EFFECT OF SMS-BASED EDUCATIONAL, COGNITIVE, AND BEHAVIOURAL INTERVENTIONS ON PREOPERATIVE ANXIETY AMONG PATIENTS AWAITING ELECTIVE ABDOMINAL SURGERY IN SOUTH-WEST NIGERIA

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Abstract

Preoperative anxiety is a common challenge among patients awaiting elective abdominal surgery, negatively impacting surgical outcomes. This study assesses the effect of SMS-based educational, cognitive, and behavioural interventions on preoperative anxiety among patients in South-West Nigeria. The study specifically aims to evaluate: (1) the impact of SMS educational information on surgical preparation, (2) the effect of SMS cognitive restructuring on preoperative anxiety, and (3) the role of SMS behavioural techniques in modifying patient behaviour for surgical readiness. A quantitative quasi-experimental design was employed, involving 440 participants from three teaching hospitals. Patients were randomly assigned to intervention (SMS group) and control groups. The SMS group received structured messages covering surgical preparation, cognitive restructuring, and behavioural modifications, while the control group followed standard preoperative care without SMS interventions. A self-structured questionnaire was used to collect data, and mean scores were analysed using descriptive statistics. Findings indicated a significant improvement in the intervention group across all domains. The mean posttest scores for educational preparedness (2.95 vs. 1.67), cognitive restructuring (2.91 vs. 1.71), and behavioural readiness (2.83 vs. 1.70) were notably higher in the SMS group than in the control group, demonstrating the effectiveness of SMS interventions. The

study concludes that SMS-based interventions effectively reduce preoperative anxiety by enhancing knowledge, cognitive restructuring, and behavioural readiness. It is recommended that healthcare institutions integrate SMS-based educational strategies into preoperative care to improve patient preparedness and surgical outcomes, particularly in resource-limited settings.

Keywords: Preoperative anxiety, SMS intervention, cognitive restructuring, behavioural modification, surgical preparation.

Introduction

Preoperative anxiety is a significant concern among patients awaiting elective abdominal surgery, often leading to adverse physiological and psychological effects. Severe levels of preoperative anxiety have been associated with autonomic disturbances, such as increased heart rate, elevated blood pressure, and arrhythmias, which can negatively impact surgical outcomes (Johnson et al. 2020). Studies have shown that heightened anxiety before surgery can lead to prolonged postoperative recovery, increased postoperative pain, and a greater need for analgesic medications (Ji et al., 2022). Additionally, high levels of preoperative anxiety have been linked to increased morbidity, extended hospital stays, and, in some cases, patient refusal to undergo planned surgical procedures (Marinelli et al., 2023). Effective management of preoperative anxiety is crucial, as it has been associated with smoother anesthesia induction, reduced pharmacological premedication requirements, and improved overall surgical outcomes.

To address preoperative anxiety, healthcare professionals—including surgeons, anesthetists, and perioperative nurses—traditionally conduct preoperative visits to educate, inform, and psychologically prepare patients for surgery (Lamonte, et al., 2018). However, the growing shortage of healthcare professionals has made it difficult to provide these essential visits to all patients, thereby contributing to heightened anxiety levels and potential surgery cancellations (Collins et al., 2019). In response, alternative interventions, such as the use of short message services (SMS), have emerged as potential tools for delivering preoperative education and psychological support to surgical patients.

Despite the increasing global adoption of mobile health (mHealth) interventions, research on the use of SMS in mitigating preoperative anxiety remains limited, particularly in Nigeria. Previous studies have investigated various strategies for reducing preoperative anxiety, including face-to-face counseling, multimedia interventions, and relaxation techniques (Gunter et al., 2022).

However, there is a notable gap in literature regarding the direct impact of SMS interventions on preoperative anxiety, especially among Nigerian patients undergoing elective abdominal surgery. This study aims to bridge that gap by assessing the effectiveness of SMS as a preoperative intervention, with the objective of determining its role in providing timely guidance, support, and reassurance to patients before surgery.

Traditionally, perioperative teams prepare patients for surgery through physical ward visits, where essential preoperative information is provided. However, supplementary methods such as SMS-based educational messages can ensure patients receive continuous and accessible information regarding their health status, surgical procedures, and necessary preoperative preparations (Ellimootti et al., 2018). Failure to deliver this information effectively can exacerbate anxiety, negatively impacting patients' psychological well-being and potentially leading to adverse postoperative outcomes such as pain, behavioral changes, and emotional distress (Platts-Mills et al., 2020).

Psychological interventions play a crucial role in preoperative care by addressing anxiety-related concerns and improving patients' mental preparedness for surgery. Assessing and managing preoperative anxiety can help prevent negative emotional states that may impact patients' perceptions of surgery and their overall recovery experience (Stamenkovic et al., 2018). A well-structured perioperative care plan that integrates psychological support, patient education, and preoperative assessments has been shown to improve surgical outcomes (Chang et al., 2022). SMS-based interventions, which provide patients with consistent and structured information, represent an innovative approach to reducing preoperative anxiety and enhancing overall perioperative care.

SMS technology offers a cost-effective and scalable solution for delivering psychological and behavioral interventions in preoperative settings. Given the widespread use of mobile phones, SMS-based messaging is an accessible intervention that does not require internet access, making it particularly beneficial in resource-limited settings (Johnson et al., 2016). Automated SMS reminders have been utilized in various healthcare contexts, including maternal health, smoking cessation, diabetes education, and physical activity promotion, demonstrating significant impacts on health-related behaviors (Suffoletto, 2016). Recognized for their simplicity, affordability, and ease of implementation, SMS interventions have been endorsed by leading healthcare

organizations such as the American Medical Association (AMA) and the World Health Organization (WHO) as effective tools for patient engagement and education (Hall, et al. 2015).

Studies conducted across different regions, including the United States, Europe, and Africa, have demonstrated the efficacy of digital interventions in reducing preoperative anxiety and improving health outcomes. For instance, Wang, et al. (2022) investigated the use of an anesthesia service platform to alleviate preoperative anxiety, highlighting the effectiveness of digital communication in preparing patients for surgery. In Nigeria, while traditional preoperative visits remain the standard practice, limited research has explored alternative methods such as SMS for preoperative anxiety management (Bridges et al., 2019). Despite the growing global use of SMS in healthcare, its role in addressing preoperative anxiety for patients undergoing abdominal surgery in Nigeria remains understudied.

Empirical studies highlight significant misconceptions, acceptance factors, and anxiety-related issues concerning surgery. The World Health Organization (WHO) identified a global disparity in surgical care, with low- and middle-income countries (LMICs) accounting for over 90% of injury-related deaths but receiving only 3.5% of surgical operations (Bridges et al., 2019). Despite its critical role in addressing trauma, maternal health, and congenital anomalies, surgery remains underfunded in global health priorities. Additionally, contrary to beliefs that surgery is costly, studies show that surgical interventions can be cost-effective, with a lower cost per Disability-Adjusted Life Year (DALY) averted compared to some public health interventions (Collins et al., 2019). Misconceptions about surgery also include beliefs that all surgeries are dangerous, long procedures indicate complications, and anesthesia poses severe risks, although these fears are often unfounded.

Acceptance of surgery varies across populations and conditions. A study on cardiac surgery patients in Australia found positive attitudes toward gene therapy, although many lacked basic understanding of the concept. In China, factors such as higher body mass index (BMI), family support, medical insurance, and a history of Type 2 diabetes influenced acceptance of bariatric surgery (Khurana, et al., 2020). Fear of surgery was significantly influenced by demographic factors. El-Gabalawy et al. (2019) found that younger patients and women exhibited higher levels of fear, with concerns ranging from postoperative pain to financial loss and fear of death.

Preoperative fear was strongly associated with prior pain experiences, feelings of inadequacy, and psychosocial stressors, particularly among women.

Preoperative anxiety remains a critical concern. El-Gabalawy et al. (2019) noted that anxiety concerns are highly individualized, questioning the clinical utility of categorizing patients based on anxiety levels. In New Zealand, Johnson et al. (2016) identified five primary concerns among surgical patients, including recovery, symptoms, surgical risks, medical procedures, and healthcare planning. A meta-analysis by Thakkar et al. (2016) revealed that nearly half of surgical patients in LMICs experience preoperative anxiety, emphasizing the need for systematic assessment. Mulugeta et al. (2018) stressed the importance of multidisciplinary management to mitigate preoperative anxiety. Similarly, Lakhe et al. (2022) found that younger, female, and first-time surgical patients exhibited higher anxiety levels. Another study on cancer patients undergoing major pancreatic surgery indicated that psychological factors, including depressive symptoms, significantly increased preoperative anxiety, reinforcing the need for targeted psychological support (Bedaso et al., 2022).

The main objective of this study is to assess the effect of SMS-based educational, cognitive, and behavioural interventions on preoperative anxiety among patients awaiting elective abdominal surgery in South-West Nigeria. The specific objectives are:

1. to assess the pre- and post-intervention SMS educational information on surgical preparation for elective abdominal surgery on preoperative anxiety among intervention and control groups;

2. to examine the pre- and post-intervention SMS cognitive restructuring on individual thoughts for elective abdominal surgery on preoperative anxiety among intervention and control groups; and

3. to assess the pre- and post-intervention SMS behavioural technique on behavioural modification for elective abdominal surgery on preoperative anxiety for intervention and control groups.

Methodology

The study employs a quantitative quasi-experimental research design to evaluate the effectiveness of SMS interventions in reducing preoperative anxiety among patients awaiting elective abdominal surgery. The research involved two groups: an experimental group receiving SMS interventions and a control group that did not receive any SMS intervention. The SMS interventions were designed using psychological approaches such as educational messages, cognitive restructuring, and behavioural techniques. The control group followed standard preoperative care procedures without any SMS exposure. By comparing pre- and post-test results between both groups, the study aims to determine the impact of SMS interventions on preoperative anxiety reduction. The research population consists of 1,436 patients from three selected teaching hospitals in Southwest Nigeria: Lagos University Teaching Hospital (LUTH), Olabisi Onabanjo University Teaching Hospital (OOUTH), and Obafemi Awolowo University Teaching Hospital Complex (OAUTHC). Inclusion criteria required participants to be 18 years or older, have access to mobile phones for SMS reception, be present during the study, and provide consent. Patients below 18 years, those not undergoing elective abdominal surgery, or unwilling to participate were excluded.

A multistage sampling technique incorporating probability sampling was used to ensure representativeness across the selected hospitals. The sample size was determined using Cochran's formula, resulting in a required sample of 400 participants, with a 10% attrition rate adjustment increasing it to 440. The proportional distribution across hospitals was LUTH (130), OOUTH (193), and OAUTHC (117). The sampling process involved three stages: first, a random selection of three states (Lagos, Ogun, and Osun) from Southwest Nigeria; second, a random selection of one teaching hospital from each state; and third, stratified random sampling to assign participants into intervention and control groups within each hospital. The final distribution ensured an approximately equal representation between intervention and control groups, with LUTH (65 intervention, 65 control), OOUTH (96 intervention, 97 control), and OAUTHC (59 intervention, 58 control). This approach enhances the study's reliability and ensures balanced participant allocation for assessing the effectiveness of SMS interventions.

The study employed a self-structured questionnaire divided into two sections to collect data from respondents. Section A gathered socio-demographic information such as age, gender, educational and employment status, marital status, and previous experiences with surgery and SMS for

health information. Section B measured surgical preparation, cognitive restructuring, and behavioural levels using a 21-item self-assessment scale rated on a 4-point scale. The instrument's content validity was ensured by presenting it to experts in tests, measurement, and nursing, whose feedback refined the wording and alignment of the questions. Additionally, refinements were made based on feedback from the expert panel and pilot testing. Data collection took place in three selected teaching hospitals in Southwest Nigeria. Research assistants, including Registered Nurses and ICT personnel, were recruited and trained on the study's objectives and data collection procedures. These assistants facilitated patient selection and dissemination of educational messages covering topics such as diet, physical activity, and surgical environment awareness. The data collection process was conducted in three stages: pre-intervention, intervention, and post-intervention phases.

Descriptive statistics, including frequency, percentages, means, and standard deviations, were employed for data analysis. Ethical considerations were strictly adhered to throughout the study. Informed consent was obtained from participants, either through signature or thumbprint, and anonymity and confidentiality were maintained by using codes instead of names. Participation was entirely voluntary, with assurances that respondents could withdraw at any time without repercussions. The study upheld the ethical principles of respect for human rights, ensuring that no individual was coerced into participation, and all data collected remained confidential.

Results

Table 1: Socio-demographic profile of patients awaiting elective abdominal surgery

Variable	Options	Intervention (n=220)	Control (n=220)
Age		48±10	49±11
Facility	LUTH	65 (50.0%)	65 (50.0%)
	OOUTH	96 (49.7%)	97 (50.3%)
	OAUTH	59 (50.4%)	58 (49.6%)
	Total	220 (50.0%)	220 (50.0%)
Educational status	Primary	127 (52.7%)	114 (47.3%)
	Secondary	93 (46.7%)	106 (53.3%)
	Total	220 (50.0%)	220 (50.0%)
Gender	Male	91 (47.4%)	101 (52.6%)
	Female	129 (52.0%)	119 (48.0%)
	Total	220 (50.0%)	220 (50.0%)
Marital status	Single	0 (0.0%)	6 (100.0%)

	Married	220 (50.7%)	214 (49.3%)
	Total	220 (50.0%)	220 (50.0%)
Religion	Christianity	194 (52.2%)	178 (47.8%)
	Islam	26 (38.2%)	42 (61.8%)
	Total	220 (50.0%)	220 (50.0%)
Employment status	Employed	81 (35.7%)	146 (64.3%)
	Self-employed	139 (65.3%)	74 (34.7%)
	Total	220 (50.0%)	220 (50.0%)
Monthly income (in naira)	Less than 50,000	0 (0.0%)	14 (100.0%)
	50,000-100,000	220 (51.6%)	206 (48.4%)
	Total	220 (50.0%)	220 (50.0%)
Previous use of SMS for health information	No	220 (50.0%)	220 (50.0%)
	Total	220 (50.0%)	220 (50.0%)
Perception of the healthcare system	Positive	220 (50.0%)	220 (50.0%)
	Total	220 (50.0%)	220 (50.0%)

The socio-demographic profile of patients awaiting elective abdominal surgery revealed a balanced distribution between the intervention and control groups across key variables. The mean age of participants was similar, with 48±10 years in the intervention group and 49±11 years in the control group. The distribution across healthcare facilities (LUTH, OOUTH, and OAUTH) was nearly equal between groups. In terms of education, more participants in the intervention group had primary education (52.7%) compared to the control group (47.3%), whereas the control group had a slightly higher proportion with secondary education (53.3%). Gender representation was also nearly equal, with 47.4% of males and 52.0% of females in the intervention group. Marital status showed that all intervention participants were married, while six single patients were in the control group. Christianity was the predominant religion, with higher representation in the intervention group (52.2%) than in the control (47.8%), while Islam was more represented in the control group (61.8%). Employment patterns showed that more participants in the intervention group were self-employed (65.3%), whereas employment was higher in the control group (64.3%). Monthly income distribution indicated that only control group participants earned less than ₦50,000, while both groups had a similar representation in the ₦50,000-₦100,000 category. Previous use of SMS for health information and perception of the healthcare system were uniformly distributed across both groups, indicating no baseline differences in these aspects.

Table 2: Mean and standard deviation of educational information scores among the SMS and control groups

Group	N	Mean Pretest	SD	Mean Posttest	SD	Mean score
SMS	220	1.74	0.95	2.95	0.72	1.21
Control	220	1.70	1.01	1.67	1.11	-0.02

Surgical Preparation Scoring:

Unprepared: 1.0–1.74, Slightly Prepared: 1.75–2.49, Prepared: 2.50-3.24, Highly Prepared: 3.25-4.0

Table 2, the SMS group had a mean pretest score is 1.74 (SD = 0.95), indicating that the intervention group were "unprepared" before the intervention. After receiving SMS educational information, the mean posttest score increased to 2.95 (SD = 0.72), reflecting a significant improvement in educational preparedness prior the surgery. The mean score change of 1.21 indicates a notable enhancement in their understanding and readiness for the elective abdominal surgery. In contrast, the control group, had a mean pretest score of 1.70 (SD = 1.01), showing that they were earlier unprepared as well. However, post-intervention, their mean score drops to 1.67 (SD = 1.11), suggesting a decline in preparedness. The mean score change of -0.02 indicates that the control group did not benefit from any educational intervention, and their preparedness actually worsened. Overall, the findings suggest that the SMS educational information improves surgical preparation scores among the intervention group while the control group shows no improvement and a slight decline.

Table 3: Mean and standard deviation of cognitive restructuring scores among the SMS and control groups

Group	N	Mean Pretest	SD	Mean Posttest	SD	Mean score
SMS	220	1.71	0.94	2.91	0.74	1.21
Control	220	1.73	1.06	1.71	1.16	-0.03

Surgical Preparation Scoring:

Unprepared: 1.0–1.74, Slightly Prepared: 1.75–2.49, Prepared: 2.50-3.24, Highly Prepared: 3.25-4.0

In Table 3, the SMS group had a mean pretest score of 1.71 (SD = 0.94), indicating that experimental group were unprepared prior to the cognitive restructuring, therefore battling with some negative thoughts before the intervention. After the SMS cognitive restructuring intervention, the mean posttest score rises significantly to 2.91 (SD = 0.74), showing the intervention group had a cognitive restructuring towards the surgery. The mean score change of 1.21 demonstrates a substantial improvement in their cognitive restructuring and readiness. On the other hand, the control group, had a mean pretest score of 1.73 (SD = 1.06), placing them in the "unprepared" category as well. However, post-intervention, their mean score remained unchanged at 1.71 (SD = 1.16), indicating no improvement in cognitive restructuring. The mean score change of -0.03 suggests a negligible decline in their preparedness. The findings indicate that SMS cognitive restructuring enhances individual thoughts and preparedness among the intervention group, while the control group shows no improvement.

Table 4: Mean and standard deviation of behavioural modification scores among the SMS and control groups

Group	N	Mean Pretest	SD	Mean Posttest	SD	Mean score
SMS	220	1.67	0.94	2.83	0.81	1.16
Control	220	1.75	1.10	1.70	1.15	-0.05

Surgical Preparation Scoring:

Unprepared: 1.0–1.74, Slightly Prepared: 1.75–2.49, Prepared: 2.50-3.24, Highly Prepared: 3.25-4.0

In Table 4, the SMS group had a mean pretest score of 1.67 (SD = 0.94), indicating that they were not earlier prepared before the behavioural modification. After implementing SMS behavioral techniques, the mean posttest score improved to 2.83 (SD = 0.81), moving them into the "Prepared" category. However, the mean score change of 1.16 demonstrates a substantial improvement in their behavioural readiness for the surgical preparation. In contrast, the control group with a mean pretest score of 1.75 (SD = 1.10), places them in the "unprepared" category before the behavioural intervention. Post-intervention, their mean score remains relatively stable at 1.70 (SD = 1.15), indicating no significant change in their behavioural modification. The mean score change of 0.05 reflects a negligible improvement.

Discussion of Findings

The study findings revealed that SMS educational interventions significantly improved surgical preparation scores among the intervention group, whereas the control group experienced a slight decline. This aligns with Bedaso et al. (2022), who found that SMS applications enhanced engagement and outcomes in maternal health and smoking cessation. Similarly, Shapiro et al. (2022) demonstrated the effectiveness of SMS updates for cardiac surgery patients and their families, with participants appreciating the service's reassurance and ease of use. Hart and Vaccaro (2017) also found that SMS reminders improved goal-directed behaviors among individuals recovering from traumatic brain injuries. Additionally, Lu et al. (2020) highlighted the role of SMS in managing chronic conditions like diabetes and promoting physical activity.

The study also found that SMS cognitive restructuring significantly enhanced individual thoughts and preparedness among the intervention group, whereas the control group exhibited no notable changes. This finding is supported by research on mobile health (mHealth) platforms, including studies by Franklin et al. (2018) and Salisbury-Afshar et al. (2020), which demonstrated the positive impact of SMS on health-related behaviors. Schwebel and Larimer (2018) conducted a systematic review of 162 studies, confirming the effectiveness of SMS reminders in improving medical compliance and appointment attendance. Their findings emphasized the cost-effectiveness, efficiency, and acceptability of SMS interventions in healthcare. Kaliyadan and Ramsey (2019) provided additional evidence, showing that SMS reminders significantly enhanced diabetes knowledge and self-management skills. These findings suggest that SMS interventions can improve procedural readiness and cognitive restructuring in various healthcare settings.

The results further indicated that the SMS group showed an increase in preparedness following the intervention, while the control group exhibited no significant improvement. This aligns with findings from Caumo et al. (2001), who emphasized the simplicity, low cost, and rapid delivery of SMS interventions. Similarly, Laatifi et al. (2019), recommend SMS interventions as an effective strategy in healthcare. Suffoletto et al. (2012) reported that SMS has been widely used in counseling HIV patients, supporting adherence to antiretroviral therapy, and promoting repeated HIV testing. Additionally, SMS interventions have been applied in medication administration, clinic appointment reminders, and information dissemination for conditions such

as epilepsy, cardiovascular disease, asthma, and allergic rhinitis. Wang et al. (2014) observed significant clinical improvements in patients receiving SMS interventions, reinforcing the positive impact of SMS in healthcare.

Conclusion

The findings of this study highlight the effectiveness of SMS-based educational intervention in enhancing surgical preparation, cognitive restructuring, and behavioural modification among patients undergoing elective abdominal surgery. The SMS group demonstrated significant improvements across all three domains, transitioning from an unprepared state to a more prepared one after receiving structured SMS interventions. These improvements suggest that SMS educational messages positively influenced patients' understanding of surgical procedures, reduced negative thoughts, and encouraged behavioural adjustments necessary for better surgical outcomes. Conversely, the control group, which did not receive any educational intervention, showed no meaningful improvement and, in some cases, a slight decline in their preparedness levels, reinforcing the necessity of structured preoperative education. The substantial improvements observed in the SMS group suggest that mobile health strategies can be an effective tool for enhancing patient engagement and preparedness, particularly in resource-limited settings where face-to-face educational interventions may be challenging to implement. The findings indicate that integrating digital health education into preoperative care can significantly improve patient outcomes, reduce anxiety, and promote positive behavioural modifications, ultimately contributing to better surgical experiences and recovery

Recommendations

Based on the findings, it is recommended that:

1. Healthcare institutions should consider adopting SMS-based educational interventions as a standard component of preoperative care. These messages can be tailored to address surgical preparation, cognitive restructuring, and behavioural modification, ensuring that patients are well-informed and psychologically prepared for their procedures.

2. The effectiveness of SMS interventions in improving surgical readiness suggests that similar approaches could be applied to other medical procedures requiring patient preparation.

Hospitals and healthcare providers should explore the use of SMS-based education for various medical conditions, including chronic disease management and post-operative care, to enhance patient adherence to medical advice and improve health outcomes.

3. Policymakers should develop guidelines and frameworks for integrating mobile health technologies into routine healthcare services. Standardising the use of SMS-based educational interventions can help ensure consistency, accessibility, and effectiveness, particularly in regions where face-to-face preoperative counselling is limited due to resource constraints.

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