

Pre-operative Anxiety among Patients undergoing Elective Surgery in Northern state, Sudan, 2024: A Multi-center, Cross-sectional Study

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Table of Contents

Original Manuscript.....	5
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Abstract

Background: Pre-operative anxiety and the desire for information are prevalent conditions among patients undergoing surgery. Understanding the prevalence and associated factors of these psychological states is essential for improving patient care and surgical outcomes.

Objective: This study aimed to assess the prevalence of preoperative anxiety and the desire for information, as well as associated socio-demographic, medical, and surgical factors among elective surgery patients, in Northern state, Sudan

Methods: A hospital-based, multi-center cross-sectional study was conducted over four months in Northern State, Sudan, involving patients undergoing elective surgery. Socio-demographic characteristics, medical and surgical history, pre-operative anxiety, and the desire for information were collected through face-to-face interviews using a structured questionnaire and the Amsterdam Preoperative Anxiety and Information Scale (APAIS). The data were analyzed using SPSS (version 27), where Chi-square tests, univariate logistic regression, and multivariate logistic regression were used to identify risk factors, with statistical significance set at $p < .05$.

Results: Among the 305 participants (Response rate = 80.3%), 56.9% were male, with a median age of 43 years (IQR: 30–64 years). Most were married (67.9%), educated (81.3%), and had family support (83.0%). The majority underwent intermediate (44.6%) or major (46.6%) surgeries under general anesthesia (52.2%), and primarily in public hospitals (55.4%). Most participants lacked insurance (86.6%) and reported good sleep quality the night before surgery (72.5%). The prevalence of pre-operative anxiety was 24.6%, while 23.9% expressed an average desire for information, and 6.2% reported a high desire. Factors significantly associated with pre-operative anxiety included family support (aOR = 7.12, 95% CI: 2.64–19.23, $p < .001$), surgery in public hospitals (aOR = 4.31, 95% CI: 2.30–8.07, $p < .001$), poor sleep quality the night before surgery (aOR = 2.85, 95% CI: 1.51–5.38, $p = .001$), and ASA classification III and IV (aOR = 2.36, 95% CI: 1.00–5.54, $p = .049$). For the desire for information, significant factors included being educated (aOR = 2.48, 95% CI: 1.00–6.11, $p = .049$), family support (aOR = 4.10, 95% CI: 1.81–9.30, $p = .001$), surgery in public hospitals (aOR = 3.57, 95% CI: 1.93–6.61, $p < .001$), and ASA classification III and IV (aOR = 3.26, 95% CI: 1.39–7.64, $p = .007$).

Conclusions: Pre-operative anxiety and the desire for information are prevalent among patients undergoing elective surgery. Family support, poor sleep quality, and higher ASA classification were significant predictors of pre-operative anxiety, while education, family support, and chronic diseases were associated with a higher desire for information. We recommend developing strategies and targeted interventions to address psychological and informational needs in the pre-operative period.

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Pre-operative Anxiety among Patients undergoing Elective Surgery in Northern state, Sudan, 2024: A Multi-center, Cross-sectional Study

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Abstract

Background: Pre-operative anxiety and the desire for information are prevalent conditions among patients undergoing surgery. Understanding the prevalence and associated factors of these psychological states is essential for improving patient care and surgical outcomes.

Objective: This study aimed to assess the prevalence of preoperative anxiety and the desire for information, as well as associated socio-demographic, medical, and surgical factors among elective surgery patients, in Northern state, Sudan

Methods: A hospital-based, multi-center cross-sectional study was conducted over four months in Northern State, Sudan, involving patients undergoing elective surgery. Socio-demographic characteristics, medical and surgical history, pre-operative anxiety, and the desire for information were collected through face-to-face interviews using a structured questionnaire and the Amsterdam Preoperative Anxiety and Information Scale (APAIS). The data were analyzed using SPSS (version 27), where Chi-square tests, univariate logistic

regression, and multivariate logistic regression were used to identify risk factors, with statistical significance set at $p < 0.05$.

Results: Among the 305 participants (Response rate = 80.3%), 56.9% were male, with a median age of 43 years (IQR: 30–64 years). Most were married (67.9%), educated (81.3%), and had family support (83.0%). The majority underwent intermediate (44.6%) or major (46.6%) surgeries under general anesthesia (52.2%), and primarily in public hospitals (55.4%). Most participants lacked insurance (86.6%) and reported good sleep quality the night before surgery (72.5%). The prevalence of pre-operative anxiety was 24.6%, while 23.9% expressed an average desire for information, and 6.2% reported a high desire. Factors significantly associated with pre-operative anxiety included family support (aOR = 7.12, 95% CI: 2.64–19.23, $p < .001$), surgery in public hospitals (aOR = 4.31, 95% CI: 2.30–8.07, $p < .001$), poor sleep quality the night before surgery (aOR = 2.85, 95% CI: 1.51–5.38, $p = .001$), and ASA classification III and IV (aOR = 2.36, 95% CI: 1.00–5.54, $p = .049$). For the desire for information, significant factors included being educated (aOR = 2.48, 95% CI: 1.00–6.11, $p = .049$), family support (aOR = 4.10, 95% CI: 1.81–9.30, $p = .001$), surgery in public hospitals (aOR = 3.57, 95% CI: 1.93–6.61, $p < .001$), and ASA classification III and IV (aOR = 3.26, 95% CI: 1.39–7.64, $p = .007$).

Conclusions: Pre-operative anxiety and the desire for information are prevalent among patients undergoing elective surgery. Family support, poor sleep quality, and higher ASA classification were significant predictors of pre-operative anxiety, while education, family support, and chronic diseases were associated with a higher desire for information. We recommend developing strategies and targeted interventions to address psychological and informational needs in the pre-operative period.

Keywords:

Pre-operative anxiety; Desire for information; Risk factors; Elective surgery; Northern state; Sudan

Introduction

Anxiety is a subjective state of emotional unease, distress, or apprehension, often arising from the anticipation of danger and accompanied by autonomic and somatic symptoms that can impair functioning. While occasional anxiety is common, anxiety disorders involve intense and excessive fear and worry [1]. Approximately 33.7% of the global population experiences an anxiety disorder during their lifetime [2]. Anxiety becomes particularly concerning in medical contexts, such as surgery, where it can significantly impact outcomes and well-being. Elective surgery, which includes non-emergency procedures that can be delayed for at least 24 hours, often triggers preoperative anxiety in patients [3]. This anxiety is characterized by feelings of worry, nervousness, and unease about the impending procedure and its potential outcomes [4,5].

The prevalence of preoperative anxiety varies widely, with global pooled prevalence of 48% [6]. In low- and middle-income countries (LMICs), the issue is exacerbated by limited healthcare resources, inadequate patient information, and cultural beliefs surrounding surgery. Studies in LMICs reveal even higher prevalence rates, ranging from 55% to 99%, highlighting the need for context-specific research and interventions [7]. Neighboring countries like Ethiopia, and Yemen also report varying rates, influenced by factors such as surgery type,

patient demographics, prior surgical experiences, individual coping mechanisms, and others [8-9].

In Sudan, where the healthcare system faces significant constraints due to the ongoing war, the issue of preoperative anxiety among patients undergoing elective surgery may be particularly pronounced. Factors such as limited access to information, long waiting times, and potential communication barriers between healthcare providers and patients could contribute to heightened anxiety levels. Furthermore, the socioeconomic circumstances and cultural beliefs of the Sudanese population may also play a role in shaping patients' perceptions, expectations, and experiences of surgery.

Pre-operative anxiety can have significant negative impacts on patients. It is associated with increased anesthesia requirements and postoperative complications such as nausea, vomiting, and dizziness, as well as hemodynamic instability during surgery[10-11]. High anxiety levels can lead to poor postoperative pain management, increased analgesic needs, and lower patient satisfaction [12,13]. Furthermore, anxiety can prolong recovery times and hospital stays due to complications like surgical site infections and delayed wound healing [14].

Despite growing global recognition of preoperative anxiety as a significant health concern, it remains under-researched in Sudan. This pioneering study, the first of its kind in the country, aims to address this gap by estimating the prevalence of preoperative anxiety among Sudanese patients undergoing elective surgery and identifying key associated factors. The findings will urge health authorities and healthcare providers in developing targeted interventions to reduce anxiety, enhance patient satisfaction, and improve surgical outcomes in Sudan and similar war-affected, resource-limited settings.

Materials & Methods

Study design, setting, and period

This was a hospital-based, multi-center, cross-sectional study conducted over four months, from November 2024 to February 2025, at four major hospitals in the Northern State of Sudan. The participating hospitals included two public (Dongola Specialized Hospital, and Karima Teaching Hospital), and two private (Alwifaq Al-Qatari Hospital, and Al-Daman Hospital), all of which have operational theaters. The study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies [15].

Study population

The study included patients aged 18 years and above who were scheduled for elective surgery at the participating hospitals. Exclusion criteria comprised patients unable to provide informed consent, those with cognitive impairments, individuals undergoing emergency or obstetrical surgeries, and cases with incomplete survey responses.

Sample Size and Sampling Technique

The sample size was calculated using the Cochran formula; sample size (n) = $\frac{z^2 pq}{e^2}$, based on the estimated prevalence of pre-operative anxiety in similar populations in low- and middle-income countries (55.7%), with a 95% confidence level and a 5% margin of error [16,7]. This calculation yielded a sample size of 380 participants. A convenience sampling technique was employed to recruit participants from the surgical wards and outpatient clinics of the participating hospitals.

Data collection

Data were collected through face-to-face interviews using a structured questionnaire. The questionnaire consisted of three sections: a socio-demographic section with 7 items, a medical and surgical history section with 7 items, and the Amsterdam Preoperative Anxiety and Information Scale (APAIS) with 6 items. The APAIS is a widely validated scale that measures anxiety related to both anesthesia and surgery, as well as the patient's desire for information [17,18].

To ensure cultural relevance and clarity, the questionnaire was translated into Arabic, the primary language of the participants, and the Arabic-validated version of the APAIS was used [19]. The APAIS scale consists of six items, scored on a 5-point Likert scale from "not at all" to "extremely agree," and is divided into two sections: anxiety (items 1, 2, 4, and 5) and desire for information (items 3 and 6). The anxiety scale ranges from 4 to 20, with scores of 11 or higher indicating clinically significant anxiety [20]. For the desire for information section, scores range from 2 to 10 and are categorized as low (2-4), average (5-7), and high (8-10).

Prior to data collection, a pilot test was conducted with a small group of 40 patients from different hospitals in the targeted area. This pilot test assessed the internal consistency and reliability of the instrument using Cronbach's alpha, which yielded a value of 0.91, indicating excellent reliability [21].

Data analysis

Data were analyzed using SPSS version 27. Descriptive statistics were used to summarize the socio-demographic, medical, and surgical characteristics of the study population, as well as the prevalence of pre-operative anxiety and the desire for information. Results were presented as frequencies and percentages. Chi-square tests were employed to assess associations between independent variables and the outcomes of interest (pre-operative anxiety and the desire for information). Univariate logistic regression was performed to identify potential risk factors, and significant variables were included in a multivariate logistic regression model. Adjusted odds ratios (aOR) with 95% confidence intervals (CI) were calculated to determine independent predictors of pre-operative anxiety and the desire for information. A p -value of less than 0.05 was considered statistically significant.

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Research Ethical Committee of the Northern State Ministry of Health (REC-MoH-NS-41-2023) and the research offices of the involved hospitals. Written informed consent was obtained from all participants prior to their inclusion in the study. Participants were assured of the confidentiality of their responses and their right to withdraw from the study at any time without any impact on their medical care.

Results

General characteristics of the study population

A total of 305 patients undergoing elective surgery participated in this study (Response rate = 80.3%). About half of participants were male (56.7%), aged 30-65 years (52.7%), with a median age of 43 years (IQR: 30-64 years). Most participants were married (67.9%), and the majority had some level of education (81.3%). In terms of occupation, more than a were freelancers (37.4%), or unemployed (38.4%). The average monthly income for nearly half of the participants was above \$250.00 USD (49.5%). Family support was reported by most of the participants (83.0%). The socio-demographic characteristics of the participants are summarized in Table 1.

Table 1: Socio-Demographics of the Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Frequency	Percent
Sex		
Male	173	56.7
Female	132	43.3
Age (years)		
18-30 years	86	28.2
31-50 years	102	33.4
51-65 years	59	19.3
>65 years	58	19.0
Median(IQR) of age	43.00 (30-64)	
Occupation		
Employed	46	15.1
Freelance	114	37.4
Student	28	9.2
Unemployed	117	38.4
Marital status		
Married	207	67.9
Unmarried	98	32.1
Educational level		
Educated	248	81.3
Uneducated	57	18.7
Average Monthly income (in USD)		
<50.00\$	125	41.0
50.00 - 250.00\$	29	9.5
>250.00\$	151	49.5

Family Support		
Yes	253	83.0
No	52	17.0

Medical and Surgical Characteristics of the study population

The medical and surgical characteristics of the participants are detailed in Table 2. The majority of patients were classified as ASA Class I and II (87.9%). Most patients underwent major (46.6%) or intermediate (44.6%) surgeries, with general anesthesia being the most common type (52.2%), and in public hospitals (55.4%). The majority of surgeries were not covered by insurance (86.6%), and most patients reported good subjective sleep quality the night before the operation (72.5%). A significant proportion of patients had no previous operations (61.0%) and no chronic diseases (65.2%).

Table 2: Medical and Surgical Characteristics of the Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Frequency	Percent
Type of Hospital		
Public hospital	169	55.4
Private hospital	136	44.6
ASA classification		
ASA Class I and II	268	87.9
ASA Class III and VI	37	12.1
Type of surgery		
Minor	27	8.9
Intermediate	136	44.6
Major	142	46.6
Type of anesthesia		
General	160	52.2
Spinal	124	40.7
Local	21	6.9
Operation covered by insurance		
Yes	41	13.4
No	264	86.6
Subjective sleep quality of the night before the operation		
Good	221	72.5
Poor	84	27.5
Previous operations		
Yes	119	39.0
No	186	61.0
Chronic diseases		
Yes	106	34.8
No	199	65.2

Prevalence of Pre-operative Anxiety and the Desire for Information

The prevalence of pre-operative anxiety and the desire for information among

the participants are shown in Table 3 and Table 4. Overall, 24.6% of participants reported experiencing pre-operative anxiety. Regarding the desire for information, 23.9% of participants expressed an average desire for information, while 6.2% reported a high desire for information.

Table 3: Results of the Amsterdam Preoperative Anxiety and Information Scale (APAIS) Score among the Patients undergoing Elective Surgery in the study centers Patients with chronic diseases attending the study centers, Northern state, Sudan, 2024 (n=305).

Question	NAA	SLT	MOD	QAB	EXT
1. I am worried about the anesthesia	148 (48.5%)	82 (26.9%)	38 (12.5%)	30 (9.8%)	7 (2.3%)
2. The anesthetic is on my mind continually	157 (54.5%)	68 (22.3%)	51 (16.7%)	23 (7.5%)	6 (2.0%)
3. I would like to know as much as possible about the anesthesia	169 (55.4%)	66 (21.6%)	43 (14.1%)	21 (6.9%)	6 (2.0%)
4. I am worried about the procedure	127 (41.6%)	73 (23.9%)	54 (17.7%)	43 (14.1%)	8 (2.6%)
5. The procedures on my mind continually	123 (40.3%)	79 (25.9%)	51 (16.7%)	44 (14.4%)	8 (2.6%)
6. I would like to know as much as possible about the procedure	132 (43.3%)	85 (27.9%)	52 (17.0%)	26 (8.5%)	10 (3.3%)

- **Keys:** NAA = Not at all; SLT = Slightly; MOD = Moderately; QAB = Quite a bit; EXT = Extremely

Table 4: Prevalence of Pre-operative Anxiety and the Desire for Information among Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Frequency	Percent
Pre-operative Anxiety		
Positive	75	24.6
Negative	230	75.4
Desire for Information		
No desire	213	69.8
Average desire	73	23.9
High desire	19	6.2

Associated Factors for Pre-operative Anxiety and the Desire for Information

The factors associated with pre-operative anxiety (Tables 5 and 6) included family support ($p=.016$), poor subjective sleep quality the night before the operation ($p=.005$), Public hospital ($p<.001$), and ASA classification III and IV ($p=.016$).

Table 5: Association of Socio-Demographics with Pre-operative Anxiety

among Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Prevalence of Pre-operative Anxiety		
	Positive	Negative	P-value
Sex			
Male	39 (22.5%)	134 (77.5%)	0.342
Female	36 (27.3%)	96 (72.7%)	
Age (years)			
18-30 years	20 (23.3%)	66 (76.7%)	0.563
31-50 years	30 (29.4%)	72 (70.6%)	
51-65 years	13 (22.0%)	46 (78.0%)	
>65 years	12 (20.7%)	46 (79.3%)	
Occupation			
Employed	13 (28.3%)	33 (71.7%)	0.189
Freelance	21 (18.4%)	93 (81.6%)	
Student	10 (35.7%)	18 (64.3%)	
Unemployed	31 (26.5%)	86 (73.5%)	
Marital status			
Married	49 (23.7%)	158 (76.3%)	0.588
Single	26 (26.5%)	72 (73.5%)	
Educational level			
Educated	65 (26.2%)	183 (73.8%)	0.171
Uneducated	10 (17.5%)	47 (82.5%)	
Average Monthly income (in USD)			
<50.00\$	36 (28.8%)	89 (71.2%)	0.360
50.00 - 250.00\$	33 (21.9%)	118 (78.1%)	
>250.00\$	6 (20.7%)	23 (79.3%)	
Family Support			
Yes	69 (27.3%)	184 (72.7%)	0.016*
No	6 (11.5%)	46 (88.5%)	

*: Statistically significant

Table 6: Association of Medical and Surgical Characteristics with Pre-operative Anxiety among Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Prevalence of Pre-operative Anxiety		
	Positive	Negative	P-value
Type of Hospital			
Public hospital	57 (33.7%)	112 (66.3%)	<0.001*
Private hospital	18 (13.2%)	118 (86.8%)	
ASA classification			
ASA I and II	60 (22.4%)	208 (77.6%)	0.016*
ASA II and IV	15 (40.5%)	22 (59.5%)	
Type of surgery			
Minor	9 (33.3%)	18 (66.7%)	0.266
Intermediate	28 (20.6%)	108 (79.4%)	
Major	38 (26.8%)	104 (73.2%)	
Type of anesthesia			

General	37 (23.1%)	123 (79.9%)	0.793
Spinal	32 (25.8%)	92 (74.2%)	
Local	6 (28.6%)	15 (71.4%)	
Operation covered by insurance			
Yes	6 (14.6%)	35 (85.4%)	0.112
No	69 (26.1%)	195 (73.9%)	
Subjective sleep quality of the night before the operation			
Good	45 (20.4%)	176 (79.6%)	0.005*
Poor	30 (35.7%)	54 (64.3%)	
Previous operations			
Yes	25 (21.0%)	94 (79.0%)	0.245
No	50 (26.9%)	136 (73.1%)	
Chronic diseases			
Yes	33 (31.1%)	73 (68.9%)	0.053
No	42 (21.1%)	157 (78.9%)	

*: Statistically significant

The factors associated with the desire for information (Tables 7 and 8) included occupation ($p=.032$), being educated ($p=.004$), Public hospital ($p<.001$), and having chronic diseases ($p=.043$).

Table 7: Association of Socio-Demographics with the Desire for Information among Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Desire for Information		
	No or little desire	Average or High desire	P-value
Sex			
Male	125 (72.3%)	39 (22.5%)	0.513
Female	88 (66.7%)	34 (25.8%)	
Age (years)			
18-30 years	63 (73.3%)	23 (26.7%)	0.256
31-50 years	65 (63.7%)	37 (36.3%)	
51-65 years	40 (67.8%)	19 (32.2%)	
>65 years	45 (77.6%)	13 (22.4%)	
Occupation			
Employed	24 (52.2%)	22 (47.8%)	0.007*
Freelance	90 (78.9%)	24 (21.1%)	
Student	21 (75.0%)	7 (25.0%)	
Unemployed	78 (66.7%)	39 (33.3%)	
Marital status			
Married	145 (70.0%)	62 (30.0%)	0.907
Single	68 (69.4%)	30 (30.6%)	
Educational level			
Educated	164 (66.1%)	84 (33.9%)	0.003*
Uneducated	49 (85.0%)	8 (14.0%)	
Average Monthly income (in USD)			
<50.00\$	88 (70.4%)	37 (29.6%)	0.702
50.00 - 250.00\$	103 (68.2%)	48 (31.8%)	

>250.00\$	22 (75.9%)	7 (24.1%)	
Family Support			
Yes	170 (67.2%)	92 (32.8%)	0.027*
No	43 (82.7%)	9 (17.3%)	

*: Statistically significant

Table 8: Association of Medical and Surgical Characteristics with the Desire for Information among Patients undergoing Elective Surgery in the study centers, Northern state, Sudan, 2024 (n=305).

Characteristics	Desire for Information		
	No or little desire	Average or High desire	Positive
Type of Hospital			
Public hospital	100 (59.2%)	69 (40.8%)	<0.001*
Private hospital	113 (83.1%)	23 (16.9%)	
ASA classification			
ASA I and II	196 (73.1%)	72 (26.9%)	0.001*
ASA II and IV	17 (45.9%)	20 (54.1%)	
Type of surgery			
Minor	21 (77.8%)	6 (22.2%)	0.565
Intermediate	92 (67.6%)	44 (32.4%)	
Major	100 (70.4%)	42 (29.6%)	
Type of anesthesia			
General	114 (71.3%)	46 (28.8%)	0.804
Spinal	84 (67.7%)	40 (32.3%)	
Local	15 (71.4%)	6 (28.6%)	
Operation covered by insurance			
Yes	26 (63.4%)	14 (34.1%)	0.179
No	187 (70.8%)	59 (22.3%)	
Subjective sleep quality of the night before the operation			
Good	156 (70.6%)	55 (24.9%)	0.128
Poor	57 (67.9%)	18 (21.4%)	
Previous operations			
Yes	86 (72.3%)	27 (22.7%)	0.693
No	127 (68.3%)	46 (24.7%)	
Chronic diseases			
Yes	65 (61.3%)	41 (38.7%)	0.018*
No	148 (74.4%)	51 (25.6%)	

*: Statistically significant

Based on the logistic regression analysis (Table 9), patients who had family support were seven times more likely to develop pre-operative anxiety (aOR = 7.12, 95% CI: 2.64–19.23, $p < .001$). Patients treated in public hospitals had more than four times the risk of having pre-operative anxiety compared to those treated in private hospitals (aOR = 4.31, 95% CI: 2.30–8.07, $p < .001$). Patients with poor subjective sleep quality the night before the operation and those classified as ASA III and IV had more than two times the risk of pre-operative anxiety compared to their counterparts (aOR = 2.85, 95% CI: 1.51–5.38, $p = .001$; and aOR = 2.36, 95% CI: 1.00–5.54, $p = .049$, respectively).

Regarding the desire for information, patients with some level of education were

more than two times more likely to have a desire for information compared to uneducated patients (aOR = 2.48, 95% CI: 1.00–6.11, $p=.049$). Patients with family support were also more than four times more likely to have a desire for information compared to those without family support (aOR = 4.10, 95% CI: 1.81–9.30, $p=.001$). Patients treated in public hospitals had more than three times the desire for information compared to those treated in private hospitals (aOR = 3.57, 95% CI: 1.93–6.61, $p<.001$). Furthermore, ASA III and IV patients were more than three times more likely to have a desire for information compared to those without chronic diseases (aOR = 3.26, 95% CI: 1.39–7.64, $p=.007$).

Table 9: Risk Assessment of factors affecting the Pre-operative Anxiety and the Desire for Information, using Binary and Multinomial Logistic Regression Test, 2024 (n=305)

Scale	Variables	cOR (95% CI)	P-Value	aOR (95% CI)	P-Value
Pre-op anxiety	Family Support				
	Yes	2.88 (1.18-7.03)	0.021*	7.12 (2.64-19.23)	<0.001*
	No	Reference			
	Type of Hospital				
	Public hospital	3.35 (1.85-6.02)	<0.001*	4.31 (2.30-8.07)	<0.001*
	Private hospital	Reference			
	Subjective sleep quality of the night before the operation				
	Good	Reference			
	Poor	2.17 (1.25-3.78)	0.006*	2.85 (1.51-5.38)	0.001*
	ASA classification				
	ASA I & II	Reference			
	ASA II & IV	2.36 (1.16-4.84)	0.019*	2.36 (1.00-5.54)	0.049*
	Chronic diseases				
Desire for information	Yes	1.69 (0.99-2.88)	0.054	1.14 (0.61-2.14)	0.608
	No	Reference			
	Occupation				
	Student	Reference			
	Freelancer	0.80 (0.30-2.10)	0.651	0.78 (0.29-2.14)	0.635
	Employed	2.75 (0.98-7.72)	0.055	2.58 (0.89-7.49)	0.081
	Unemployed	1.50 (0.59-3.83)	0.397	1.55 (0.57-4.19)	0.389
	Educational level				
	Uneducated	Reference			
	Educated	3.14 (1.42-6.93)	0.005*	2.48 (1.00-6.11)	0.049*

Type of Hospital					
Public hospital	3.39 (1.97-5.84)	<0.001*	3.57 (1.93-6.61)	<0.001*	
Private hospital	Reference				
Family support					
Yes	2.33 (1.09-5.01)	0.030*	4.10 (1.81-9.30)	0.001*	
No	Reference				
ASA classification					
ASA I & II	Reference				
ASA II & IV	3.20 (1.59-6.45)	0.001*	3.26 (1.39-7.64)	0.007*	
Chronic diseases					
Yes	1.83 (1.11-3.03)	0.019*	1.30 (0.72-2.37)	0.388	
No	Reference				

*:Statistically significant | **cOR:** Crude Odd Ration | **aOR:** adjusted Odd Ratio | **CI:** Confidence Interval

Discussion

Pre-operative anxiety is a common psychological response among patients awaiting surgery, with significant implications for their overall well-being, surgical outcomes, and recovery [22]. This study aimed to assess the prevalence of pre-operative anxiety and the desire for information among patients scheduled for elective surgery in Northern State, Sudan, and to identify factors associated with these outcomes.

The study found that 24.6% of participants experienced pre-operative anxiety, a rate lower than the global prevalence and that of low- and middle-income countries (48% and 55.7%, respectively) [6,7]. However, findings from Yemen, Nigeria, Palestine, India, Nepal, and France were consistent with our results, reporting rates of 29.8%, 24.4%, 27.1%, 21.0%, 25.8%, and 24.7%, respectively [9,23-27]. These variations may be attributed to a variety of factors, such as differences in healthcare systems, geographical locations, study populations, and assessment tools used.

Our study identified several factors linked to pre-operative anxiety, including lack of family support, poor subjective sleep quality, undergoing surgery in a public hospital, and ASA classification III and IV. Surprisingly, patients with family support were seven times more likely to experience pre-operative anxiety (aOR = 7.12, 95% CI: 2.64–19.23, $p < .001$). This contrasts with the conventional view of family support as a protective factor. The unexpected result may stem from unique family dynamics in Sudan, where extensive visits from relatives and community members might inadvertently heighten a patient's anxiety by amplifying concerns or sharing negative experiences. This underscores the complex role of social support in pre-operative anxiety. Previous studies have shown conflicting results, with some suggesting family support reduces anxiety and others finding no significant impact [28,29].

Consistent with previous research, our study found that patients treated in

public hospitals had a significantly higher risk of pre-operative anxiety compared to those in private hospitals (aOR = 4.31, 95% CI: 2.30–8.07, $p < .001$). A similar trend was observed in a study from Tanzania, which also reported higher pre-operative anxiety among patients in public hospitals [30]. This disparity may be due to factors such as differences in resource availability, staffing levels, and the overall patient experience between public and private healthcare settings.

Poor sleep quality the night before surgery was significantly associated with pre-operative anxiety (aOR = 2.85, 95% CI: 1.51–5.38, $p = .001$), consistent with existing literature highlighting the strong link between sleep disturbances and anxiety disorders [31–34]. The stress and anticipation of surgery can disrupt sleep, exacerbating anxiety levels. Similarly, patients classified as ASA III and IV had a higher risk of pre-operative anxiety (aOR = 2.36, 95% CI: 1.00–5.54, $p = .049$), likely due to their increased risk of complications and poorer health status [35]. This aligns with several studies demonstrating a significant association between higher ASA classes and elevated anxiety levels [23,36,37]. Regarding the desire for information, 23.9% of the patients expressed an average desire for information, and 6.2% reported a high desire for information. This desire, as part of broader health information-seeking behavior, enhances health literacy. However, surgeons often underestimate the extent of information patients wish to receive preoperatively [38,39]. Similar patterns have been observed in studies from Yemen and Nigeria, where comparable percentages of patients expressed average and high desires for information (16.5% and 14.4% for average, and 16.9% and 5.1% for high, respectively) [9,23].

Our study reveals that patients with some education are more likely to seek information (aOR = 2.48, 95% CI: 1.00–6.11, $p = .049$), possibly due to greater health awareness. Patients in public hospitals also showed a higher desire for information (aOR = 3.57, 95% CI: 1.93–6.61, $p < .001$), possibly due to perceived communication gaps. Additionally, ASA III and IV patients had a stronger desire for information (aOR = 3.26, 95% CI: 1.39–7.64, $p = .007$), likely driven by the need to understand their health risks. To the best of our knowledge, this study is the first to comprehensively explore these factors, addressing a significant gap in literature and offering insights for enhancing patient-centered care.

Conclusion

This study found that a notable proportion of surgical patients in Northern State, Sudan, experienced pre-operative anxiety, a rate lower than global averages but consistent with some local and international findings. Factors associated with increased anxiety included family support, poor sleep quality, public hospital settings, and higher ASA classifications. The study also highlighted a significant desire for information among patients, particularly those with some education and those in public hospitals. Addressing these factors through targeted interventions could improve patient outcomes and satisfaction.

Recommendations

Based on the findings of this study, several recommendations can be made to enhance patient care and reduce pre-operative anxiety. Healthcare providers should implement targeted interventions aimed at improving pre-operative sleep quality and providing adequate information to patients, as these factors were significantly linked to anxiety levels. Additionally, Hospital administrations

should limit extensive family visits in the pre-operative period to prevent amplifying patient anxiety. Furthermore, public hospitals should prioritize improving patient communication and addressing perceived gaps in information provision, as these factors were associated with a higher desire for information among patients.

Limitations and strengths

This study had several limitations. The use of convenience sampling may limit generalizability, but the multi-centric design enhances representativeness. The cross-sectional design prevents establishing causality, though it provides a detailed snapshot for future longitudinal studies. The reliance on self-reported data introduces potential biases, but using a valid assessment tool and face-to-face interviews helped minimize these issues.

What is already know on this topic

- Pre-operative anxiety is a common issue affecting surgical outcomes and patient well-being, with varying prevalence rates globally.
- Patients often desire more information than they receive, which can impact their satisfaction and anxiety levels.
- Previous studies have identified factors such as sex, educational level, and ASA classification as influencing pre-operative anxiety.

What this study adds

- Public and private healthcare settings can have different impacts on patient anxiety and information needs due to resource availability and patient experience.
- Certain cultural factors, such as extensive family involvement, can uniquely amplify pre-operative anxiety in certain regions.
- Educated patients, those with higher ASA classifications, and those managed in public hospitals are more likely to seek information.

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Competing interests

The authors declare no competing interest.

Authors' contributions

Conception: Abeer Ahmed. **Design of the study:** Abeer Ahmed, Mohamed Nasur, and Mohamed Issak. **Data collection:** Mustafa Ahmed, Shima Mohammed, Eman Mohamed, Amna Faragalla, Elmunzir Salih. **Data analysis and interpretation:** Abeer Ahmed, Mohamed Nasur, and Mohamed Issak. **Supervision:** Abeer Ahmed and Mohamed Issak. **Writing original draft:** Abeer Ahmed, Eman Mohamed, and Amna Faragalla. **Writing review and editing:** Mohamed Issak, Mohamed Nasur, Mustafa Ahmed, and Shima Mohammed. **Guarantor of the study:** Abeer Ahmed. All the authors read and approved the final version of the manuscript to be published

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