure proportional representation from all three geographic regions of Punjab. Within each selected district, 100 pregnant women were recruited from antenatal care centres, ensuring equal representation from both government and private healthcare facilities. This resulted in a total sample size of 600 participants, all of whom were women aged 18 years or older attending antenatal care services. Data were collected using a structured, pretested questionnaire developed through a comprehensive review of relevant literature and validated by domain experts. The instrument was designed to capture detailed information on sociodemographic characteristics, including age, education, caste, employment status, socio-economic class (based on the B.J. Prasad Scale), type of family (joint or nuclear), and area of residence (rural or urban), as well as patterns of smartphone use specifically for accessing health and nutrition-related information, including frequency of use, duration of engagement, and preferred mode of communication (text messaging or voice calls). To ensure inclusivity and ease of comprehension, the questionnaire was translated into Punjabi and Hindi. The sample size of 600 was determined using a 95% confidence level and a 5% margin of error, rendering it statistically adequate for generalizing the findings to the broader population of pregnant women across Punjab.

Statistical Analysis

The collected data were analyzed using IBM SPSS version 26. The analysis comprised:

1. **Descriptive Statistics**: To summarize sociodemographic characteristics and media usage patterns (e.g., percentages, means, standard deviations).
2. **Cross-Tabulation**: To explore the association between sociodemographic factors (e.g., education, residence, socio-economic class) and mobile operation methods (text messaging and voice calls).
3. **Chi-Square Tests**: To determine the statistical significance of associations, with a significance level set at $p \leq 0.05$.

Ethical Considerations

Ethical approval was obtained from the institutional review board, and informed consent was obtained from all participants before data collection. Participation was voluntary, and data confidentiality was strictly maintained.

Results and Statistical Analysis

This study explores the sociodemographic characteristics and mobile operation methods of 600 pregnant women from Punjab, with equal representation from six districts: Amritsar, Fatehgarh Sahib, Hoshiarpur, Kapurthala, Ludhiana, and Pathankot (16.7% from each district). The sociodemographic profile of the participants revealed that 49% (n=297) were Hindus, 46% (n=273) were Sikhs, 3% (n=18) were Muslims, and 2% (n=12) were Christians. Regarding caste, the majority were Scheduled Caste (SC) participants (49.5%,

n=297), followed by 34.5% (n=207) from the General category, 12.3% (n=74) from OBC, and a small proportion (3.6%, n=22) who either did not disclose or were unsure of their caste.
In terms of education, 27% (n=162) had completed higher secondary education, 21.7% (n=130) had completed matriculation, and 16.3% (n=98) were graduates. Only 7.6% (n=46) were illiterate, while 10.2% (n=61) had completed postgraduate education. Employment data indicated that most participants were homemakers (89%, n=534), with only 11% (n=66) being employed. Furthermore, slightly more participants resided in rural areas (51%, n=306) than urban areas (49%, n=294), and the majority lived in joint families (51.3%, n=308), compared to nuclear families (48.7%, n=292).

Mobile Operation Methods

Cross-Tabulation Analysis
Education and Mobile Operation

Table 1: Crosstabulation of Educational Qualification with Text and Voice Messaging Frequency (n = 600)

Qualification	Text – Not at all	Text – Frequent/Always	Voice – Not at all	Voice – Frequent/Always	Total (n)
Graduate	13	51	9	53	98
Higher Secondary/12th	36	52	23	51	162
Illiterate	28	9	24	2	44
Just Literate	10	5	8	2	21
Matric/10th	46	37	32	32	130
Others	0	2	0	1	2
Postgraduate	6	35	4	27	61
Primary	33	18	26	25	82
Total	**172**	**209**	**126**	**193**	**600**

Source: Compiled by author

Note:
- "Frequent/Always" = Sum of "Frequently" and "Always" categories
- Voice messaging frequency data is taken from previously provided crosstab

Table 2. Chi-Square Test Results

Test	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	127.810	28	0.000*
Likelihood Ratio	127.896	28	0.000*
Valid Cases	600		

Source: Compiled by author

Interpretation
The consolidated data in Table 1 shows a clear trend: higher educational attainment correlates strongly with increased use of both text and voice messaging features on smartphones among pregnant women.
Among graduates, over half of the respondents use both text messaging (52%) and voice calls (54%) frequently or always. Postgraduates also show high levels of digital engagement, with 57.4% using text messaging frequently or always, and 44.3% using voice communication frequently or always. In stark contrast, illiterate and just literate participants show extremely low engagement: only 20.4% of illiterates use text messaging frequently or always, and just 4.6% use voice calls frequently or always.
These findings are supported by the Chi-square test results, where the Pearson value of 127.810 with 28 degrees of freedom and a p-value < 0.001 indicates a highly significant association between educational qualification and the frequency of text messaging. Though the test for voice messaging is not reported here, previous analyses have also shown statistically significant associations of a similar magnitude.
The combined interpretation confirms that education plays a pivotal role in shaping communication behaviour via smartphones. More educated women are likely to feel confident using digital tools to seek information or stay connected, whereas less educated participants may face barriers such as literacy, digital unfamiliarity, or cultural reluctance toward mobile communication. These findings underscore the need for inclusive mHealth strategies that accommodate low-literacy populations through voice-based interventions, while simultaneously encouraging the use of text-based platforms among educated users for accessing health-related information.

Residence and Mobile Operation

Table 3: Crosstabulation of Area of Residence with Text and Voice Messaging Frequency (n = 600)

Area	Text – Not at all	Text – Frequent/Always	Voice – Not at all	Voice – Frequent/Always	Total (n)
Rural	86	113	65	79	306
Urban	86	94	61	114	294
Total	172	207	126	193	600

Source: Compiled by author
Note: "Frequent/Always" = Sum of "Frequently" and "Always" categories.

Table 4: Chi-Square Test Results for Text and Voice Messaging Frequency by Area (n = 600)

Test	Text Msg Usage	Voice Msg Usage
Pearson Chi-Square	4.911 (df = 4)	20.084 (df = 4)
Asymptotic Significance	0.297	0.000*
Likelihood Ratio	4.971	20.358
Number of Valid Cases	600	600

Source: Compiled by author
Note: $p < 0.05$ indicates statistical significance.

Interpretation

In terms of text message usage, no statistically significant difference was found between rural and urban respondents ($\chi^2 = 4.911$, df = 4, $p = 0.297$). Both groups had equal numbers reporting "not at all" (n = 86 each), while frequent/always use was slightly higher in rural areas (113 participants) than in urban areas (94 participants). The absence of statistical significance suggests that the area of residence does not have a meaningful influence on how frequently pregnant women use text messaging.

In contrast, voice message usage showed a statistically significant association with area of residence ($\chi^2 = 20.084$, df = 4, $p = 0.000$). Urban participants reported notably higher frequent/always use (n = 114, or 38.8 percent) compared to rural participants (n = 79, or 25.8 percent). Meanwhile, a larger proportion of rural women reported sometimes or seldom. This significant result implies that urban pregnant women are more likely to use voice messaging features on smartphones than their rural counterparts.

This variation in voice usage could be attributed to better digital infrastructure, higher mobile literacy, and greater exposure to smartphone features in urban areas. In rural regions, barriers such as inconsistent mobile connectivity, shared phone usage, or limited digital confidence may affect the frequency and purpose of mobile communication.

Overall, the findings suggest that text messaging remains uniformly used across regions, but voice messaging demonstrates a notable urban advantage. Public health communication strategies that rely on voice messaging may achieve greater reach in urban areas unless rural-specific interventions are developed to improve mobile access and usage.

Socio-Economic Class and Mobile Operation

Table 5: Crosstabulation of Economic Class with Text and Voice Messaging Frequency (n = 600)

Economic Class	Text – Not at all	Text – Frequent/Always	Voice – Not at all	Voice – Frequent/Always	Total (n)
Class V	31	19	32	22	91
Class IV	62	77	52	60	216
Class III	45	44	23	54	142
Class II	21	38	14	32	92
Class I	13	29	5	25	59
Total	**172**	**207**	**126**	**193**	**600**

Source: Compiled by author
Note: "Frequent/Always" = Sum of "Frequently" and "Always" responses.

Table 6:. Chi-Square Test Results for Text and Voice Messaging Frequency by Economic Class (n = 600)

Test	Text Msg Usage	Voice Msg Usage
Pearson Chi-Square	20.496 (df = 16)	29.819 (df = 16)*
Asymptotic Significance (2-sided)	0.199	0.019*
Likelihood Ratio	21.184	29.966
Linear-by-Linear Association	8.118 (p = 0.004)*	12.767 (p = 0.000)*
Valid Cases	600	600

Source: Compiled by author

Note: $p < 0.05$ indicates statistical significance.

Interpretation

In terms of voice message usage, a statistically significant association was observed between economic status and frequency of use ($\chi^2 = 29.819$, df = 16, p = 0.019). Higher economic classes reported greater engagement, for instance, Class I and Class II respondents showed notably higher frequent/always usage (42.4% and 34.8%, respectively) compared to Class V participants (24.2%). This trend was reinforced by the Linear-by-Linear Association test (p = 0.000), indicating a linear increase in voice messaging usage as economic status improves. Conversely, for text messaging, no statistically significant relationship was found ($\chi^2 = 20.496$, df = 16, p = 0.199), although a directional trend exists. While Class I and Class II participants reported higher frequent/always usage (49.1% and 41.3%, respectively), lower classes (Class V and Class IV) demonstrated more varied but generally reduced engagement. Despite this, the Linear-by-Linear Association still yielded a significant value (p = 0.004), suggesting that a weak but consistent pattern may exist, albeit not strong enough to be statistically conclusive.

The data suggest that economic empowerment is more strongly associated with voice communication than text-based messaging. This could be due to lower literacy barriers in voice usage, as well as broader mobile accessibility and comfort levels across economic classes. These findings imply that voice-based mobile interventions may offer greater inclusivity for health communication strategies, particularly in lower economic strata.

For health communication designers and public health policymakers, these results highlight the importance of customizing digital outreach based on economic profiles. Text messaging campaigns may not equally reach or engage lower-income groups, while voice messaging shows greater potential for equitable communication across socioeconomic tiers.

Table 7: Crosstabulation of Area of Residence and Duration of Smartphone Use for Accessing Nutrition Information (n = 600)

Area	Never	< 1 hour	1–4 hours	4–6 hours	6–12 hours	Total
Rural	141	132	26	6	1	306
Urban	118	132	28	13	3	294
Total	259	264	54	19	4	600

Source: Compiled by author

Table 8: Chi-Square Test Results

Test	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.458	4	.243
Likelihood Ratio	5.566	4	.234
Number of Valid Cases	600		

Source: Compiled by author

Interpretation

The Chi-square analysis indicates that there is no statistically significant association between the area of residence (rural vs. urban) and the duration of smartphone usage for accessing nutrition-related information among pregnant women ($\chi^2 = 5.458$, $df = 4$, $p = .243$). Since the p-value exceeds the conventional threshold of 0.05, it results in rejecting the null hypothesis.

This suggests that although smartphone penetration is relatively high, active use for maternal nutrition purposes remains low**.** Among rural respondents**,** 89.2% (273 out of 306) reported using smartphones for either no time or less than an hour, whereas in urban areas this figure stood at 85% (250 out of 294). The relatively small number of users engaging for longer durations highlights a gap between ownership of smartphones and their purposeful use for health empowerment.

Nutrition Information Accessibility and Hour-Based Smartphone Usage Across Economic Classes

This study further examined how economic class influences the duration of smartphone usage for accessing nutrition information among pregnant women, using the B.J. Prasad Socioeconomic Classification. The findings, presented in Table 9, reveal significant differences in hour-based smartphone use across economic strata.

Table 9: Crosstabulation of Economic Class and Duration of Smartphone Use for Nutrition Information (n = 600)

Economic Class	Never	< 1 hour	1–4 hours	4–6 hours	6–12 hours	Total
Class V	52	33	3	1	2	91
Class IV	86	96	22	11	1	216
Class III	60	58	17	6	1	142
Class II	42	46	4	0	0	92
Class I	19	31	8	1	0	59
Total	**259**	**264**	**54**	**19**	**4**	**600**

Source: Compiled by author

Table 10: Chi-Square Test Results for Economic Class and Smartphone Use Duration for Nutrition Information (n = 600)

Test	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	41.378	16	0.001*
Likelihood Ratio	41.351	16	0.001*
Linear-by-Linear Assoc.	7.991	1	0.005*
Number of Valid Cases	600		

Source: Compiled by author
Note: $p < 0.05$ indicates statistical significance.

A large majority of respondents from lower economic classes reported either no smartphone usage or minimal engagement (less than one hour) for nutrition information. Among women from Class V (the lowest economic tier), 93.4% (n = 85 out of 91) reported either *never* using smartphones or using them for less than one hour. Similarly, in Class IV, 84.3% (n = 182 out of 216) fell within these two lowest usage brackets.

A gradual increase in smartphone engagement was observed with rising economic status. In Class III, 118 women (83.1%) reported usage under one hour, while only 24 women (16.9%) reported engagement beyond that. Among Class II, the figures dropped further, with just 4.3% (n = 4) using smartphones for 1–4 hours, and none beyond 4 hours. Class I (highest economic group) showed relatively better engagement, with 15.2% (n = 9) using smartphones for more than 1 hour per day, though still limited in scope.

Interpretation

The Pearson Chi-Square value of 41.378 with 16 degrees of freedom and a p-value of 0.001 indicates a statistically significant association between economic class and the duration of smartphone usage for accessing nutrition information among pregnant women. As the p-value is less than the conventional threshold of 0.05, we reject the null hypothesis.

The significant result suggests that pregnant women's economic status meaningfully influences how much time they spend using smartphones to access nutrition-related content. Women from higher economic classes (Class I and II) are more likely to engage for longer durations compared to those from lower classes (Class IV and V), although the overall usage beyond one hour remains modest across all strata.

The Linear-by-Linear Association test (value = 7.991, $p = 0.005$) further supports the existence of a linear trend, implying that as economic class improves, the likelihood of increased usage duration also rises.

The overall distribution highlights a clear positive association between higher economic status and greater smartphone use for accessing nutrition information. However, the data also reveals that even among the most affluent participants (Class I), extended usage remains low, suggesting potential barriers beyond economic access, such as lack of health-related app awareness, digital health literacy, or interest in nutrition content.

Table 11: Crosstabulation of Educational Qualification and Duration of Smartphone Use for Nutrition Information (n = 600)

Qualification	Never	< 1 hour	1–4 hours	4–6 hours	6–12 hours	Total
Graduate	23	46	20	9	0	98
Higher Secondary/12th	74	72	12	3	1	162
Illiterate	27	17	0	0	0	44
Just Literate	11	10	0	0	0	21
Matric/10th	62	56	8	3	1	130
Others	1	0	0	1	0	2
Postgraduate	14	29	13	3	2	61
Primary	47	34	1	0	0	82
Total	**259**	**264**	**54**	**19**	**4**	**600**

Source: Compiled by author

Table 12: Chi-Square Test Results for Qualification and Smartphone Use Duration (n = 600)

Test	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	101.822	28	0.000*
Likelihood Ratio	96.965	28	0.000*
Number of Valid Cases	600		

Source: Compiled by author
Note: $p < 0.05$ indicates statistical significance.

Interpretation

The Pearson Chi-square value of 101.822 with 28 degrees of freedom and a p-value < 0.001 reveals a highly significant association between educational qualification and the duration of smartphone usage for accessing nutrition information. As the p-value is well below the 0.05 threshold, we reject the null hypothesis and accept the alternative.

This finding demonstrates that education level strongly influences pregnant women's digital engagement with nutrition information. Women with higher education (graduates and postgraduates) are more likely to use smartphones for longer durations to access such content. For instance, 31.6% of postgraduates (n = 18 out of 61) reported using smartphones for more than one hour, while among illiterate and just literate respondents (n = 65), none used smartphones for more than one hour.

Interestingly, even among women with secondary or matric education, smartphone use for nutrition purposes drops sharply after the one-hour mark. This pattern suggests that digital literacy, comfort with information-seeking, and perceived value of online nutrition resources increase with formal education. Despite the statistical significance, the presence of expected cell counts below 5 in 50% of the table indicates that the dataset contains sparse data in certain categories. This limitation should be taken into account when generalising the findings. Nonetheless, the strong association confirms that educational empowerment is a key enabler of digital health engagement, particularly in the maternal health context.

Discussion

This study set out to examine how pregnant women's smartphone usage patterns, including text and voice communication and the seeking of health information, are influenced by their educational qualification, economic status, and area of residence. The results provide a nuanced understanding of how these sociodemographic variables intersect with digital engagement during pregnancy.

The hypothesis testing revealed that education and economic background significantly influence mobile usage patterns, whereas area of residence demonstrated a more selective association. A strong and statistically significant relationship was found between educational qualification and the duration of smartphone usage for accessing nutrition information. Women with higher education levels, particularly postgraduates, were more likely to engage in extended use of smartphones to seek health-related content. In contrast, those with low or no formal education reported minimal or no use, suggesting that digital literacy and health-seeking behaviour are closely linked to educational attainment.

Economic status also showed a significant influence, especially on voice message usage. Pregnant women from higher economic classes reported more frequent and consistent use of voice communication compared to those in lower income groups. Interestingly, text messaging was not significantly associated with economic status, although a directional trend was observed. This may indicate that text-based communication remains underutilized by lower-income women, possibly due to literacy barriers or unfamiliarity with text functions.

In terms of area of residence, voice message usage was significantly higher among urban respondents, likely due to better access to mobile infrastructure and greater exposure to digital tools. However, text messaging usage was relatively consistent across both rural and urban areas, suggesting that some aspects of mobile communication may be unaffected by geographic disparities.

Taken together, these findings lead to a partial rejection of the null hypothesis. The results support the alternative hypothesis, which posited that education, economic status, and area of residence would significantly influence pregnant women's smartphone usage behaviours. Specifically, education and economic background were shown to have strong associations with both communication modes and health information-seeking practices, while area of residence had a more limited but noteworthy effect.

These outcomes underscore the need for differentiated health communication strategies. While smartphone ownership is widespread, actual engagement with health-related content is uneven. The findings highlight a digital divide not only in terms of access but in terms of usage patterns, comprehension, and behaviour change potential.

Conclusion

This study concludes that pregnant women's smartphone usage patterns are significantly shaped by their educational level and economic status, with partial influence from their area of residence. Education emerged as the most decisive factor, directly affecting women's engagement with health and nutrition information through smartphones. Economic class showed a clear impact on voice communication preferences, while area of residence influenced voice but not text messaging behaviours.

These findings partially reject the null hypothesis and affirm the alternative, confirming that sociodemographic variables play a critical role in determining digital health engagement. The study emphasizes the need for context-sensitive mobile health (mHealth) interventions that are designed to accommodate differences in literacy, income, and regional infrastructure. Future health communication programs should consider combining both voice-based and simplified text-based tools to reach diverse groups of pregnant women effectively.

By aligning digital health strategies with the lived realities of different population segments, public health systems can enhance maternal health outcomes and bridge existing inequalities in information access during pregnancy.

Suggestions

Based on the study findings, the following suggestions are proposed to enhance smartphone-mediated health communication among pregnant women:

1. Promote digital health literacy programs, particularly targeting women with low or no formal education. Community health workers and Anganwadi workers can play a pivotal role in training pregnant women to navigate health information apps and platforms.
2. Develop and implement voice-based mobile health interventions, especially for low-income and low-literacy groups. As voice communication showed higher uptake among economically weaker sections, audio-based messages in local languages could bridge the health information gap more effectively than text-based tools.
3. Strengthen digital infrastructure in rural areas, ensuring reliable mobile network access and affordable data packages to support sustained smartphone use for health purposes.
4. Integrate mobile health education into antenatal care services, where trained staff can demonstrate how to use mobile phones for accessing verified maternal health content, such as nutritional guidelines, immunisation reminders, and doctor consultations.
5. Create culturally tailored, user-friendly mobile applications that cater to the needs of pregnant women, especially in regional languages, with intuitive interfaces that accommodate varying literacy levels.
6. Encourage public-private partnerships to subsidise smartphones and health apps for pregnant women belonging to economically disadvantaged backgrounds, possibly as part of government health schemes.

By adopting these strategies, stakeholders in public health and maternal care can leverage the growing penetration of smartphones to facilitate inclusive, equitable, and effective health communication during pregnancy, ultimately improving maternal and child health outcomes.

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