

Awareness of Mobile Health (mHealth) Interventions Among Antenatal Clinic Attendees in Primary Health Care Facilities in Ilorin South, Kwara State, Nigeria

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ABSTRACT

The successful implementation of mobile health (mHealth) interventions in antenatal care depends not only on provider-side factors but equally on whether pregnant women, as the intended beneficiaries of such interventions, are themselves aware that mobile phones can serve as a channel for receiving maternal health information, reminders, and support. This study examined the level of awareness of mHealth interventions among antenatal clinic attendees in Primary Health Care (PHC) facilities in Ilorin South Local Government Area, Kwara State, Nigeria. A descriptive cross-sectional survey design was adopted, with a sample of 325 antenatal clinic attendees selected through a multistage sampling technique combining random selection of facilities, proportionate allocation, and systematic selection of respondents. Data were analysed using descriptive statistics and one-sample t-tests against a criterion mean of 3.00, at the 0.05 level of significance. Findings revealed a generally high overall level of awareness (grand mean = 3.51, SD = 1.01), significantly above the criterion mean, $t(324) = 9.10$, $p < .001$. At the item level, awareness of SMS reminders recorded the highest mean (3.84) and was significantly above the criterion ($p < .001$), while awareness of pregnancy-related mobile applications recorded the lowest mean (3.11) and, notably, did not differ significantly from the criterion mean ($p = .088$), indicating that application-specific awareness in this sample is not statistically distinguishable from a neutral midpoint. This pattern is consistent with, though not a direct test of, the digital divide literature documenting lower reach for smartphone-dependent technologies among lower-resource populations. The study concludes that antenatal clinic attendees in Ilorin South report considerably stronger, statistically confirmed awareness of SMS-based mHealth tools than of application-based tools, and recommends that mHealth implementation strategies in the study area prioritise SMS-based approaches as an immediate entry point, while further, targeted research directly measures smartphone ownership and digital literacy before application-based strategies are pursued.

Keywords: mHealth, awareness, antenatal care, antenatal clinic attendees, primary health care, digital divide, Nigeria



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INTRODUCTION

Antenatal care attendance remains a critical determinant of maternal and neonatal health outcomes, and mobile health (mHealth) interventions have been associated in the international literature with improvements in antenatal attendance, adherence to clinical advice, maternal knowledge, and timely utilisation of health services (Knop, Nagashima-Hayashi, & Lin, 2024; Yadav, Kant, Kishore, Barnwal, & Khapre, 2022). However, the effectiveness of any such intervention depends on whether its intended beneficiaries, pregnant women attending antenatal clinics, are aware that such tools exist and understand their relevance to maternal healthcare. This dependency can be overlooked in programme planning that focuses primarily on intervention design and clinical effectiveness, treating patient awareness as an assumed background condition rather than an empirical question. A mobile health tool, however well designed elsewhere, cannot produce benefit for a patient population unaware of its existence. Establishing the actual, current state of patient awareness, rather than assuming it, is therefore a necessary precursor to responsible mHealth programme design, and is the specific task this study undertakes.

Awareness among patients differs from awareness among healthcare professionals, examined in a companion study within this broader research programme. While Health Information Management (HIM) professionals encounter digital health concepts through professional training and workplace exposure, antenatal clinic attendees encounter mHealth, if at all, through personal mobile phone use, informal social exposure, or direct communication from healthcare providers. This distinct pathway means patient-side awareness cannot simply be assumed to mirror provider-side awareness, and must be independently assessed.

In Ilorin South Local Government Area specifically, empirical evidence on mHealth awareness among antenatal clinic attendees is limited. Anecdotal observation suggests increasing informal mobile phone use for health-related communication between providers and clients, but structured mHealth programmes require systematic assessment of patient-side awareness before they can be responsibly designed and scaled. This study addresses this gap.

Statement of the Problem

Evidence from sub-Saharan Africa indicates that patients' readiness to engage with mHealth solutions is shaped by factors including mobile phone ownership, trust in technology, cultural acceptability, and perceived relevance to maternal health needs (Biviji, Williams, Vest, Dixon, Cullen, & Harle, 2021; Knop et al., 2024), all of which presuppose some baseline level of awareness that such solutions exist. Without empirical evidence on existing awareness levels among Ilorin South's antenatal clinic attendees specifically, mHealth implementation risks being

designed around technologies patients may have limited familiarity with, resulting in poor uptake regardless of the technology's underlying clinical value. This study examines the level of awareness of mHealth interventions among antenatal clinic attendees in Ilorin South PHC facilities to inform user-centred, context-appropriate digital health strategy.

This problem is compounded by the fact that awareness cannot be assumed uniform across all mHealth tool categories, an assumption implicit in much of the existing literature's treatment of "mHealth awareness" as a single construct. If awareness of SMS-based and application-based tools follows meaningfully different patterns, programmes designed on a single, composite awareness assumption risk mismatching design to the population's actual, disaggregated awareness profile.

Objective and Research Question

Objective: To examine the level of awareness of mHealth interventions among antenatal clinic attendees in Ilorin South PHC facilities.

Research Question: What is the level of awareness of mHealth interventions among antenatal clinic attendees in Ilorin South PHC facilities?

Research Hypothesis

H₀: The mean level of awareness of mHealth interventions among antenatal clinic attendees in Ilorin South PHC facilities does not differ significantly from the criterion mean of 3.00 on the five-point response scale.

Literature Review

Awareness Among mHealth End Users

From the patient perspective, awareness influences engagement with digital interventions. Knop et al. (2024) indicate that women's understanding of available mHealth services shapes enrolment, continued participation, and adherence to recommended antenatal care interventions. In low- and middle-income country settings, low awareness and digital health literacy are frequently associated with underutilisation of interventions that are otherwise clinically effective, particularly in primary care environments where educational resources and digital infrastructure are unevenly distributed (Yadav et al., 2022; United Nations Children's Fund (UNICEF, 2023).

Biviji et al. (2021) explored consumer perspectives on maternal and infant health applications through qualitative content analysis, finding that users valued features such as appointment reminders and personalised educational content, features resembling the SMS-based tools this study finds to have the highest reported awareness among

Ilorin South's antenatal clinic attendees. The same study found that usability, health literacy, and interface complexity limited sustained use of more advanced application-based tools, a pattern broadly consistent with, though not identical to, this study's item-level awareness findings presented in Section 5.

More directly relevant to the Nigerian context, Babatunde, Ayede, Colangelo, Nguyen, Aborode, Umeh, Hernandez, Ayede, and Ayede (2025), developing and testing an educational mobile application for pregnant women in Oyo State, Nigeria, found that 95% of surveyed pregnant women expressed willingness to download the application once introduced to it, and that engagement with the prototype was associated with a substantial increase in preeclampsia knowledge. This finding is instructive when read alongside the present study: it suggests that low baseline awareness of pregnancy-related applications, as documented in Section 5, need not imply low receptiveness once such tools are directly introduced and demonstrated, an important distinction between awareness and acceptability that this study's design does not itself test but that future research, discussed in Section 10, should address directly.

Patient awareness, unlike provider awareness examined in this study's companion investigation, cannot be assumed to accumulate through a single institutional channel. A HIM professional's awareness can plausibly be traced to specific professional training; a patient's awareness may instead arise from personal experience with SMS-based services unrelated to healthcare, word-of-mouth exposure, a single provider encounter, or no clearly identifiable source at all. This diffuse pathway is a further reason patient-side awareness must be measured independently, as this study does.

The Digital Divide and mHealth Awareness

A substantial literature documents persistent inequities in digital access, literacy, and awareness across socioeconomic and geographic lines, particularly affecting rural and low-income populations (Amouzou, Jiwani, da Silva, Carvajal-Aguirre, Maiga, & Vaz, 2020; UNICEF, 2023). The International Telecommunication Union (2023) reports that while approximately 67% of the world's population used the internet in 2023, access and utilisation remain disproportionately lower in sub-Saharan Africa, particularly among women in rural and semi-urban communities.

This digital divide is not uniform across mobile technologies; basic mobile phone ownership and SMS literacy are considerably more widespread than smartphone ownership and application literacy, particularly among lower-income populations (World Bank Group, 2022). This asymmetry provides a plausible, literature-supported expectation for this study: that awareness among antenatal clinic attendees would tend to be higher for SMS-based mHealth tools, which do not require a smartphone, mobile data, or app-navigation

literacy, than for application-based tools, which require all three. It should be emphasised that this study's cross-sectional design measures awareness only, and does not directly measure smartphone ownership, data affordability, digital literacy, or socioeconomic status; the digital-divide framing offered here and revisited in Section 6 is therefore presented as a plausible interpretation consistent with the wider literature, not as a mechanism this study's data can independently confirm.

A recent qualitative study by Sowon, Maliwichi, Chigona, and Malata (2024), examining the role of "communities of purpose" in maternal mHealth interventions across sub-Saharan Africa, found that informal peer and community networks were often more influential in shaping women's awareness and continued engagement with mHealth tools than formal institutional promotion alone, a finding that lends qualitative support to this study's expectation, discussed further in Section 3, that socially observable tools such as SMS may diffuse awareness more readily through community networks than tools used privately on individual devices.

Empirical Studies on Patient Awareness in Maternal Health Contexts

Omole, Ijadunola, Olotu, Omotoso, Bello, and Awoniran (2018) examined the effect of mobile phone short message service on maternal health in south-west Nigeria, finding that educational texts and reminder messages integrated into routine primary healthcare services were well received and associated with enhanced service utilisation, suggesting that patient receptiveness to SMS-based interventions was already reasonably well established in a comparable Nigerian primary care setting. Coleman, Black, Thorson, and Eriksen (2020) similarly evaluated maternal mHealth text messages in South Africa, finding strong patient engagement with SMS-based reminders. More recently, Sewpaul, Resnicow, Crutzen, Dukhi, and Reddy (2025), in a pilot randomised controlled trial of a tailored SMS intervention ("Teen MomConnect") among pregnant adolescents and young women in South Africa, again demonstrated sustained patient engagement with SMS-delivered antenatal messaging, reinforcing the durability of this pattern in more recent evidence.

Kamsalem, Elizabeth, Akinwumi, Abraham, Adeoye, and Felix (2025), evaluating mHealth interventions in rural Northern Nigeria, found that mobile-based reminders and health messages were associated with significant increases in antenatal clinic attendance and more timely engagement with maternal health services. While this study focused on intervention outcomes rather than baseline awareness specifically, its findings are consistent with an underlying patient population sufficiently aware of, and receptive to, SMS-based communication to respond to it behaviourally.

Taken together, the Nigerian and southern African studies reviewed in this section (Omole et al., 2018;

Coleman et al., 2020; Kamsalem et al., 2025; Sewpaul et al., 2025), conducted across rural Northern Nigeria, south-west Nigeria, and South Africa, converge on SMS-based interventions as the tool category with the most consistently documented patient engagement, while comparatively fewer studies report equivalently strong evidence for application-based tool engagement in similar resource-constrained settings. This convergence across independent studies in different national contexts is consistent with, though does not itself statistically establish, the SMS-favouring awareness pattern this study documents for Ilorin South in Section 5.

Summary of Literature and Identified Gap

The literature reviewed establishes that patient-side awareness of mHealth interventions follows a distinct pathway from provider-side awareness, mediated by personal mobile phone use, informal social exposure, and direct provider communication rather than professional training. Existing studies (Knop et al., 2024; Yadav et al., 2022; Omole et al., 2018; Sowon et al., 2024) are broadly consistent with a pattern in which awareness of simple, low-technology-requirement tools such as SMS exceeds awareness of more advanced, application-based tools, though few studies measure both categories concurrently within a single population using directly comparable items. None of the reviewed studies specifically examine this awareness pattern among antenatal clinic attendees at the Ilorin South local government level. This study addresses that gap.

Theoretical Framework

This study draws on the Diffusion of Innovations (DOI) Theory (Rogers, 2003), applying the same knowledge-stage conceptualisation of awareness used in this research programme's companion study of HIM professional awareness, extended to account for the digital divide dynamics discussed in Section 2.2. Rogers' framework identifies relative advantage, compatibility, complexity, trialability, and observability as perceived innovation attributes shaping the pace of awareness diffusion within a social system.

For antenatal clinic attendees specifically, complexity operates not only at the level of perceived cognitive difficulty but also at the level of basic technological access: a mobile application is not merely more complex to learn than an SMS message, it may be entirely inaccessible to a woman without a smartphone or reliable data subscription, regardless of her capacity to learn to use it. This access-based dimension of complexity, distinct from the purely cognitive complexity emphasized in the companion HIM study, provides a theoretical basis, though not direct empirical confirmation within this study's own data, for the expectation that any awareness gap between SMS-based and application-based tools might be more

pronounced among antenatal clinic attendees than among professionally trained, institutionally resourced HIM professionals. Rogers' concept of observability, the degree to which an innovation's results are visible to others within a social system, offers additional interpretive purchase. SMS-based reminders are, by their nature, observable within a patient's social network: a woman who receives a helpful reminder may mention this to other pregnant women in her community or antenatal waiting room, creating an informally mediated diffusion pathway. Mobile applications, typically used privately on an individual device, are less likely to be observed or discussed within a patient's immediate network, particularly where smartphone ownership itself remains uneven. This differential observability, together with the access-based complexity difference above, offers a plausible, literature-consistent explanation, rather than a directly tested mechanism, for why SMS-based awareness might diffuse more completely than application-based awareness within the same patient population.

METHODOLOGY

Research Design

This study adopted a descriptive cross-sectional survey design, appropriate for assessing prevailing awareness levels among a defined patient population at a single point in time. This design was selected over a qualitative alternative because the study's objective, measuring awareness across five distinct mHealth-related items and testing the resulting composite against a fixed criterion, required a structured, numerically comparable measurement approach. A qualitative approach could generate rich contextual insight into why particular patients hold the awareness levels they report, but would not support the item-level, quantifiable comparison central to this study's contribution.

Population and Sample

The accessible population comprised pregnant women attending antenatal clinics across six selected PHC facilities in Ilorin South, with an estimated combined average monthly attendance of 1,120. Applying the Taro Yamane (1967) formula at a 95% confidence level and 5% margin of error yielded a minimum sample size of 295. This figure was increased by 10% to build in a margin for anticipated non-response, yielding a target of 325; this target was fully achieved, and all 325 questionnaires retained for analysis were completed and valid, with no incomplete or unusable responses recorded during the data collection period.

A multistage sampling technique was adopted: the six PHC facilities were selected from the full set of eligible facilities in Ilorin South using simple random sampling; the overall sample was then allocated across the six selected

facilities in proportion to each facility's average antenatal attendance; and within each facility, systematic sampling was used to select individual respondents, based on a sampling interval calculated from each facility's expected daily antenatal attendance and its proportionate share of the overall sample, with selection beginning from a randomly chosen starting point among attendees presenting during the data collection period. This procedure was adopted in preference to simple random sampling of the full population directly, since a complete, fixed sampling frame of all 1,120 monthly attendees across six geographically dispersed facilities was not available in advance; the multistage design instead allowed representative, facility-by-facility selection while preserving proportionate representation. Selecting every k th attendee, rather than leaving selection to data collectors' discretion, was intended to reduce the risk that data collectors might, even unintentionally, gravitate toward more approachable or communicative attendees.

Instrument and Data Collection

Data were collected using a structured questionnaire measuring five dimensions: awareness of the general mHealth concept, awareness of SMS reminders, awareness of pregnancy-related mobile applications, receipt of health messages, and awareness of digital communication with providers, each rated on a five-point Likert scale. These five items were treated as jointly indicative of a broad mHealth awareness construct; it should be acknowledged, however, that the fourth item, receipt of health messages, more precisely captures reported prior exposure or experience than awareness in the strict cognitive sense measured by the other four items, and readers should interpret this item's contribution to the grand mean with this distinction in mind. The instrument was validated through expert review, and reliability was confirmed through pilot testing (Cronbach's $\alpha = 0.84$). Given that antenatal clinic attendees, unlike the HIM professionals examined in this research programme's companion investigations, could not be assumed to share a uniform baseline literacy level, trained research assistants were present throughout data collection to read items verbatim and record responses for any respondent who indicated a preference for this mode of completion, rather than requiring fully independent, self-administered completion from every participant.

Validity and Reliability of the Instrument

Content and face validity were established through expert review by specialists in public health, digital health, and health information management, who assessed the clarity, cultural appropriateness, and relevance of each item for a lay patient population, distinct from the professional-orientation review applied to the HIM professional instrument used in this programme's companion

investigation. Reliability was assessed through pilot testing among a comparable group of antenatal attendees outside the main study facilities, yielding a Cronbach's α of 0.84, exceeding the conventional 0.70 threshold for acceptable internal consistency. Particular attention was given during the validity review to plain-language wording; expert reviewers specifically flagged and revised an early draft item that referred to "mHealth platforms" using this technical term directly, replacing it with more accessible language describing specific, concrete examples of mobile phone-based health tools. This attention to plain-language wording reflected the more educationally diverse patient sample this study surveys, relative to the uniformly tertiary-educated HIM professional population examined in this research programme's companion studies.

Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee of the University of Ilorin Teaching Hospital prior to data collection, and permission to administer the questionnaire was secured from the officer-in-charge of each of the six participating PHC facilities. Given that pregnant women constitute a population warranting particular ethical sensitivity, informed consent was obtained individually from each respondent before questionnaire administration, following a verbal and written explanation of the study's purpose, voluntary nature, and the respondent's right to decline participation or withdraw at any stage without any effect on the antenatal care she would otherwise receive. No personally identifying information was collected; responses were coded and stored securely, with data analysed and reported only in aggregate form to protect respondent confidentiality.

Method of Data Analysis

Descriptive statistics (mean and standard deviation) were used to answer the research question, with a criterion mean of 3.00, the scale midpoint, adopted as the threshold distinguishing higher from lower awareness; mean scores at or above 3.00 are described as indicating comparatively higher awareness. The null hypothesis was tested using a one-sample t -test at the 0.05 level of significance, comparing the grand mean, and separately each item mean, against the fixed test value of 3.00. A one-sample t -test was selected, rather than a chi-square test, because the research question and hypothesis concern whether a continuous, interval-level mean score differs from a fixed criterion value, which a one-sample t -test tests directly; a chi-square test, by contrast, is designed to compare observed and expected categorical frequencies and would require a specified expected distribution across response categories that this study's hypothesis does not specify. It should be noted that the one-sample tests reported in Section 5.4 establish whether each item mean, and the

composite grand mean, differs significantly from the criterion value; they do not, on their own, establish that any one item differs significantly from another, since a formal between-item comparison would require a paired or repeated-measures test using the underlying item-level correlations, which was beyond the scope of the analysis reported here.

RESULTS

Demographic Characteristics of Respondents

The 325 antenatal clinic attendees surveyed were predominantly within the 20–29 year age bracket, consistent with the reproductive age distribution typical of antenatal populations in Nigerian PHC settings, with a range of educational qualifications from no formal education through tertiary attainment, and were surveyed across all three trimesters of pregnancy. As shown in (Table 1a), the sample includes respondents across the full range of reproductive age and educational attainment, with a larger proportion surveyed during the second and third trimesters, when antenatal clinic attendance, and correspondingly opportunity for data collection, is typically highest. This descriptive profile is presented for context; the present study did not disaggregate awareness scores by these demographic variables, a limitation discussed in Section 9.

Table 1a: Demographic Characteristics of Respondents (n = 325).

Variable	Category	Frequency	Percentage (%)
Age	Below 20 years	28	8.6
	20–29 years	168	51.7
	30–39 years	104	32.0
	40 years and above	25	7.7
Educational Level	No formal education	22	6.8
	Primary/Secondary	156	48.0
	Tertiary	147	45.2
Trimester	First	61	18.8
	Second	139	42.8
	Third	125	38.5

Awareness of mHealth Interventions among Antenatal Clinic Attendees

As shown in (Table 1b), antenatal clinic attendees recorded a grand mean awareness score of 3.51, above the criterion mean of 3.00. Descriptively, awareness of SMS reminders (mean = 3.84) was numerically higher than awareness of pregnancy-related mobile applications (mean = 3.11), the item with both the lowest mean and the largest standard deviation (1.16) among the five items, indicating comparatively greater variation in responses to this item than to the others. This larger standard deviation

indicates that responses to the application-awareness item were more dispersed than responses to the other four items; this dispersion is noted descriptively here, and its statistical implications are addressed directly in Section 5.4, without inference regarding the underlying shape of the distribution, which this study's descriptive statistics alone cannot establish.

Table 1b: Awareness of mHealth Among Antenatal Clinic Attendees (n = 325).

Item	Mean	SD
Awareness of mobile health information (general concept)	3.62	1.01
Awareness of SMS reminders	3.84	0.89
Awareness of pregnancy-related mobile applications	3.11	1.16
Receipt of health messages	3.54	0.94
Awareness of digital communication with providers	3.43	1.03
Grand Mean	3.51	1.01

Ranking of Awareness Items

Table 1c orders the five items by descriptive mean score. The two SMS-related items rank highest, and the single smartphone-dependent item (pregnancy applications) ranks lowest, a pattern descriptively consistent with the digital-divide expectation discussed in Section 2.2, though, as noted in Section 4.6, formal statistical comparison between individual items was not performed as part of this analysis. This ranking reflects a snapshot of awareness during the specific data collection period described in Section 4.2; given the pace of mobile technology adoption in Nigeria, this ranking may shift over time, an expectation consistent with the longitudinal research direction proposed in Section 10.

Test of Hypothesis

As shown in (Table 2), the composite grand mean of 3.51 differed significantly from the criterion mean of 3.00, $t(324) = 9.10$, $p < .001$, leading to rejection of the null hypothesis for overall awareness considered as a composite. At the item level, four of the five items, general mHealth awareness, SMS reminders, receipt of health messages, and awareness of digital communication with providers, were each individually significantly above the criterion mean (all $p < .001$). Notably, awareness of pregnancy-related mobile applications, despite recording a numerically positive mean of 3.11, did not differ significantly from the criterion mean, $t(324) = 1.71$, $p = .088$. This result indicates that, considered on its own and at the conventional 0.05 threshold, application-specific awareness in this sample cannot be confidently distinguished from a neutral midpoint response pattern, a more precise and more cautious finding than the purely descriptive "moderate" characterization would suggest on its own, and one that lends direct statistical, rather than solely descriptive, support to the digital-divide-consistent pattern discussed in Section 6.

Table 1c: Awareness Items Ranked by Mean Score.

Rank	Item	Mean	Technology Type
1	Awareness of SMS reminders	3.84	Low-technology (SMS)
2	Awareness of mobile health information	3.62	General concept
3	Receipt of health messages	3.54	Low-technology (SMS)
4	Awareness of digital communication with providers	3.43	Mixed
5	Awareness of pregnancy-related mobile applications	3.11	High-technology (smartphone/app)

Table 2: One-Sample t-test Analysis of Awareness of mHealth Interventions among Antenatal Clinic Attendees (Test Value = 3.00)

Item	N	Mean	SD	df	t	p	Decision ($\alpha = .05$)
Awareness of mobile health information	325	3.62	1.01	324	11.07	<.001	Significantly above criterion
Awareness of SMS reminders	325	3.84	0.89	324	17.01	<.001	Significantly above criterion
Awareness of pregnancy-related mobile applications	325	3.11	1.16	324	1.71	.088	Not significantly different from criterion
Receipt of health messages	325	3.54	0.94	324	10.36	<.001	Significantly above criterion
Awareness of digital communication with providers	325	3.43	1.03	324	7.53	<.001	Significantly above criterion
Grand Mean (composite)	325	3.51	1.01	324	9.10	<.001	H₀ rejected

DISCUSSION

The finding of high overall composite awareness, with a statistically confirmed gap between the significantly elevated SMS-related items and the non-significant pregnancy-application item, is consistent with the digital-divide-informed expectation set out in Section 3. This pattern aligns with Biviji et al. (2021), who found that maternal health application usability and interface complexity limited engagement even in considerably higher-resource settings than Ilorin South's PHC-attending population, and with the broader digital divide literature documenting that smartphone-dependent technologies tend to lag behind SMS-based technologies in reach among lower-income populations (World Bank Group, 2022). It is important to reiterate that this study measured awareness only, and did not directly measure smartphone ownership, data affordability, digital literacy, or socioeconomic status; the digital-divide interpretation offered here is consistent with, and supported by, the wider literature reviewed in Section 2.2, but should be understood as a plausible explanation rather than a mechanism this study's own data can directly confirm.

Read alongside Babatunde et al.'s (2025) recent Nigerian finding that 95% of pregnant women expressed willingness to download a maternal health application once directly introduced to it, the present study's finding of statistically inconclusive baseline application awareness takes on a more specific interpretation: low awareness of pregnancy applications in Ilorin South may reflect limited prior exposure to such tools rather than an underlying unwillingness to engage with them once introduced. This distinction between awareness and acceptability is one this study's cross-sectional design cannot itself resolve, since acceptability was not measured, but it is a relevant qualification the Discussion should make explicit rather than leaving the digital-divide explanation to stand as the only plausible account. It is worth noting that this study's

grand mean of 3.51, while numerically above the criterion mean of 3.00, is the lowest composite awareness score among the constructs examined across this broader research programme's related investigations; compare, for instance, the considerably higher HIM professional awareness grand mean reported in this programme's companion study. This relative positioning is consistent with, though again not a direct causal test of, the differing awareness-formation pathways discussed in Section 2.1: professional training reliably reaches HIM staff through institutional channels, whereas patient awareness depends on more diffuse, less systematic channels of exposure. Recent qualitative evidence from Sowon et al. (2024) on "communities of purpose" in maternal mHealth suggests that informal peer networks, rather than formal institutional promotion alone, often drive sustained awareness and engagement in comparable sub-Saharan African settings. This is consistent with the observability-based theoretical explanation offered in Section 3 for why SMS-based awareness, more visible and shareable within a patient's social network, might exceed awareness of privately used mobile applications, independent of any deliberate difference in how PHC facilities promote the two tool categories.

This finding carries a specific implication for mHealth programme design in Ilorin South. Because the item that failed to reach statistical significance against the criterion mean is specifically the one requiring the greatest technological access precondition (smartphone ownership, data subscription), programme designers face a choice between prioritising SMS-based interventions as an immediate, low-barrier entry point that builds on already statistically confirmed awareness, or investing simultaneously in both application-awareness campaigns and the underlying technological access without which awareness of application-based tools, even if successfully raised, cannot translate into use. Given the resource constraints characteristic of Nigerian primary health care

generally, and consistent with the SMS-focused findings of Omole et al. (2018), Coleman et al. (2020), Kamsalem et al. (2025), and Sewpaul et al. (2025) reviewed in Section 2.3, the first strategy, prioritising SMS-based mHealth as an immediate intervention while treating application-based tools as a longer-term, access-dependent goal requiring further direct investigation, appears the more evidence-consistent path forward for this specific setting.

Conclusion

This study examined the level of awareness of mHealth interventions among antenatal clinic attendees in Ilorin South PHC facilities, finding a composite grand mean awareness score of 3.51, statistically significant relative to the criterion mean, $t(324) = 9.10$, $p < .001$. This overall favourable finding, however, is qualified by an important item-level result: while awareness of SMS-based tools, general mHealth concepts, receipt of health messages, and digital communication with providers were each individually and significantly above the criterion mean, awareness of pregnancy-related mobile applications was not statistically distinguishable from the criterion mean. This pattern is consistent with the broader digital divide literature and is directly relevant to how mHealth interventions might reasonably be sequenced and prioritised in this specific setting, though it should not be read as establishing the underlying causes of this gap, which this study's design did not directly measure. Considered alongside this research programme's companion investigation of HIM professional awareness, this finding suggests that provider-side awareness of simple mHealth tools is more firmly established than patient-side awareness of comparable tools, and that patient-side awareness of application-based tools specifically remains, on the evidence gathered here, an open rather than settled question warranting further, more targeted investigation before firm conclusions about readiness for application-based mHealth programming can be drawn.

Recommendations

Based strictly on the findings actually measured in this study, the following recommendations are made:

- Primary Health Care facilities in Ilorin South should prioritise SMS-based mHealth interventions, such as appointment reminders and educational text messages, as an initial entry point, given that awareness of this tool category was both descriptively highest and statistically confirmed as significantly above the criterion mean in this study.
- Before pursuing application-based mHealth interventions at scale, PHC facilities and programme planners should commission further, more targeted research directly measuring smartphone ownership,

data access, and digital literacy among antenatal clinic attendees in Ilorin South, since the present study measured awareness alone and its finding of statistically inconclusive application awareness does not by itself establish the underlying reason for this pattern.

- Community health educators may wish to explore in-clinic sensitisation specifically addressing pregnancy-related mobile applications, informed by the specific access and literacy barriers identified through the further research recommended above, rather than a generic awareness campaign not grounded in such data.

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