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Efficacy of short message service (SMS) intervention on medication adherence and knowledge of stroke prevention among clinic attendees at risk of stroke: a randomized controlled trial

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Abstract

Background Stroke remains a leading cause of long-term disability and mortality worldwide, particularly in low- and middle-income countries where suboptimal management of modifiable risk factors such as hypertension and diabetes mellitus are prevalent. Poor medication adherence, a critical barrier to effective risk management, is widespread in Nigeria, with adherence rates below 50% in patients with chronic illnesses. This study evaluates the efficacy of a 12-week short message service (SMS)-based intervention in improving medication adherence, knowledge, and prevention practices among hypertensive and diabetic patients attending the Medical Outpatient Clinic at the University College Hospital, Ibadan, Nigeria.

Methodology A single-center randomized controlled trial was conducted with 150 participants aged 18 years and above and had a documented clinical diagnosis of hypertension and/or diabetes mellitus and currently being treated with a prescribed medication. The intervention group received bi-daily SMS reminders on medication adherence, lifestyle modifications, and stroke prevention, alongside standard care. The control group received standard care only. Outcomes assessed included change in medication adherence, knowledge, stroke prevention practices, and quality of life. A *p* value of 0.05 was used.

Result The prevalence of hypertension and diabetes were 90.0% and 20.7% respectively; 16 individuals (10.7%) had comorbidity of hypertension and diabetes. There was a 14.7% increase in the proportion of participants with a high medication adherence in the intervention arm whereas the control arm had a 2.7% increase. This 5 times relative increase in proportion was however not statistically significant. The study showed a significant effect of the intervention on participants knowledge of stroke prevention ($t = 3.339$, $p = 0.001$). There was no significant impact of the intervention on self-rated health scores ($t = 0.132$; $p = 0.896$).

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Conclusion The SMS intervention significantly improved stroke prevention knowledge and showed a non-significant trend towards better medication adherence. Baseline motivational and cultural factors likely influenced outcomes, underscoring the need to address behavioral, cultural and economic barriers. This scalable telehealth model warrants further exploration to optimize adherence in resource-limited settings.

Clinical trial registration This study was registered on the 25th July and approved on 25th of August 2023 by the Pan African Clinical Trials Registry (PACTR) with unique identification number: PACTR202308767234235. The findings from this study are presented in accordance with the Consolidated Standards of Reporting Trials (CONSORT) statement.

Keywords Short message service (SMS) intervention, Medication adherence, Stroke knowledge, Hypertension, Diabetes mellitus, Randomized controlled trial

Introduction

Poor medication adherence is a major contributing factor to the development of stroke in hypertensive and diabetic patients. Stroke, also known as cerebrovascular accident (CVA), is a medical emergency in which there is a compromise of brain function resulting from ischaemia or haemorrhage [1]. It is a leading cause of long-term disability and the second most common cause of death globally [2]. Stroke fatality has been recorded to be as high as 40% just within 30days of stroke incidence in some parts of sub Saharan Africa. Studies have shown worse prognosis among African stroke survivor with more than 80% mortality over a 3-year period [3–5].

Epidemiological studies reveal that hypertension and diabetes mellitus are major modifiable risk factors for stroke [6–8]. In low- and middle-income countries (LMICs), the surge in the prevalence of hypertension and diabetes mellitus has contributed significantly to increasing burden of stroke whereas developed countries have witnessed a downward trend in the incidence of stroke owing to better control of modifiable risk factors [9].

Prevention of stroke is much more economical and desirable than the management of its sequelae. Hence, the need for adequate health education on stroke prevention practices, identification and optimal control of risk factors [6, 8].

Preventive measures are apparently suboptimal in LMICs where medication adherence has been estimated to be less than 50% in patients with chronic illnesses like diabetes and hypertension [7, 10]. Boima et al. found the prevalence of medication non adherence among Nigerian and Ghanaian hypertensive patients to be about 7 in 10 [11]. Oluwole et al. reported that only 1% of clinic attendees in Lagos University Teaching Hospital had high adherence to antihypertensives [12]. Another study in the same tertiary health institution showed that many diabetic patients were non-adherent to their medications [13]. In other regions, diabetes and hypertension have been associated with the highest rates of patient attrition from follow-up care, complicating long-term disease management. Associated with poor blood pressure and glycaemic control, treatment non-adherence is a major challenge in the prevention of stroke among those who are at risk [14–16].

The application of mobile technologies in healthcare (mHealth) has been shown to be quite promising and has the potential to reduce healthcare costs, improve medication adherence and treatment outcomes via personalised health services and follow-up [10]. A meta-analysis of 16 randomised controlled trials has shown that the use of short message service (SMS) reminders doubles the odds of medication adherence in patients with long-term illness [16]. The efficacy of text message reminders on treatment adherence and outcomes has been demonstrated in several diseases including HIV/AIDS [17, 18], asthma, sickle cell [19], hypertension [20], stroke [21, 22], and coronary heart disease [23].

Mobile technology has penetrated different places in the world and is available to people of varying socioeconomic classes and age groups [16] The ownership of feature phones and smartphones in Nigeria has been on the increase. According to a report, more than four-fifths of Nigerians are subscribed to a mobile network [24]. With wide and increasing coverage and penetrance in developing countries, we hypothesise that mobile technology will be effective as an adjunct intervention for managing hypertension and diabetes and ultimately reduce the burden of stroke. We hereby propose this study in order to test the efficacy of short message service (SMS) interventions as an adjunct to standard therapy in improving knowledge and medication adherence in hypertensive and diabetic patients.

Despite the potential for text message-based interventions to improve antihypertensive medication adherence, no study in Nigeria has primarily addressed this issue. A similar one published by Owolabi et al. in 2014 [22] was an interventional trial to improve blood pressure control among those who had had a stroke.

This study is of clinical and public health importance as it aims to answer an important question across various disciplines and medical specialities. Our findings are of interest to multiple clinical specialities which includes;

the cardiologists, endocrinologists, neurologists, public health physicians and pharmacists.

Methodology

Recruitment of study participants

This study was a single-center, randomized controlled trial evaluating the efficacy of 2-way daily text message reminders on medication adherence among hypertensive and diabetic clinic attendees. The study was carried out at the Medical Outpatient (MOP) clinic, University College Hospital (UCH), Ibadan, Oyo State, the foremost tertiary hospital that receives patients from all regions of the country [25].

The study population comprised of hypertensive and diabetic clinic attendees who attended the Cardiology and Endocrinology clinics at the MOP, UCH. Study participants included individuals aged ≥ 18 years old who were able to give informed consent and had a documented clinical diagnosis of hypertension and/or diabetes mellitus being treated with a prescribed medication. Additional inclusion criteria included the ability to read and communicate in English language; the possession of personal cell phone that patient has access to all times and the ability to receive, comprehend and reply to an SMS in English.

We excluded the following individuals: those who have had a stroke, a biological impairment in reading or responding to SMS such as, but not limited to, loss of vision, visual field cuts and aphasia, individuals with a diagnosed organ dysfunction or malignancy, pregnant women and those who would not be available in Nigeria for the 12-week follow-up period.

At the point of recruitment, patients were interviewed to evaluate eligibility in accordance to the aforementioned inclusion and exclusion criteria. Stroke status was ascertained using the Questionnaire for verifying stroke-free status (QVSFS), a validated questionnaire which has been previously shown to have good psychometric properties across culturally diverse populations in West Africa [5].

Ethics Statement

Ethical approval was obtained from the University of Ibadan and University College Hospital Joint Ethical Committee with assigned number: UI/EC/22/0465. The study was also approved by the Chairman of the Medical Advisory Committee of the University College Hospital, Ibadan. Informed consent was obtained from study participants and research was conducted in accordance with the World Medical Association Declaration of Helsinki on Ethical Principles for medical research involving human subjects.

Sample size

Sample size was calculated as follows:

$$n = 2 \times \left(\frac{Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}}{\mu_1 - \mu_2}\right)^2 \times (SD)^2$$

Significance level, α =1%, $Z_{1-}\alpha = Z_{95} = 1.96$, power, β = 90%, $Z_{1-}\beta = Z_{10} = 1.645$.

From existing literature [21], we anticipated a medication adherence score in the control group, $\mu_1 = 6$ and the intervention group, $\mu_2 = 7$ with a standard deviation, SD = 2. A power of 90% is desired at a confidence level of 99%. Allowing for an attrition rate of 20%, the calculated sample size for this study is 130, however we recruited 150 participants for the study.

Randomization of study participants

The total number of 150 participants were recruited and randomized into the 2 study groups. Participants were grouped into the interventional group or control group using simple random sampling. Eligible participants were recruited between 7th September, 2023 and 31st October, 2023; and each individual was randomly assigned into the control or intervention arm in a 1:1 ratio such that there were 75 subjects in the intervention group and 75 study controls. The study arm assignment was done using the online randomization http://www.graphpad.com/quickcalcs/index.cfm.

Data collection and survey instruments

Sociodemographic details that were collected include: age, gender, marital status, religion, ethnicity, educational status, and risk factor for cerebrovascular disease (hypertension and/or diabetes) in participants and relatives. Medication adherence is defined as the primary outcome in this study. Secondary outcomes include health-related quality of life (HRQoL), knowledge and practices about stroke prevention.

Medication adherence was assessed using the Medication Adherence scale from the SPRINT study [26]. After obtaining due permission, the participants' HRQoL was assessed using the EQ-5D–5 L. Knowledge and practices of study participants about stroke prevention were assessed using structured questions adapted from the works of [7, 27]. Study participants in both study arms were assessed for the abovementioned variables at recruitment and at the end of the 90-day follow-up period.

The Medication Adherence Scale is an 8-item questionnaire assessing the extent to which participants' behaviors corresponds with optimal and regular use of their medications. Participants with a score of 8 were considered to have high adherence. A between 6 and < 8 indicates medium adherence, and a score of < 6 indicates low adherence. The EQ-5D-5 L is comprised of 2 major components– a qualitative measurement and a quantitative scale. The qualitative component assesses the extent of HRQoL across 5 sub-components– mobility, self-care, usual activities, pain/discomfort, anxiety/depression. The quantitative component assigns a self-rated score to each individual on a scale of 0 (worst imaginable health) to 100 (best imaginable health). Participants' knowledge of stroke -prevention was determined based on the number of correct responses to a 13-item structured questionnaire requiring agreement or disagreement with the questionnaire statement. Participants' stroke prevention practices were assessed using a 15-item questionnaire on a 5-point Likert scale (Never, Rarely, Sometimes, Often, Always) to ascertain participants' degree of engagement in stroke prevention practices.

Intervention and follow-up

Study participants in the intervention arm began receiving text messages the next day after their recruitment into the study. They received the text messages through their personal cellphone for 90 days at 8am and 7pm each day. This phase lasted between 8th September, 2023 and 29th January, 2024 (on completion of 90-day follow-up for the last recruited patients).

Prior to the beginning of the study, the text messages were reviewed by experts in cardiology, endocrinology and neurology for content and accuracy. The messages contained reminders to participants to take their medications; information on lifestyle modification and stroke prevention practices; and reminders for patients to make clinic appointments. The intervention group was encouraged to reply and make enquiries about their medical condition via a provided helpline. On the other hand, the control group received no text messages throughout the 90-day follow-up period. They were however informed at the beginning of the study about the helpline to call for enquiries.

After the 90-day follow-up, participants in both study arms were contacted for an interview assessing the post-trial medication adherence, HRQoL, stroke prevention knowledge and practices using the aforementioned survey instruments.

Data imputation and statistical analysis

The data was analyzed using the intention-to-treat approach, thus necessitating the imputation of variables for participants who dropped out of the study at the post-trial assessment. Imputation was done using the last observation carried forward (LOCF) approach. Since all participants had non-missing data at baseline, the baseline values were essentially used to replace the missing values for participants who failed to complete the study. This was based on the assumptions that missing values were completely at random (MCAR) and participants' responses would remain the same in the absence of complete follow-up.

All collected variables were summarized using counts, frequencies and proportions. The change in quantitative endpoints was determined by finding the absolute difference between each participants' baseline and post-trial measurements. Bivariate relationship with participants' attrition was tested using the Chi-squared test. The association between intervention and change in self-rated health score was tested using Student's t-test. We assessed the association between intervention and change in the number of correct responses to stroke prevention knowledge using Student's t-test. The 95% confidence interval (95% CI) was determined for reported alongside difference in proportions between study arms for categorical variables. *P*-value < 0.05 was considered significant.

Results

The total number of 150 participants were recruited and randomized into the 2 study groups. Figure 1 (in supplementary file) shows the Trial Flowchart.

Table 1 presents the sociodemographic characteristics of the study participants; consisting of 63.3% females and 91.3% married individuals. Mean (SD) age of the study participants is 58.5 (11.0). The prevalence of hypertension was 90.0% while the prevalence of diabetes was 20.7%; 16 individuals (10.7%) had a comorbidity of hypertension and diabetes.

Forty-eight participants (32.0%) were lost to follow up (31 females, 17 males). We impute after-study missing data points for the 48 participants that were lost to follow-up with the before-study data.

At the beginning of the study, 19 of the participants lost to follow-up had high adherence; 21 had medium adherence, 8 had low adherence. Table 2 presents the characteristics of the participants that were lost to follow-up in the course of the study.

There was a 14.7% increase in the proportion of participants with a high medication adherence in the intervention arm; whereas the control arm had a 2.7% increase (i.e., a 5 times relative increase in the intervention arm compared to the control arm). This absolute difference in proportion of 14.7% (95%CI: -44.43, + 15.10) was however not statistically significant (Table 3). There was also no statistical significance between the intervention and sociodemographic characteristics.

Table 4 shows a significant effect of the intervention on knowledge of stroke prevention ($t = 3.339$, $p = 0.001$).

We found no significant effect of intervention on self-rated health score (Table 4; $t = 0.132$; $p = 0.896$) and the measured parameters of quality of life (Table 5). Our intervention however showed modest (although not

Table 1 Sociodemographic characteristics of study participants in control and intervention arms

Demographic Variable	Control Group (*n* = 75)	Intervention Group (*n* = 75)	Control + Intervention Group (*n* = 150)
Age in Years(mean ± SD)	60.2 ± 11.8	56.9 ± 9.9	58.5 ± 11.0
Gender			
Female (%)	46 (61.3)	49 (65.3)	95 (63.3)
Male (%)	29 (38.7)	26 (34.7)	55 (36.7)
Marital Status			
Married (%)	68 (90.7)	69 (92.0)	137 (91.3)
Single (%)	3 (4.0)	0 (0.0)	3 (2.0)
Widow/Widower (%)	4 (5.3)	6 (8.0)	10 (6.7)
Religion			
Christianity (%)	53 (70.7)	51 (68.0)	104 (69.3)
Islam (%)	22 (29.3)	24 (32.0)	46 (30.7)
Ethnicity			
Hausa (%)	2 (2.7)	0 (0.0)	2 (1.3)
Igbo (%)	4 (5.3)	6 (8.0)	10 (6.7)
Yoruba (%)	64 (85.3)	65 (86.7)	129 (86.0)
Others (%)	5 (6.7)	4 (5.3)	9 (6.0)
Highest Level of Education			
Primary (%)	23 (30.7)	7 (9.3)	30 (20.0)
Secondary (%)	16 (21.3)	16 (21.3)	32 (21.3)
Tertiary (%)	36 (48.0)	52 (69.3)	88 (58.7)
Risk Factor for Cerebrovascular Disease			
Diabetes Mellitus only (%)	9 (12.0)	6 (8.0)	15 (10.0)
Hypertension only (%)	61 (81.3)	58 (77.3)	119 (79.3)
Hypertension and Diabetes (%)	5 (6.7)	11 (14.7)	16 (10.7)
Family History of Risk Factor for Cerebrovascular Disease			
No known family history (%)	43 (57.3)	28 (37.3)	71 (47.3)
Hypertension only (%)	19 (25.3)	33 (44.0)	52 (34.7)
Diabetes only (%)	4 (5.3)	2 (2.7)	6 (4.0)
Hypertension and diabetes (%)	9 (12.0)	12 (16.0)	21 (14.0)

statistically significant) improvement in clinic attendance; increase in consumption of food low in saturated fat; improvement in engagement in weight control measures; reduction in alcohol intake; increase in frequency of taking medications for heart diseases; improvement in the frequency of blood donations (Table 6 in supplementary file).

Discussion

The present study explored the potential of SMS-based interventions to improve medication adherence and enhance knowledge of stroke prevention among clinic attendees at risk of stroke. While the intervention led to improvements in adherence and stroke prevention knowledge, our findings underscore that knowledge gains may not automatically translate into meaningful behavioral changes, particularly in contexts marked by economic and contextual challenges.

A key observation was the significant improvement in participants' knowledge regarding stroke prevention. This enhancement suggests that SMS reminders can serve as an effective tool for health education. However, despite this clear knowledge gain, corresponding improvements in medication adherence did not reach statistical significance. This divergence between knowledge and practice calls for a more nuanced understanding of how educational interventions interact with other determinants of behavior.

In comparing our findings with previous work, our results are broadly consistent with earlier studies that have shown SMS reminders can bolster adherence in chronic disease populations [16, 28]. However, the degree of improvement in adherence observed in our study was less pronounced. One plausible explanation is the presence of baseline differences in participants motivation or other socio-behavioral factors that were not fully captured by the study's sociodemographic measures.

Economic factors further complicate the translation of improved knowledge into adherence. In Nigeria, escalating inflation and declining purchasing power have likely contributed to challenges in consistently affording prescribed medications. Even though our intervention succeeded in imparting critical stroke prevention information, these economic constraints may have prevented patients from acting on that knowledge. Medication adherence is closely linked to patients' financial capacity,

Table 2 Factors associated with attrition

Associated factors	Attrition during intervention		Chi-squared (χ^2)	*p*-value
	Yes (%)	No (%)		
Medication adherence before intervention			**2.090**	**0.352**
Low adherence	8 (16.7)	15 (14.7)		
Medium adherence	21 (43.8)	34 (33.3)		
High adherence	19 (39.6)	53 (52.0)		
Trial Arm			**0.123**	**0.726**
Control group	23 (47.9)	52 (51.0)		
Intervention group	25 (52.1)	50 (49.0)		
Gender			**0.047**	**0.827**
Female	31 (64.6)	64 (62,7)		
Male	17 (35.4)	102 (37.3)		
Marital Status			**3.416**	**0.181**
Married	41 (85.4)	96 (94.1)		
Single	2 (4.2)	1 (1.0)		
Widow/Widower	5 (10.4)	5 (4.9)		
Religion			**0.236**	**0.627**
Christian	32 (66.7)	72 (70.6)		
Islam	16 (33.3)	30 (29.4)		
Highest Level of Education			**1.640**	**0.440**
Primary	10 (20.8)	20 (19.6)		
Secondary	13 (27.1)	19 (18.6)		
Tertiary	25 (52.1)	63 (61.8)		

*$p < 0.05$

Table 3 Impact of intervention on medication adherence

Medication Adherence	Control Group ($n = 75$)			Intervention Group ($n = 75$)			Difference in proportion between Intervention and Control ΔI– ΔC (%); 95% CI
	Before Intervention	After Intervention	ΔC	Before Intervention	After Intervention	ΔI	
Low (%)	6 (8.0)	4 (5.3)	*-2 (2.7)*	17 (22.7)	17 (22.7)	*0 (0.0)*	**+ 2.67 (-18.71, + 24.04)**
Medium (%)	28 (37.3)	28 (37.3)	*0 (0.0)*	27 (22.7)	16 (21.3)	*-11 (14.7)*	**-14.67 (-44.43, + 15.10)**
High (%)	41 (54.7)	43 (57.3)	*+ 2 (2.7)*	31 (41.3)	42 (56.0)	*+ 11 (14.7)*	**+ 12.00 (-19.71, + 43.71)**

ΔC = Difference before and after study in control group; positive values indicate an increase; negative values indicate a decrease

ΔI = Difference before and after study in intervention group; positive values indicate an increase; negative values indicate a decrease

95% CI: 95% confidence interval

Table 4 Impact of intervention on participants' self-rated health score and knowledge about stroke prevention

Outcome Variable	Control Group ($n = 75$)	Intervention Group ($n = 75$)	t-test statistics	*p*-value
Change in number of correctly answered questions on participants' knowledge of stroke prevention (mean ± SD)	0.11 ± 0.83	0.60 ± 0.97	3.339	0.001*
Change in self-rated health score (mean ± SD)	-1.93 ± 14.63	-2.21 ± 11.21	-0.132	0.896

SD = standard deviation

*$p < 0.05$

as recent literature suggests [29]. In this context, the increased cost of medications can be a significant barrier, making it essential to consider economic support measures alongside digital interventions.

Our secondary outcomes further illuminate this complex scenario. Although we observed no significant change in self-rated health scores or quality-of-life parameters, there were modest improvements in behaviors such as clinic attendance and dietary choices. It is

Table 5 Impact of intervention on health-related quality of life

Health-related quality of life parameters	Control Group (*n* = 75)			Intervention Group (*n* = 75)			Difference in proportion between Intervention and Control ΔI– ΔC (%); 95% CI
	Before Intervention	After Intervention	ΔC	Before Intervention	After Intervention	ΔI	
MOBILITY– degree of impairment in walking about							
None (%)	63 (84.0)	64 (85.3)	*+ 1 (1.3)*	63 (84.0)	63 (84.0)	*0 (0.0)*	**-1.33 (-24.60, + 21.93)**
Moderate (%)	12 (16.0)	11 (14.7)	*-1 (1.3)*	12 (16.0)	11 (14.7)	*-1 (1.3)*	**0.00 (-23.06, + 23.06)**
Extreme (%)	0 (0.0)	0 (0.0)	*0 (0.0)*	0 (0.0)	1 (1.3)	*+ 1 (1.3)*	**+ 1.33 (-1.26, + 3.93)**
SELF-CARE– degree of impairment with self-care							
None (%)	68 (90.7)	71 (94.7)	*+ 3 (4.0)*	70 (93.3)	72 (96.0)	*+ 2 (2.7)*	**-1.33 (-16.83, + 14.17)**
Moderate (%)	7 (9.3)	4 (5.3)	*-3 (4.0)*	5 (6.7)	3 (4.0)	*-2 (2.7)*	**+ 1.33 (+ 14.17, + 16.83)**
USUAL ACTIVITIES– degree of impairment with performing usual activities							
None (%)	63 (84.0)	68 (90.7)	*+ 5 (6.7)*	64 (85.3)	66 (88.0)	*+ 2 (2.7)*	**-4.00 (-25.46, + 17.46)**
Moderate (%)	12 (16.0)	7 (9.3)	*-5 (6.7)*	11 (14.7)	9 (12.0)	*-2 (2.7)*	**+ 4.00 (-17.46, + 25.46)**
PAIN/DISCOMFORT– degree of pain or discomfort							
None (%)	30 (40.0)	38 (50.7)	*+ 8 (10.7)*	31 (41.3)	36 (48.0)	*+ 5 (6.7)*	**-4.00 (-35.72, + 27.72)**
Moderate (%)	43 (57.3)	35 (46.7)	*-8 (10.7)*	43 (57.3)	38 (50.7)	*-5 (6.7)*	**+ 4.00 (-27.81, + 35.81)**
Extreme (%)	2 (2.7)	2 (2.7)	*0 (0.00)*	1 (1.3)	1 (1.3)	*0 (0.0)*	**0.00 (-8.83, + 8.83)**
ANXIETY/DEPRESSION– degree of anxiety or depression							
None (%)	53 (70.7)	56 (74.7)	*+ 3 (4.0)*	55 (73.5)	61 (81.3)	*+ 6 (8.0)*	**+ 4.00 (-23.59, + 31.59)**
Moderate (%)	22 (29.3)	19 (25.3)	*-3 (4.0)*	20 (26.7)	13 (17.3)	*-7 (9.3)*	**-5.33 (-32.76, + 22.09)**
Extreme (%)	0 (0.0)	0 (0.0)	*0 (0.0)*	0 (0.0)	1 (1.3)	*+ 1 (1.3)*	**+ 1.33 (-1.26, + 3.93)**

ΔC = Difference before and after study in control group; positive values indicate an increase; negative values indicate a decrease

ΔI = Difference before and after study in intervention group; positive values indicate an increase; negative values indicate a decrease

95% CI: 95% confidence interval

important to note that clinic attendance was assessed at a single follow-up visit, and this limitation should be taken into account when interpreting these trends. Nonetheless, the observed improvements in stroke prevention practices suggest that SMS interventions can serve as effective vehicles for behavior change if coupled with other supportive strategies.

This study contributes new insights into the challenges of implementing digital health interventions in resource-constrained settings. The significant enhancement in stroke prevention knowledge suggests that SMS remains a scalable and accessible tool for patient education. However, the gap between increased knowledge and actual behavioral change, particularly in medication adherence, highlights the need for a more comprehensive approach. Motivation is widely recognized as a critical determinant of medication adherence [14, 30]. Integrating SMS reminders with targeted motivational support and economic assistance may be necessary to overcome the multifaceted barriers encountered by patients in similar settings.

Limitations

Despite randomization, there were potential baseline imbalances in medication adherence and motivational factors between the study arms. For example, our study noted that participants in the control arm had a higher proportion of high baseline adherence (55%) compared to those in the intervention group (41%). This imbalance, likely due to our modest sample size, may have confounded the observed effectiveness of the SMS intervention. Second, the study was conducted at a single tertiary center, limiting the generalizability of the findings to other settings, especially in rural or less resourced areas. Additionally, our reliance on self-reported measures for medication adherence and clinic attendance introduces the potential for reporting bias. Finally, while economic factors appear to have played a role in adherence challenges, we did not directly monitor medication access or affordability during the study. Future research should integrate these dimensions to provide a more comprehensive evaluation of intervention efficacy.

Conclusion

In conclusion, our SMS-based intervention significantly improved stroke prevention knowledge but yielded only a modest, non-significant improvement in medication adherence. These findings suggest that while digital interventions can effectively disseminate health information, their impact on behavior change may be limited by baseline imbalances, motivational disparities, and economic constraints. A multifaceted approach that combines SMS reminders with motivational and economic support could be more effective in enhancing adherence in resource-limited settings. Future multicenter trials that quantitatively assess these additional factors are warranted to optimize the design and implementation of digital health interventions for chronic disease management.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-22204-6.

Supplementary Material 1

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Author contributions
D.A. secured funding for the study, registered the trial, obtained licenses for study materials, managed the data, and wrote the main manuscript. B.A. conceptualized the study, analyzed the data, and contributed to writing the main manuscript. J.I., T.O., A.A., P.A., and F.O. collaborated on drafting and editing the main manuscript. V.A., T.O., and O.O. were involved in data management. O.P. and A.O. supervised the study and provided critical revisions to the manuscript. All authors reviewed and approved the final manuscript.

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Data availability
The data supporting the findings of this study are available upon reasonable request from the corresponding author.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the University of Ibadan and University College Hospital Joint Ethical Committee with assigned number: UI/EC/22/0465. The study has also been approved by the Chairman of the Medical Advisory Committee of the University College Hospital, Ibadan. We ensured that the research was carried out in accordance with the World Medical Association Declaration of Helsinki on Ethical Principles for medical research involving Human Subjects. Informed consent was obtained from study participants. This study is registered and approved by the Pan African Clinical Trials Registry (PACTR) with unique identification number: PACTR202308767234235. The approval date is 25 Aug 2023. This is in accordance with the recommendations of the International Committee of Medical Journal Editors (ICMJE).

Consent for publication
Not applicable. This manuscript does not contain any individual person’s data in any form (including individual details, images, or videos).

Competing interests
The authors declare no competing interests.

Abbreviations
Not applicable.

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