

Knowledge, Perceived Benefits and Willingness to Adopt Telehealth Among Women of Reproductive Age Attending Selected Rural Primary Health Care Centres in Ibadan, Oyo State, Nigeria: A Facility-Based Cross-Sectional Study

Deborah Anjolajesu Elegbeleye

elegbeleye0452@pg.babcock.edu.ng

Babcock University

Motunrayo Florence Olanrewaju

Babcock University

Research Article

Keywords: telehealth, mHealth, technology acceptance model, perceived benefits, maternal health, rural women, primary health care, willingness to adopt, digital health, Nigeria

Posted Date: July 6th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9852218/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.
[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Nigeria contributes nearly one-third of global maternal deaths, and rural women bear a disproportionate burden due to understaffed primary health centres (PHCs), geographic barriers, and limited access to skilled care. Telehealth has been identified as a scalable strategy for improving access to maternal and reproductive health services. However, evidence on demand-side readiness, specifically the knowledge and perceived benefits that drive willingness to adopt telehealth, remains limited among rural women of reproductive age in Nigeria.

Methods

A facility-based descriptive cross-sectional study was conducted among 336 women of reproductive age (15–49 years) attending nine rural PHCs across three Local Government Areas (Ido, Oluyole, and Ona Ara) in Ibadan zone, Oyo State, using multistage probability sampling. Data were collected using the validated bilingual Rural Telehealth Adoption Assessment Questionnaire (R-TAAQ), grounded in the Technology Acceptance Model (TAM), Health Belief Model (HBM), and UTAUT. Descriptive statistics, chi-square tests, Pearson correlation, and binary logistic regression were employed.

Results

The response rate was 93.6%. The majority demonstrated high knowledge of telehealth (62.8%; mean = $5.80 \pm 2.34/8$) and positive perceived benefits (82.4%; mean = $25.6 \pm 7.52/30$). Willingness to adopt was high (83.9%; mean = $11.1 \pm 3.24/15$). Perceived benefits were the only variable significantly associated with willingness to adopt ($\chi^2 = 46.774$, $p < 0.001$). Knowledge ($p = 0.428$), facilitating conditions ($r = 0.037$, $p = 0.493$), and all socio-demographic variables ($p > 0.05$) were not significant. Binary logistic regression confirmed perceived benefits as the sole significant predictor (AOR = 11.274, 95% CI: 5.427–23.422, $p < 0.001$; Nagelkerke $R^2 = 0.254$; classification accuracy = 84.5%). Women with 3–4 children were significantly less likely to be willing to adopt (AOR = 0.073, $p = 0.027$).

Conclusions

Rural women demonstrated high knowledge and strong willingness to adopt telehealth for maternal care. Perceived benefits, not knowledge, infrastructure, or demographics, is the primary determinant of adoption intention. Telehealth promotion in rural PHC settings should prioritise benefit-focused communication. Structural barriers, particularly electricity instability and data unaffordability, must be addressed to close the intention-behaviour gap.

Background

Nigeria's maternal health crisis is one of the most severe and persistent public health challenges in Sub-Saharan Africa. The country contributes nearly one-third of all global maternal deaths, with maternal mortality ratios estimated between 512 and 1,047 deaths per 100,000 live births depending on the source and estimation methodology [1, 2]. These figures place Nigeria among the countries furthest from achieving the Sustainable Development Goal 3.1 target of fewer than 70 maternal deaths per 100,000 live births by 2030 [3]. The leading causes, including postpartum haemorrhage, eclampsia, sepsis, obstructed labour, and unsafe abortion, are largely preventable with timely access to skilled obstetric care; yet they continue to claim an estimated 40,000 lives annually [4]. Sub-Saharan Africa as a region bears approximately 70% of global maternal deaths despite comprising only 14% of the world's population, and the structural drivers of this burden are well-established: weak health system infrastructure, chronic shortages of skilled birth attendants, inadequate emergency obstetric care, geographic inaccessibility of health facilities, gender inequalities limiting women's healthcare autonomy, and poverty that constrains care-seeking behaviour across all three of the delays described by Thaddeus and Maine [5, 6].

Rural women bear a disproportionate share of this burden. Over 60% of Nigerians reside in rural communities characterised by lower educational attainment, limited health literacy, financial constraints, poor transportation infrastructure, and shortages of skilled healthcare workers [7]. These structural inequities are compounded by the ongoing mass emigration of health professionals, popularly referred to as the 'Japa syndrome', which has left fewer than half of registered physicians practising within the country, with the remaining workforce concentrated in urban tertiary facilities and private hospitals [7]. The consequences are visible at the primary health centre (PHC) level: in Oyo State, documented cases of single health workers attending to approximately 100 pregnant women weekly underscore the severity of workforce constraints [8]. These conditions directly reproduce the second and third delays identified by Thaddeus and Maine [6], creating settings where even motivated women who seek care may not receive it in time. Consistent with this trajectory, antenatal care (ANC) coverage from skilled providers in Oyo State declined from 67% in 2018 to 63% in 2023 [4], a deterioration occurring against a backdrop of stated government investment in PHC infrastructure.

Telehealth, broadly defined as the use of telecommunications and digital technologies to deliver health services across distance [9], has attracted substantial policy and research attention as a scalable complement to physical health infrastructure. In Nigeria, mobile phone penetration exceeds 94.5% and the national digital health market is valued at approximately USD 1.2 billion [10, 11], creating the technological prerequisite for mobile health (mHealth) delivery even in communities that lack computer or broadband access. The Federal Ministry of Health's National Digital Health Strategy (2021–2025) explicitly leverages this connectivity to expand healthcare access in underserved communities [12]. At the state level, the Oyo State Health Insurance Agency (OYSHIA) has enrolled over 173,000 beneficiaries and promotes Virtual Health Care Providers for remote consultations and prescriptions [13], while 66 PHCs across the state have been upgraded with solar power systems to address energy constraints that

limit digital health delivery [14]. Evidence supports the potential of these investments: mHealth interventions have improved ANC attendance in 89% of evaluated Sub-Saharan African studies [15], and a cluster-randomised trial in Lagos PHCs demonstrated that voice message-based mHealth significantly increased ANC completion rates among intervention-group women [16].

Despite this convergence of policy investment, infrastructure development, and empirical evidence for mHealth effectiveness, actual telehealth utilisation among rural women of reproductive age in Nigeria remains low. Scholars have described this as the 'mobile paradox': high device ownership coexisting with minimal telehealth engagement [7]. The Technology Acceptance Model (TAM), developed by Davis [17], provides a theoretical explanation for this paradox: technology adoption is driven primarily by Perceived Usefulness, the belief that the technology will produce beneficial outcomes, and Perceived Ease of Use, rather than by the availability of the technology itself. This proposition has been consistently supported in telemedicine and mHealth adoption research across Nigeria and Sub-Saharan Africa, where perceived usefulness has emerged as the dominant predictor of adoption intention across professional, student, and community populations [18, 19, 20, 21]. The Health Belief Model (HBM) [22] supplements TAM by grounding perceived benefits in the specific health-seeking context of maternal care, where women weigh the anticipated clinical, financial, and psychosocial advantages of remote consultation against the perceived adequacy of telehealth as an alternative to face-to-face care. The Unified Theory of Acceptance and Use of Technology (UTAUT) [23] contributes the Facilitating Conditions construct, capturing the objective structural prerequisites, electricity, network connectivity, data affordability, and device access, that determine whether expressed willingness to adopt can be translated into actual sustained use.

What is critically missing from the Nigerian evidence base is demand-side data from the population most likely to benefit from telehealth: rural women of reproductive age attending PHCs. The majority of Nigerian telehealth research has focused on healthcare professionals [18, 24], medical students [25], or urban populations [20], leaving rural community women largely absent from the empirical literature [26]. A scoping review confirmed rural women of reproductive age as the most critically underrepresented group in Nigeria's digital health research landscape [27]. Without understanding what rural women know about telehealth, how they perceive its potential benefits, and what factors make them more or less willing to engage, it is impossible to design adoption-enabling interventions grounded in community reality. This study addresses this gap by simultaneously assessing knowledge, perceived benefits, facilitating conditions, barriers, and willingness to adopt telehealth among rural women attending PHCs in Ido, Oluyole, and Ona Ara Local Government Areas (LGAs) of Ibadan zone, Oyo State, and by identifying the independent predictors of adoption intention within a validated integrated theoretical framework.

Methods

Study Design and Setting

A facility-based descriptive cross-sectional study was conducted between February and March 2025 in nine rural PHCs across three LGAs in Ibadan zone, Oyo State, Nigeria. The three LGAs, Ido, Oluyole, and Ona Ara, were selected by simple random sampling (balloting method) from six rural and peri-urban LGAs in the zone. They are geographically proximate to urban Ibadan, creating a context where mobile phone penetration is relatively high but telehealth utilisation remains low, making them appropriate for investigating the knowledge-to-adoption gap. Three PHCs per LGA were selected by simple random sampling from lists provided by each LGA's PHC headquarters. The nine PHCs served populations ranging from 70 to 140 women per day and represented the primary point of maternal healthcare contact for their communities.

Population, Eligibility and Sampling

The target population comprised women aged 15 to 49 years attending the nine selected PHCs for maternal and reproductive health services, including ANC, postnatal care (PNC), family planning, and child welfare clinic visits. Women presenting with severe illness or obstetric emergencies, women who had previously participated at another PHC within the same LGA, and women who were unwilling to provide informed consent were excluded. The sample size was calculated using Cochran's (1977) formula for a single proportion, based on a conservative prevalence estimate of 30% telehealth adoption readiness from comparable Nigerian community studies [28], yielding a minimum required sample of 323, adjusted to 359 after a 10% non-response allowance. This sample was adequate for binary logistic regression with 7–8 predictor variables, yielding an Events-Per-Variable ratio of 12.6–14.4, exceeding the recommended minimum of 10 [29]. Within each PHC, participants were recruited by systematic random sampling using sampling intervals calculated from facility attendance records, with a randomly selected starting point.

Data Collection Instrument

Data were collected using the Rural Telehealth Adoption Assessment Questionnaire (R-TAAQ), an interviewer-administered bilingual (English and Yoruba) questionnaire developed for this study (see Additional File 1). Items were adapted from the WHO's Monitoring and Evaluating Digital Health Interventions guide [30] and contextualised using TAM, HBM, and UTAUT constructs, and a validated instrument from a comparable Ibadan-based study [18]. The 34-item questionnaire covered socio-demographic characteristics (8 items); knowledge of telehealth (8 True/False/Don't Know items, scored 0–8, categorised as Low [0–3], Moderate [4–5], or High [6–8]); perceived benefits of telehealth (6 Likert-scale items, mean score ≥ 3.5 classified as positive perception); facilitating conditions (6 availability items, 1–5 scale); willingness to adopt telehealth (3 Likert-scale items, mean score ≥ 3.0 classified as willing to adopt); and one open-ended perceived barriers item. Content validity was established through expert review by three public health specialists. A pilot study among 30 eligible women at a PHC in Ogun State confirmed face validity and cultural acceptability. Internal consistency was confirmed across all four quantitative scales (Cronbach's Alpha: 0.712–0.754). Bilingual equivalence was established through

rigorous forward-backward translation by independent certified translators. An interviewer-administered format was selected given the varying literacy levels among the study population.

Statistical Analysis

All analyses were conducted using IBM SPSS Statistics Version 27. Descriptive statistics summarised socio-demographic characteristics and construct distributions. Chi-square tests of independence examined associations between categorical predictors and willingness to adopt; Fisher's exact test was used where expected cell counts fell below 5. Pearson product-moment correlation assessed the relationship between the continuous facilitating conditions score and the continuous willingness score. Binary logistic regression identified independent predictors of willingness to adopt while controlling for confounders. Prior to regression, the Hosmer-Lemeshow goodness-of-fit test confirmed model fit, and Variance Inflation Factor values confirmed no multicollinearity (all VIF < 2.5). Results are reported as adjusted odds ratios (AOR) with 95% confidence intervals. Statistical significance was set at $\alpha = 0.05$.

Ethical Considerations

Ethical approval

was obtained from the Babcock University Health Research Ethics Committee (BUHREC) and the Oyo State Research Ethics Committee (OYSREC). Administrative clearance was obtained from the Oyo State Primary Health Care Board and the Officer-in-Charge of each PHC. Informed consent was obtained from all participants; for participants aged 15–17 years, both parental or guardian consent and participant assent were obtained per Nigerian ethical guidelines for research involving minors. Participation was entirely voluntary, with no impact on care regardless of the decision to participate.

Results

Socio-demographic Characteristics

Of 359 targeted women, 336 completed valid questionnaires (response rate: 93.6%). Table 1 presents the full socio-demographic profile. The majority were aged 20–39 years (85.1%), married (80.7%), and of Yoruba ethnicity (93.2%). Educational attainment was notably high for a rural setting: 54.5% had completed secondary education and 39.9% had attained tertiary education. Half of respondents were self-employed or engaged in trading (50.0%). Monthly household income was low to moderate, with 72.1% earning ₦70,000 or less per month. The majority had one to two children (50.6%).

Table 1
Socio-demographic Characteristics of Respondents (N = 336)

Variable	Category	n	%
Age group	15–19 years	17	5.1
	20–29 years	148	44.0
	30–39 years	138	41.1
	40–49 years	33	9.8
Marital status	Married	271	80.7
	Single	37	11.0
	Divorced/Separated/Widowed	28	8.3
Education	No formal education	4	1.2
	Primary	15	4.5
	Secondary	183	54.5
	Tertiary	134	39.9
Employment	Self-employed/Trader	168	50.0
	Civil/Private sector	102	30.4
	Unemployed/Housewife	43	12.8
	Student	23	6.8
Monthly income	< ₦30,000	102	30.4
	₦31,000–₦70,000	140	41.7
	₦71,000–₦100,000	48	14.3
	> ₦100,000	46	13.7
Parity	None	68	20.2
	1–2 children	170	50.6
	3–4 children	83	24.7
	5 or more	15	4.5

Knowledge, Perceived Benefits, Barriers, and Facilitating Conditions

The majority (62.8%) demonstrated high knowledge of telehealth (mean = $5.80 \pm 2.34/8$). More than half (58.3%) had previously heard of telehealth. Knowledge of core functions was strong: 79.8% correctly

identified that telehealth enables remote phone consultation, 79.2% knew it is most appropriate for follow-up rather than emergency care, 76.8% knew prescriptions can be renewed via telehealth, and 71.7% recognised its applicability to family planning and pregnancy care. Awareness of Oyo State's specific programme was lower at 64.3%.

Perceived benefits were overwhelmingly positive: 82.4% held positive perceptions (mean = $25.6 \pm 7.52/30$). Convenience was rated highest (74.4% agreed or strongly agreed), followed by improved health management (73.9%), easier specialist access (71.8%), and privacy for sensitive reproductive health discussions (71.5%). Cost savings on transport and time savings were each endorsed by 68.5% of respondents.

Among 201 respondents who identified at least one barrier, electricity and phone charging problems were the most frequently cited (26.2%, $n = 88$), followed by data unaffordability (20.5%, $n = 69$) and limited device access (16.1%, $n = 54$). Only 10 respondents (3.0%) expressed a preference for in-person care as a barrier, indicating that attitudinal resistance was minimal. Electricity instability was also the most constrained facilitating condition in the structured scale: only 53.9% reported electricity as always or usually available, compared to 70.8% for smartphone access, 70.6% for home privacy, and 68.5% for network signal.

Willingness to Adopt Telehealth

The majority (83.9%) were willing to adopt telehealth (mean = $11.1 \pm 3.24/15$). Willingness was highest for recommending telehealth to other community women (74.1%) and for using it for minor health complaints (74.1%), with 68.5% willing to use it for routine check-ups. Notably, 51.8% reported having previously used their phone to speak to a health worker or receive health advice, indicating that informal telehealth practices were already present in the study communities; however, 59.2% of past users had engaged only once in the preceding six months.

Hypothesis Testing and Regression

Table 2 presents the full hypothesis testing results. Perceived benefits were the only variable with a statistically significant association with willingness to adopt ($\chi^2 = 46.774$, $df = 1$, $p < 0.001$). Among willing adopters, 88.7% held positive benefit perceptions, compared to 50.0% of non-adopters, a difference of 38.7 percentage points. Knowledge level was not significantly associated with willingness ($\chi^2 = 1.696$, $df = 2$, $p = 0.428$). Facilitating conditions showed no significant correlation with willingness (Pearson $r = 0.037$, $p = 0.493$). All socio-demographic variables tested were non-significant (age $p = 0.745$, education $p = 0.216$, income $p = 0.476$, parity $p = 0.503$).

Table 2
Summary of Hypothesis Testing Results (N = 336)

Hypothesis	Variable	Test	Statistic	p-value	Decision
H ₁	Knowledge vs. willingness to adopt	Chi-square	$\chi^2 = 1.696$, df = 2	0.428	Not supported
H ₂	Perceived benefits vs. willingness to adopt	Chi-square	$\chi^2 = 46.774$, df = 1	< 0.001	Supported
H ₃	Facilitating conditions vs. willingness	Pearson r	r = 0.037	0.493	Not supported
H _{4a}	Age vs. willingness	Chi-square	$\chi^2 = 1.235$, df = 3	0.745	Not supported
H _{4b}	Education vs. willingness	Chi-square	$\chi^2 = 4.460$, df = 3	0.216	Not supported
H _{4c}	Income vs. willingness	Chi-square	$\chi^2 = 2.497$, df = 3	0.476	Not supported
H _{4d}	Parity vs. willingness	Chi-square	$\chi^2 = 2.351$, df = 3	0.503	Not supported

Binary logistic regression confirmed perceived benefits as the sole significant independent predictor of willingness to adopt (AOR = 11.274, 95% CI: 5.427–23.422, $p < 0.001$). Women with 3–4 children were significantly less likely to express willingness to adopt compared to women with five or more children (AOR = 0.073, 95% CI: 0.007–0.745, $p = 0.027$). All other predictor variables were non-significant in the adjusted model. The model demonstrated good fit (Hosmer-Lemeshow $\chi^2 = 10.581$, df = 8, $p = 0.227$), explained 25.4% of variance in willingness to adopt (Nagelkerke $R^2 = 0.254$), and correctly classified 84.5% of cases. Table 3 presents the full regression output.

Table 3
Binary Logistic Regression Predicting Willingness to Adopt Telehealth (N = 336)

Predictor Variable	B	SE	Wald	p-value	AOR	95% CI
Perceived Benefits (Positive vs Negative)	2.423	0.373	42.168	< 0.001*	11.274	5.427–23.422
Knowledge: Low vs High	-0.605	0.452	1.788	0.181	0.546	0.225–1.326
Knowledge: Moderate vs High	-0.140	0.416	0.113	0.737	0.869	0.385–1.965
Age: 15–19 vs 40–49	0.919	0.941	0.955	0.329	2.508	0.396–15.865
Age: 20–29 vs 40–49	0.604	0.634	0.908	0.341	1.830	0.528–6.339
Age: 30–39 vs 40–49	0.349	0.592	0.348	0.555	1.418	0.445–4.520
Parity: None vs 5+	-2.097	1.234	2.889	0.089	0.123	0.011–1.379
Parity: 1–2 vs 5+	-2.083	1.174	3.150	0.076	0.125	0.012–1.243
Parity: 3–4 vs 5+	-2.620	1.186	4.877	0.027*	0.073	0.007–0.745
Income: < ₦30k vs > ₦100k	-0.101	0.557	0.033	0.856	0.904	0.303–2.694
Education: Secondary vs None	1.805	1.094	2.722	0.099	6.080	0.712–51.900
Education: Tertiary vs None	1.971	1.114	3.128	0.077	7.177	0.808–63.739
Note. AOR = Adjusted Odds Ratio; CI = Confidence Interval; SE = Standard Error. *Significant at $p < 0.05$. Model fit: Hosmer-Lemeshow $\chi^2 = 10.581$, $df = 8$, $p = 0.227$. Nagelkerke $R^2 = 0.254$. Classification accuracy = 84.5%.						

Discussion

This study provides the first population-based demand-side evidence on telehealth knowledge, perceived benefits, and willingness to adopt among rural women of reproductive age attending PHCs in Oyo State, Nigeria. The findings reveal a population that is better informed about telehealth and more willing to adopt it than comparable studies in Nigeria might predict, but whose adoption intentions are driven almost entirely by perceived benefits rather than by knowledge, infrastructure, or demographics. The central finding, that women with positive benefit perceptions were over 11 times more likely to express willingness to adopt telehealth (AOR = 11.274, $p < 0.001$), constitutes robust empirical support for TAM's

foundational proposition that perceived usefulness is the primary cognitive driver of technology adoption intention [17]. This effect size is large, consistent, and held after adjusting for five categories of potential confounders.

Knowledge of Telehealth

The majority of respondents (62.8%) demonstrated high knowledge, a finding notably higher than rates in comparable Nigerian studies: Ogboghodo et al. [28] found 61.5% awareness of telemedicine in Edo State, while among medical students a more educated comparison population, only 36.4% demonstrated good telemedicine knowledge [25]. Several contextual factors likely explain the relatively high knowledge in this sample. The educational profile of respondents was unexpectedly high for a rural population (94.4% with at least secondary education), which is consistent with the study LGAs' proximity to urban Ibadan and associated spillover effects on digital information access [31]. The Oyo State government's OYSHIA virtual health programme, whose awareness among respondents reached 64.3%, likely contributed to baseline telehealth familiarity in the study communities [13]. These findings extend prior evidence that proximity to urban digital ecosystems elevates rural community awareness of health technologies independently of formal education [31].

Critically, despite relatively high knowledge, awareness did not independently predict willingness to adopt ($p = 0.428$). This finding replicates evidence from both comparable Nigerian studies [18, 19] and systematic reviews across Sub-Saharan Africa [21], and is theoretically consistent with TAM's positioning of knowledge as an external variable that shapes perceived usefulness and ease of use without directly determining adoption intention. Agbeyangi and Lukose [21], synthesising 53 studies, explicitly concluded that awareness campaigns raising knowledge without simultaneously addressing perceived usefulness consistently fail to produce behaviour change. The practical implication is significant: health education programmes targeting telehealth in rural communities should be designed not as information delivery exercises but as persuasive communication strategies demonstrating the concrete, contextually relevant benefits of digital health services. Awareness without perceived value does not produce adoption.

Perceived Benefits as the Primary Adoption Driver

The dominance of perceived benefits in predicting willingness to adopt is the study's central and most actionable finding. The 38.7 percentage-point difference in positive benefit perceptions between willing adopters (88.7%) and non-adopters (50.0%), and the AOR of 11.274, represent a robust, large-magnitude effect that is consistent across bivariate and multivariate analyses. This finding is consistent with TAM [17] and HBM [22], and with prior evidence from Ibadan-based telemedicine research [18], pregnant women in Lagos [20], women in northern Nigeria [32], and systematic reviews across LMICs [21, 33]. The consistency of this finding across populations, settings, and study designs strengthens confidence that perceived usefulness is a near-universal predictor of health technology acceptance in low-resource settings, and is not an artefact of this sample's demographic profile.

The specific benefit dimensions most valued by respondents merit attention. Convenience was rated highest (74.4%), reflecting the real time costs imposed on self-employed women, who comprised 50.0% of this sample, by travel to and waiting at PHCs. For women whose livelihoods depend on daily trading or farming, a three-hour PHC visit represents a direct financial loss, making telehealth's time-saving potential immediately meaningful. Privacy was the fourth most highly endorsed benefit (71.5%), and its prominence among rural Nigerian women is a novel and important finding. Research across Sub-Saharan Africa has documented that women frequently delay or avoid seeking reproductive health care due to fear of stigma, judgment, and confidentiality breaches in community health facilities where providers and patients share social networks [34, 35]. The finding that privacy is a near-primary driver of telehealth benefit perceptions in this population, ranking comparably with convenience and well above cost savings, suggests that telehealth's confidentiality advantage addresses a structural barrier to care-seeking that is distinct from the logistical and financial barriers typically foregrounded in implementation discussions. PHC administrators and programme designers should explicitly promote telehealth's privacy advantages in communication strategies targeting family planning, sexually transmitted infection treatment, and pregnancy complication management.

It is also notable that positive benefit perceptions were prevalent (82.4%) despite 48.2% of respondents having never used any form of telehealth service. This indicates that positive perceptions are being formed through anticipated rather than experienced advantages, a pattern consistent with TAM's specification that perceived usefulness can influence behavioural intention prior to direct experience [17]. On one hand, this is encouraging: it suggests that the cognitive conditions for adoption are already present without requiring prior exposure. On the other hand, it raises the question of whether anticipated benefits, formed in the absence of direct experience, accurately predict sustained engagement once adoption is attempted. The frequency data from past users, 59.2% having engaged only once in six months, suggests a meaningful gap between favourable anticipation and sustained use that programme designers must account for.

Barriers and the Intention-Infrastructure Gap

The barrier profile was predominantly structural rather than attitudinal. Electricity instability emerged as the most critical structural constraint, cited as a barrier by 26.2% of respondents in open-ended responses and confirmed as the facilitating condition with the highest proportion of inadequate availability (46.1% with inconsistent access). These findings are consistent with Cole et al. [36], who identified electricity instability as the most prevalent structural barrier to telemedicine in rural Nigeria across a systematic review of 34 studies, and with Udenigwe et al. [37], who found the same pattern among rural women in Edo State. The solar panel installations at 66 Oyo State PHCs [14] address facility-level energy needs but cannot resolve household-level device charging constraints, a distinction critical for programme design.

The non-significant association between facilitating conditions and willingness to adopt ($r = 0.037$, $p = 0.493$) must be interpreted carefully. Consistent with Venkatesh et al.'s [23] original UTAUT specification, facilitating conditions predict actual use behaviour more strongly than they predict behavioural intention.

Women in this study may have expressed willingness to adopt despite infrastructure constraints because adoption intention is a cognitive construct shaped by perceived value, not a report of current practical capability; they are indicating what they would do under appropriate conditions rather than what they can currently do. Okeke et al. [38] confirmed this interpretation in rural Oyo State, documenting that residents who expressed telehealth interest nonetheless encountered persistent structural barriers during actual use attempts. This 'intention-infrastructure gap' has direct policy implications: improving enabling conditions is essential for converting the high willingness documented here into actual sustained telehealth engagement, even though facilitating conditions do not independently suppress adoption intention. The high willingness (83.9%) should be understood as a strong foundation that infrastructure investment can build on, not as evidence that infrastructure does not matter.

The Parity Finding

The significant negative association between parity of 3–4 children and willingness to adopt (AOR = 0.073, $p = 0.027$) was unexpected and represents a novel finding with no clear precedent in the telehealth adoption literature for this population. Three complementary explanations are offered. First, women managing multiple young children alongside income-generating activities may face particularly acute practical constraints on their ability to engage with new healthcare modalities, even those perceived as convenient, a pattern consistent with virtual care literature identifying caregiver burden as a barrier to telehealth engagement independently of structural conditions [39]. Second, women with five or more children, the reference category, may represent a more experienced, higher-parity group whose accumulated maternal healthcare navigation experience increases openness to complementary service options. Third, the reference category comprises only 15 respondents (4.5%), creating a statistically unstable comparison reflected in the wide confidence interval (0.007–0.745). This finding should be interpreted with caution and warrants replication in larger samples. Practically, it suggests that asynchronous communication modalities, such as voice messaging or text-based consultations that do not require synchronous phone time, may be more appropriate for women in the active mid-parity caregiving stage than real-time video or phone consultation.

Equity Implications of the Socio-demographic Findings

The absence of significant associations between age, education, income, and willingness to adopt is encouraging from an equity perspective, though it requires contextual interpretation. The universality of maternal health needs across reproductive age groups likely creates a levelling effect in which telehealth's practical benefits are perceived as relevant regardless of educational attainment or economic status. The ceiling effect created by the high overall willingness (83.9%) also compresses variance between groups and reduces statistical power to detect subgroup differences. The practical implication is that telehealth rollout does not need to be finely targeted to specific demographic subgroups in this rural PHC population; it can be designed for broad population-level reach, with specific attention to asynchronous formats for women in the active caregiving parity stage and structural investments in electricity and data affordability for the minorities experiencing the most constrained facilitating conditions.

Limitations

Several limitations should be acknowledged. The cross-sectional design precludes causal inference; while the association between perceived benefits and willingness is strong, the design cannot establish temporal precedence. Facility-based sampling excludes women who do not access PHC services, who likely face greater adoption barriers, potentially overestimating willingness in the broader rural population. Self-reported willingness may be subject to social desirability bias despite neutral interviewer training. The study was conducted in three peri-urban LGAs proximate to urban Ibadan, which likely produces higher knowledge and willingness estimates than more geographically isolated communities; external validity to more remote settings requires separate investigation. The dependent variable measured behavioural intention rather than sustained actual use, and the gap between high intention (83.9%) and low use frequency among past users (59.2% once in six months) confirms that intention and behaviour are distinct outcomes requiring separate investigation. Future research should track actual telehealth use longitudinally and should include community-based sampling to capture the perspectives of women who do not access formal PHC services.

Conclusions

Rural women of reproductive age attending PHCs in Ibadan, Oyo State, demonstrate high knowledge of telehealth and strong willingness to adopt digital health services for maternal care. Perceived benefits, not knowledge, infrastructure, or demographic characteristics, is the primary and overwhelmingly dominant determinant of willingness to adopt, with women holding positive benefit perceptions being over 11 times more likely to express adoption intention. Awareness alone does not drive willingness; what matters is whether women believe telehealth will concretely improve their access to skilled care, save them time and money, and, importantly, protect their privacy in reproductive health consultations. Persistent structural barriers, particularly electricity instability and data unaffordability, do not suppress adoption intention at the cognitive level but will constrain sustained use if left unaddressed, creating an intention-infrastructure gap that simultaneous investment in both demand-side communication and supply-side infrastructure must bridge. Rural women should be understood as informed, willing potential beneficiaries of telehealth, not as passive recipients of top-down digital health mandates, and future implementation efforts should be designed around the specific, contextually grounded benefit perceptions this study has documented.

Abbreviations

ANC

Antenatal Care | AOR:Adjusted Odds Ratio | CI:Confidence Interval | HBM:Health Belief Model | LGA:Local Government Area | LMIC:Low- and Middle-Income Country | mHealth:Mobile Health | OYSHIA:Oyo State Health Insurance Agency | PHC:Primary Health Centre | R-TAAQ:Rural Telehealth Adoption Assessment Questionnaire | TAM:Technology Acceptance Model | UTAUT:Unified Theory of Acceptance and Use of Technology | WHO:World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Babcock University Health Research Ethics Committee (BUHREC) and the Oyo State Research Ethics Committee (OYSREC). Administrative clearance was obtained from the Oyo State Primary Health Care Board and the Officer-in-Charge at each PHC. Written informed consent was obtained from all participants. For participants aged 15-17 years, both parental or guardian written consent and participant assent were obtained per the National Health Research Ethics Committee guidelines (2017). Participation was entirely voluntary with no consequences for declining.

Consent for publication

Not applicable. The manuscript contains no individual person's data in any identifiable form.

Availability of data and materials

The dataset supporting the conclusions of this article is included within the article and its additional files. De-identified data are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study received no external funding. It was conducted as part of the requirements for the Master of Public Health degree at Babcock University, Ilishan-Remo, Ogun State, Nigeria.

Authors' contributions

DAE conceptualised the study, designed the R-TAAQ instrument, conducted data collection and analysis, and drafted the manuscript. MFO supervised the study design, provided methodological guidance throughout, reviewed all drafts critically for intellectual content, and approved the final manuscript. Both authors read and approved the final manuscript.

Acknowledgements

The authors acknowledge the management and staff of the nine participating PHCs in Ido, Oluyole, and Ona Ara LGAs, the Oyo State Primary Health Care Board for granting administrative access, and all women who voluntarily participated in this study. Their time and voices are the foundation of this work.

Authors' information

Deborah Anjolajesu Elegbeleye, BSc. Anatomy, is an MPH candidate in the Department of Public Health, School of Public and Allied Health, Babcock University, Ilishan-Remo, Ogun State, Nigeria. ORCID: 0009-0000-1620-3644.

Prof. Motunrayo Florence Olanrewaju, N.C.E., B.A. (Ed) English, MPH (Health Promotion and Education), DrPH, FAIPH, is a Professor of Public Health in the Department of Public Health, School of Public and Allied Health, Babcock University, Ilishan-Remo, Ogun State, Nigeria. ORCID: 0000-0001-6765-3258.

References

1. World Bank Group, UN DESA/Population Division. Trends in maternal mortality 2000 to 2020. Geneva: WHO; 2023. <https://iris.who.int/handle/10665/366225>.
2. Dogbanya G. Maternal mortality in Nigeria. *Ann Glob Health*. 2025;91(1):16. <https://doi.org/10.5334/aogh.4710>.
3. World Health Organization. Sustainable Development Goals. SDG 3: Ensure healthy lives and promote well-being for all at all ages. Geneva: WHO; 2023.
4. National Population Commission (NPC), Nigeria ICF. Nigeria Demographic and Health Survey 2023–24: Key Indicators Report. Abuja: NPC and ICF; 2024. Available from: <https://dhsprogram.com/pubs/pdf/PR157/PR157.pdf>
5. World Bank Group, United Nations Population Division. Maternal mortality: levels and trends 2000–2020. Geneva: WHO; 2023. <https://iris.who.int/handle/10665/366225>.
6. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Soc Sci Med*. 1994;38(8):1091–110. [https://doi.org/10.1016/0277-9536\(94\)90226-7](https://doi.org/10.1016/0277-9536(94)90226-7).
7. Adebulu T. Rural women hit hardest by Nigeria's worsening healthcare crisis. Pulitzer Center. 2024. Available from: <https://pulitzercenter.org/stories/rural-women-hit-hardest-nigerias-worsening-healthcare-crisis>
8. Ojo IF. Understaffed and overworked: the dire condition of primary healthcare in Oyo State. The International Centre for Investigative Reporting. 2024 Oct 16. Available from: <https://www.icirnigeria.org/understaffed-and-overworked-the-dire-condition-of-primary-healthcare-system-in-oyo-state/>
9. World Health Organization. WHO guideline: recommendations on digital interventions for health system strengthening. Geneva: WHO; 2019.
10. Ken Research. Nigeria telemedicine adoption market is worth USD 1.2 billion [Market report]. 2025. Available from: <https://www.kenresearch.com/nigeria-telemedicine-adoption-market>
11. Onumajuru HD, Hayhoe R, Kabir R, Syed HZ. Digital health utilisation in Nigeria: a scoping review. *Asian J Public Health Nurs*. 2024. <https://doi.org/10.62377/1p736r19>. 1.
12. Federal Ministry of Health. National Digital Health Strategy 2021–2025. Abuja: Government of Nigeria; 2021.

13. Oyo State Health Insurance Agency. Enrolment into Oyo State Health Insurance: fact sheet. 2024. Available from: <https://oyshia.oy.gov.ng>
14. Oyo State Government. Oyo government begins upgrade of 66 primary healthcare centres to boost healthcare delivery. 2024. Available from: <https://oyostate.gov.ng/oyo-govt-begins-upgrade-of-66-phcs-to-boost-healthcare-delivery/>
15. Mbunge E, Muchemwa B, Jiyane S, Batani J. Sensors and healthcare 5.0: transformative shift in virtual care through emerging digital health technologies. *Glob Health J.* 2023;5:169–77. <https://doi.org/10.1016/j.glohj.2021.11.008>.
16. Osanyin GE, Bankethomas A, Oluwole EO, Odeseye AK, Afolabi BB. Effects of a mHealth voice messaging intervention on antenatal care utilisation at primary care level in Lagos, Nigeria: a cluster randomised trial. *J Public Health Afr.* 2022;13(3):2222. <https://doi.org/10.4081/jphia.2022.2222>.
17. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* 1989;13(3):319–40. <https://doi.org/10.2307/249008>.
18. Kofoworola DO, Akanni OO, Solagbade AJ. Knowledge and perceived benefits of telemedicine adoption and online medical consultation among healthcare professionals at Ade-Oyo Maternity Hospital, Ibadan, Oyo State. *Electron J Med Educ Technol.* 2024;17(1):em2402. <https://www.ejmet.com/article/knowledge-and-perceived-benefits-of-telemedicine-adoption-and-online-medical-consultation-among-14300>.
19. Fostina P, Okon UE, Augustina IC. Knowledge, Attitude, and Use of Telemedicine among Health Care Professionals in Federal Medical Center, Bayelsa State, Nigeria. *GPH Int J Health Sci Nurs.* 2024;7(5):62–140. <https://doi.org/10.5281/zenodo.14237894>.
20. Babatunde AO, Ayede AI, Colangelo A, et al. Development of an educational and monitoring mobile application for pregnant women in Nigeria. *Front Public Health.* 2025;12:1368631. <https://doi.org/10.3389/fpubh.2024.1368631>.
21. Agbeyangi AO, Lukose JM. Telemedicine adoption and prospects in Sub-Saharan Africa: a systematic review with a focus on South Africa, Kenya, and Nigeria. *Healthcare.* 2025;13(7):762. <https://doi.org/10.3390/healthcare13070762>.
22. Rosenstock IM. Historical origins of the health belief model. *Health Educ Monogr.* 1974;2(4):328–35. <https://doi.org/10.1177/109019817400200403>.
23. Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: toward a unified view. *MIS Q.* 2003;27(3):425–78. <https://doi.org/10.2307/30036540>.
24. Irowa O, Ogwuche PE, Ugboaja CU, Itodo PE. Knowledge Attitude and Perception on the Use of Telemedicine in Obstetric Practice among Health Workers at the Federal Medical Centre, Makurdi. *Trop J Obstet Gynaecol.* 2025;43(3). Available from: <https://tjog.org/index.php/tjog/article/view/523>
25. Noel NB, Noel MB, Yila E, Nkala CA, Banwat ME. Knowledge and perception of telemedicine among medical students of the University of Jos, Plateau State, Nigeria. *Niger Med J.* 2024;64(6):816–24. <https://doi.org/10.60787/nmj-64-6-373>.

26. Adinoyi AB. Telemedicine as a catalyst for change in Sub-Saharan Africa: evaluating organizational, technological, and social factors – a systematic literature review. *Texila Int J Public Health*. 2025. <https://doi.org/10.21522/TIJPH.2013.13.02.Art021>.
27. Oke JA, Akinwale OP, Oladele RI. Adoption of digital health technology in Nigeria: a scoping review of current trends and future directions. *Adv Public Health*. 2025;2025:4246285. <https://doi.org/10.1155/adph/4246285>.
28. Ogboghodo EO, Omuemu V, Isah EC, Odike MAC. Awareness and use of telemedicine among adult residents of a rural community in Edo State, Nigeria. *J Community Med Prim Health Care*. 2023;35(1):1–14.
29. Peduzzi P, Concato J, Kemper E, Holford TR, Feinstein AR. A simulation study of the number of events per variable in logistic regression analysis. *J Clin Epidemiol*. 1996;49(12):1373–9. [https://doi.org/10.1016/S0895-4356\(96\)00236-3](https://doi.org/10.1016/S0895-4356(96)00236-3).
30. World Health Organization. Monitoring and evaluating digital health interventions: a practical guide to conducting research and assessment. Geneva: WHO. 2016. Available from: <https://www.who.int/publications/i/item/9789241511766>
31. Grace O, Joel A. Perceived Eye health-seeking behaviour of residents in Ido Local Government Area, Oyo State, Migeria. *Afr J Health Nurs Midwifery*. 2024;7(3):112–28. <https://doi.org/10.52589/ajhnm-hkzddwfw>.
32. Ogunniran IA, Owolabi RO, Musa AA, et al. Role of Telemedicine in increasing healthcare access in Nigeria: Challenges and Effective Adoption. *CHBS*. 2024;2(2). <https://doi.org/10.5812/chbs-153991>.
33. Mahmoud K, Jaramillo C, Barteit S. Telemedicine in low- and middle-income countries during the COVID-19 pandemic: a scoping review. *Front Public Health*. 2022;10:914423. <https://doi.org/10.3389/fpubh.2022.914423>.
34. Feroz A, Jabeen R, Saleem S. Using mobile phones to improve community health worker performance in low-and-middle-income countries. *BMC Public Health*. 2020;20:49. <https://pubmed.ncbi.nlm.nih.gov/31931773/>.
35. Cuadros DF, Huang Q, Mathenjwa T et al. Unlocking the potential of telehealth in Africa for HIV: opportunities, challenges, and pathways to equitable healthcare delivery. 2024;6:1278223. <https://doi.org/10.3389/fdgth.2024.1278223>
36. Cole OK, Abubakar MM, Isah A, et al. Barriers and facilitators of provision of telemedicine in Nigeria: a systematic review. *PLOS Digit Health*. 2025;4(7):e0000934. <https://doi.org/10.1371/journal.pdig.0000934>.
37. Udenigwe O, Okonofua FE, Ntoimo LFC, Yaya S. Enablers and barriers to the acceptability of mHealth for maternal healthcare in rural Edo, Nigeria. *Dialogues Health*. 2022;2:100067. <https://doi.org/10.1016/j.dialog.2022.100067>.
38. Okeke EB, Forman D, Taylor E, et al. Evaluating the knowledge and usage of digital health tools in rural Oyo State, Nigeria. *BMC Public Health*. 2025;25:4248. <https://doi.org/10.1186/s12889-025-25600-0>.

39. Kruse CS, Krowski N, Rodriguez B, Tran L, Vela J, Brooks M. Telehealth and patient satisfaction: a systematic review and narrative analysis. *BMJ Open*. 2018;7(8):e016242.
<https://doi.org/10.1136/bmjopen-2017-016242>.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AdditionalFile1RTAAQEnglish.docx](#)