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Postoperative sleep quality and associated factors among patients undertaking major surgical procedure at South Wollo Zone public general hospitals, Ethiopia

Birhanu Ayenew[1*], Abdulmelik Ayalew[2], Wondwossen Yimam[2] and Jemal Mohammed[2]

Abstract

Background Poor sleep following surgery prolongs hospital stays, increased complications, and delayed recovery. Despite its impact, not yet adequate research in our study area.

Methods An institutional-based cross-sectional study was conducted from May 15 to August 15, 2022; involving 428 participants selected using a systematic random sampling technique. Data were collected via the Pittsburgh Sleep Quality Index (PSQI) questionnaire. Data entry was done using Epi-Data version 4.6 and analysis SPSS version 26. Variables with a *p*-value ≤ 0.25 in the bivariable analysis were included in the multivariable analysis and a significant association was declared using AOR with 95% CI and a *p*-value of less than 0.05.

Results A total of 428 participants were included in the study, of whom 297 (69.4%) reported poor sleep quality (95% CI: 65.0-74.1). Emergency surgery (AOR = 0.388, 95% CI: 0.210–0.720), severe pain (AOR = 9.105, 95% CI: 3.682–22.519), sound disturbances (AOR = 1.878, 95% CI: 1.162–3.036), anxiety (AOR = 1.964, 95% CI: 1.197–3.221), and poor social support (AOR = 5.6, 95% CI: 2.31–13.92) were significantly associated with poor sleep quality.

Conclusion This study found that more than half of the patients experienced poor sleep quality. Type of anesthesia, pain severity, sound disturbances, anxiety, and level of social support were significantly associated with poor sleep. Healthcare providers should address this factor to improve poor sleep quality following major surgery.

Keywords Poor sleep, Sleep quality, Surgery, Anesthesia, Ethiopia, Postoperative, Patients

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Background

Sleep quality is an important element of postoperative care, influencing overall patient outcomes and satisfaction(Jaensson et al. 2019). Postoperative sleep quality refers to the ability to achieve restful and restorative sleep following surgical procedures, which is vital for healing and rehabilitation(Mukartihal et al. 2022). This includes parameters such as sleep duration, sleep latency, the frequency of awakenings, and the overall quality of sleep experienced(Albqoor and Shaheen 2021). Various factors, including pain, anxiety, the hospital environment, and the effects of anesthesia, can cause poor sleep quality, all of which interfere with a patient's ability to rest adequately(Rampes et al. 2020). These factors can disrupt the natural sleep-wake cycle, leading to fragmented and poor-quality sleep(Oliveira et al. 2019). It is often assessed using standardized questionnaires called the Pittsburgh Sleep Quality Index (PSQI)(Mollayeva et al. 2016).

Poor sleep quality can lead to various negative outcomes, including prolonged hospital stays, increased risk of postoperative complications, heightened perception of pain, and decreased immune function(Czernicki et al. 2019; Bjurström and Irwin 2019). Furthermore, inadequate sleep can contribute to psychological issues such as anxiety and depression, compounding the overall burden of the surgical experience(Abera et al. 2023; Butris et al. 2023).

Globally, studies estimated that from 7 to 77% of patients develop poor sleep quality after major surgical procedures(Rampes et al. 2020). In low- and middle-income countries, including Ethiopia, limited healthcare resources, inadequate pain management protocols, and environmental stressors within healthcare settings exacerbate the problem(Tegegne and Alemnew 2022; Ayenew and Pandey 2020). Consequently, the implications of compromised sleep quality extend beyond individual health, placing a considerable burden on healthcare systems due to increased length of hospital stays and associated costs(Morsy et al. 2019).

Despite the importance of sleep quality in patient recovery, there is limited research in our study area. Therefore, this study aimed to assess the prevalence of postoperative sleep disturbances and identify associated factors among patients who underwent major surgery in Ethiopia.

Methods

Study design, area, and period

An institutional-based cross-sectional study design was conducted among adult patients who underwent major surgery from May 15 to August 15, 2022, in the South Wollo Zone general hospitals, which is located in the Amhara National Regional State of Ethiopia. The zone is bordered by North Shewa to the south, East Gojjam to the west, South Gondar to the northwest, North Wollo to the north, the Afar Region to the northeast, and the Oromia Zone to the east. Within this region, there are 11 government hospitals, 135 health centers, and 496 health posts.

Population

Source population

All adult postoperative patients undertaking major surgical procedures in South Wollo Zone General Hospitals for elective or emergency surgery.

Study population

All adult patients in selected general hospitals who had undergone major surgical procedures during the study period.

Eligibility criteria

Adult patients who had received anesthesia for major surgery within the previous 24 h and had fully recovered from anesthesia were included in the study whereas, patients who had not fully recovered were excluded from the study.

Sample size calculation and sampling procedure

The sample size was determined using a double population proportion formula by using Epi Info software. Based on variables associated with sleep quality from a previous study(Tegegne and Alemnew 2022). The final sample size calculated was 441. Participants were recruited based on the previous six-month HMIS report, which served as the sampling frame. A proportional allocation method was applied to distribute the sample size across the four selected general hospitals based on the number of patients treated at each hospital. Study participants were then recruited using a systematic random sampling technique, with a sampling interval (k) determined to be 2. The first participant was randomly selected within the initial sampling interval, and subsequent participants were selected systematically. Detailed information about the sampling procedure is presented in Fig. 1.

Data collection tools, procedures, and quality control

The data was collected through face-to-face interviews using structured questionnaires developed from different literature (Salahuddin et al. 2017; Urtasun et al. 2019; Mossman et al. 2017; Kocalevent et al. 2018; Buysse et al. 1989). To ensure validity, the questionnaire was translated from English to Amharic and then back to English for consistency. The Pittsburgh Sleep Quality Index (PSQI) has an internal consistency with a reliability coefficient (Cronbach's alpha) of 0.78. The Patient Health Questionnaire (PHQ-9) demonstrates internal

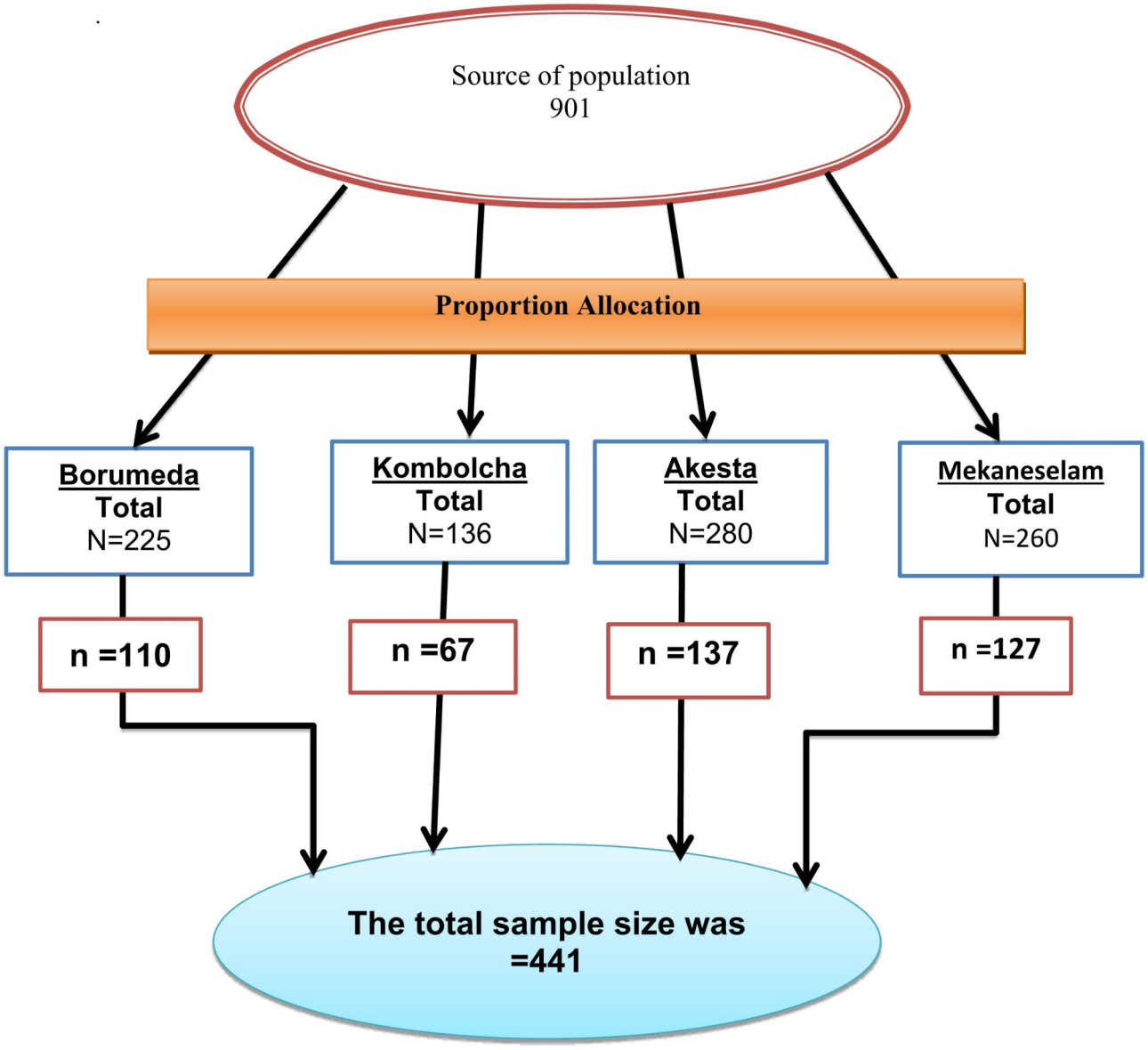


Fig. 1 Schematic presentation of the sampling procedure for the study to assess poor postoperative sleep quality and associated factors among patients undergoing major surgery in south Wollo zone public general hospital hospitals, Ethiopia, in 2022

consistency with a reliability coefficient of 0.84, while the Generalized Anxiety Disorder Item 7 (GAD-7) shows internal consistency with a reliability coefficient of 0.81 and Oslo Social Support Scale within internal consistency with a reliability coefficient of 0.88. Data collection was carried out by three trained BSc nurses, with regular supervision to ensure accuracy and adherence to protocol. We pre-tested it on 5% of the sample size at Kemisse General Hospital to check its completeness and the relevance of variables, and to identify any potential issues before the full data collection process.

Study variables

Dependent variable

Postoperative sleep quality (good/poor).

Independent variables

Socio-demographic Factors: Sex, age, residence, occupation, education level, income level; **Environmental Factors**: Light and sound exposure; **Clinical Factors**: Type of surgery, type of anesthesia, presence of pain, comorbidities; **Psychosocial and Behavioural Factors**: Depression, anxiety, social stigma, social support, substance use.

Operational definitions

Sleep quality Patients who scored above 5 on the Pittsburgh Sleep Quality Index (PSQI) were categorized as having poor sleep quality, while patients who scored 5 or less were considered to have good sleep quality(Buysse et al. 1989).

Depression Study participants who scored 0–4, 5–9, 10–14, 15–19, and 20–27 in the 9 items Patient Health Questionnaire (PHQ-9) were categorized as having none, mild, moderate, moderately severe, and severe depression respectively(Urtasun et al. 2019).

Anxiety Study participants who scored 9 or higher on the Generalized Anxiety Disorder Item 7 (GAD-7) questionnaire were classified as having anxiety(Mossman et al. 2017).

Social support Patients who scored 3–8 on the Oslo Social Support Scale were categorized as having poor social support, while those who scored 9–11 were categorized as having moderate social support. A score of 12–14 was categorized as indicating strong social support (Kocalevent et al. 2018).

Data processing and analysis

The collected data were checked for completeness and consistency then coded, cleaned, and entered into Epi-Data version 4.6 and exported to SPSS version 26 for analysis. Bivariable and multivariable logistic regression analyses were performed to assess associations between dependent and independent variables. The binary logistic regression model used to identify factors associated with poor sleep quality is based on the following formula:

$$\text{logit}(P) = \ln\left[\frac{p}{1-p}\right] = \beta 0 + \beta 1 \times 1 + \beta 2 \times 2 + \ldots + \beta n Xn$$

Where:

- P is the probability of experiencing poor sleep quality,
- β0 is the intercept,
- β1, β2,..., βn are the regression coefficients,
- X1, X2,..., Xn are the independent variables.

Multicollinearity was assessed using the Variance Inflation Factor (VIF), and all independent variable values were below 10, indicating no significant issues with collinearity. Additionally, the model fit was evaluated using the Hosmer-Lemeshow test, which yielded a *p*-value of 0.73, indicating a non-significant result and suggesting a good model fit. Variables with *p*-values less than 0.25 from bivariable logistics regression were included in the multivariable logistics regression analysis to identify associations between factors and the outcome variable. Variables with *p*-values less than 0.05 at a 95% confidence interval and adjusted odd ratios were considered significantly associated with poor sleep quality. Tthe results were presented using text, tables, and graphs.

Table 1 Socio-demographic characteristics of patients undergone surgery at South Wollo Zone General hospitals in Northeast Ethiopia 2022 (*n* = 428)

Variables	Categories	Frequency	
		No	%
Age	18–24 years	65	15.2%
	25–54 years	304	71.0%
	55–65 years	59	13.8%
Sex	Male	183	42.8%
	Female	245	57.2%
Residence	Urban	191	44.6%
	Rural	237	55.4%
Educational status	unable to read and write	129	30.1%
	Primary school	115	26.9%
	Secondary school	122	28.5%
	Diploma and above	57	14.7%
Occupation	Student	71	16.6%
	Daily labor	58	13.6%
	Farmer	77	18.0%
	Housewife	126	29.6%
	Merchant	32	7.5%
	Government employ	64	15.0%
Average monthly income	< 2500 ETB	272	63.6%
	>=2500 ETB	156	36.4%

Results

Socio-demographic characteristics

Out of 441 patients approached, 428 participants were included in this study, resulting in a response rate of 97%. The majority of participants were aged between 25 and 54 years (*n* = 304, 71.0%), with a notable representation of females (*n* = 245, 57.2%). Additionally, 55.4% (*n* = 237) of participants resided in rural areas. Regarding educational status, 28.5% (*n* = 122) attended secondary school, while 29.6% (*n* = 126) were housewives. Most participants (*n* = 272, 63.6%) reported an average monthly income of less than 2500 Ethiopian Birr (Table 1).

Clinical, social, and environmental related factors

From study particpants, 65.2% (*n* = 279) of of them reported poor social support, and the majority (80.1%, *n* = 343) received general anesthesia, while 70.3% (*n* = 301) reported experiencing anxiety. Sound disturbance was reported by 52.1% (*n* = 223) of participants, and 50.2% (*n* = 215) experienced light disturbance. Additionally, 33.2% (*n* = 142) reported mild pain (Table 2).

Table 2 Clinical, Social, and environmental related factor among patients undergone surgery at South Wollo Zone General hospitals in Northeast Ethiopia 2022 ($n=428$)

Variables	Categories	Frequency	
		No	%
Type of surgery	General	316	73.8%
	Emergency	112	26.2%
Type of anaesthesia	General	343	80.1%
	Regional	85	19.9%
Anxiety	Have anxiety	301	70.3%
	Haven't anxiety	127	29.7%
Social support	Poor	279	65.2%
	Moderate	118	27.6%
	Strong	31	7.2%
Sound disturbance	Yes	223	52.1%
	No	205	47.9%
Light disturbance	Yes	215	50.2%
	NO	213	48.8%
Pain level	No	37	8.6%
	Mild	142	33.2%
	Moderate	141	32.9%
	Sever	108	25.2%

Sleep quality among postoperative patients

The prevalence of poor sleep quality among adult postoperative patients was found to be 69.4% (95% CI: 65.0-74.1)(Fig. 2).

Factors associated with poor sleep quality

Variables with a p-value of ≤0.25 in bivariable logistic regression were included in the multivariable logistic regression analysis. The analysis indicated that type of surgery, type of anesthesia, anxiety, sound disturbance; light disturbance, social support, and pain were significantly associated with poor sleep.

Patients who underwent emergency surgery were 62% less likely to experience poor sleep quality compared to those who underwent elective surgery (AOR = 0.388, 95% CI: 0.210–0.720). Additionally, patients receiving general anesthesia were 65% less likely to report poor sleep quality compared to those receiving regional anesthesia (AOR = 0.359, 95% CI: 0.178–0.726).

Furthermore, patients experiencing mild (AOR = 6.263, 95% CI: 2.656–14.764), moderate (AOR = 6.001, 95% CI: 2.552–14.112), and severe pain (AOR = 9.105, 95% CI: 3.682–22.519) were significantly more likely to report poor sleep quality as compared to those without pain.

Patients who experienced sound disturbance had a 1.8 times higher likelihood of poor sleep quality (AOR = 1.878, 95% CI: 1.162–3.036), and those with light disturbance were 1.6 times more likely to have poor sleep quality (AOR = 1.637, 95% CI: 1.013–2.645). Patients with anxiety were 1.9 times more likely to report poor sleep quality than those without anxiety (AOR = 1.964, 95% CI: 1.197–3.221). Patients with poor and moderate social support were 5.6 times and 6.3 times more likely to experience poor sleep quality, respectively, compared to those with strong social support (AOR = 5.672, 95% CI: 2.310-13.922; AOR = 6.332, 95% CI: 2.462–16.526)(Table 3).

Discussion

This study aimed to assess postoperative poor sleep quality and associated factors among patients undergoing major surgery at South Wollo Zone General Hospitals in Northeast Ethiopia. The overall prevalence of postoperative poor sleep quality was 69.4% (95% CI: 65.2, 73.8).

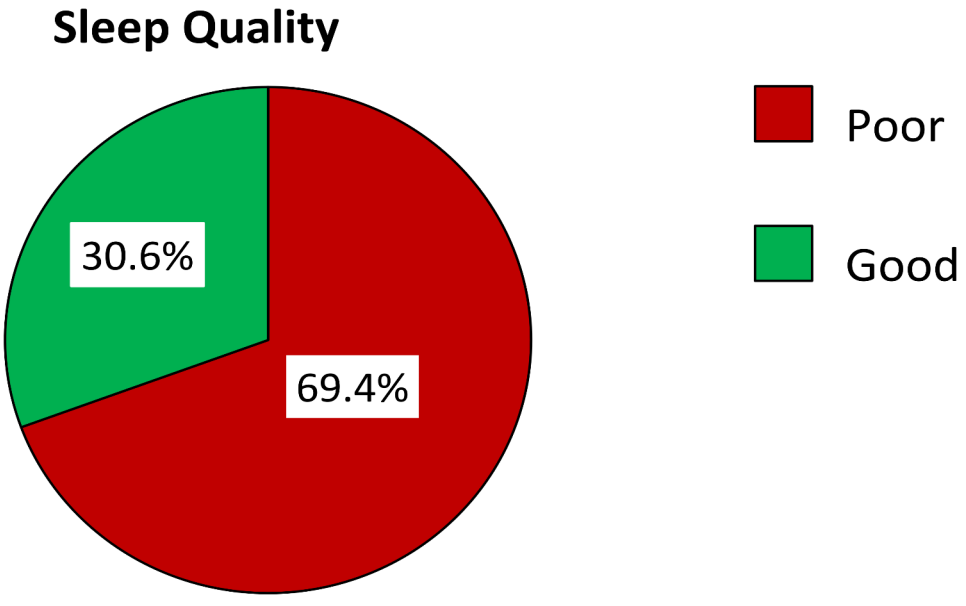


Fig. 2 Magnitude of sleep quality among postoperative patients in South Wollo zone Hospital, Ethiopia, in 2022($n=428$)

Table 3 Bivariable and multivariable logistic regression analysis of factors determining postoperative sleep quality at south Wollo Zone General hospitals, Ethiopia in 2022($n=428$)

Variables	Category	Sleep quality		95% C.I.		
		Poor n (%)	Good n (%)	COR	AOR	*p*-value
Types of Surgery	Elective Surgery(1)	206(48.1%)	110(25.7%)	1	1	
	Emergency Surgery	91(21.3%)	21(4.9%)	0.43(0.25–0.73)	0.38 (0.21–0.72)	. 003
Types of Anesthesia	Regional (1)	72(16.8%)	13(3%)	1	1	
	General	225(52.6%)	118(27.6%)	0.34(0.18–0.64)	0.35 (0.17–0.72)	0.004
Sound disturbance	No(1)	127(29.7%)	78(1%)	1	1	
	Yes	170(39.7%)	53(12.4%)	1.9(1.29–2.99)	1.8 (1.16–3.03)	0.001
Light disturbance	No(1)	138(32.2%)	75(17.5%)	1	1	
	Yes	159(37.2%)	56(13.1%)	1.5(1.01–2.33)	1.6(1.01–2.64)	0.044
Anxiety	No(1)	75(17.5%)	52(12.1%)	1	1	
	Yes	222(51.9%)	79(18.5%)	1.9(1.25–3.01)	1.9 (1.19–3.22)	0.008
Social support	Strong(1)	9(2.1%)	22(5.1%)	1	1	
	Poor	204(47.7%)	75(17.5%)	6.6(2.93–15.08)	5.6 (2.31–13.92)	0.001
	Moderate	84(19.6%)	34(7.9%)	6.0(2.52–14.44)	6.3 (2.42–16.52)	0.001
Pain	No(1)	12(2.8%)	35(8.2%)	1	1	
	Mild	101(23.6%)	41(9.6%)	5.1(2.35–11.17)	6.2 (2.65–14.76)	0.001
	Moderate	101(23.6%)	40(9.3%)	5.2(2.41–11.47)	6.0 (2.55–14.11)	0.001
	Sever	83(19.4%)	25(5.8%)	6.9(3.04–15.71)	9.1 (3.68–22.51)	0.001

Types of surgery, types of anesthesia, sound disturbance, light disturbance, social support, anxiety, and pain were significantly associated with poor sleep quality.

The finding of this study was consistent with the findings of studies from Amanuel Mental Specialized Hospital, Addis Ababa Ethiopia 65.4% (Adem et al. 2020), Debre Tabor, Ethiopia 64.9% (Tegegne and Alemnew 2022), Chinese 67.3% (Zhu et al. 2020) and Malaysia 61% (Musa et al. 2018).

However, the findings of this study were higher than the findings of the studies done in Hawassa, Ethiopia 57.6% (Bedaso et al. 2020), Saudi Arabia 55.4% (Darraj et al. 2018), United States of America 21.7%, 23% (Kain and Caldwell-Andrews 2003; Kunze et al. 2019), Canada 24% (Chung et al. 2007), China 27.59%, 29.2% (Tian et al. 2015; Xie et al. 2018), and Turkey 60%, 61% (Yilmaz 2020; Demirtaş and Dolu 2022). These discrepancies may be attributed to differences in sample size, study design, study population, study setting, and Socio-demographic differences of the study participants. The sample sizes were small in Saudi Arabia (307), the USA (127 and 115), Canada (305), China (192 and 83), and Ankara, Turkey (103). Furthermore, there were differences in the study design used; both the USA and Ankara, Turkey, utilized a prospective cohort approach. The sampling procedures varied as well: Saudi Arabia employed multistage cluster sampling, while the USA used convenience sampling, and China implemented cluster sampling. Additionally, the studies in China included only literate patients, while only outpatients were included in Turkey. Socio-demographic differences between Ethiopia and Saudi Arabia, the USA, Turkey, Canada, and China may also contribute to these variations. Additionally, In Canada, China and Turkey the study were conducted in single hospital but this study was conducted in different hospitals.

In contrast, the findings of this study were lower than the findings of the study conducted in Morocco 78% (Aquil et al. 2021), likely due to differences in study population and setting. The study conducted in Morocco was studied only on patients who have undergone women with gynecological cancer and was limited to a single study area. In contrast, the current study encompasses all surgical procedures and includes multiple hospitals.

Our results indicate that patients with mild, moderate, or severe pain were increasingly more likely to report postoperative sleep disturbances compared to those without pain. This finding is supported by studies from USA(Nowakowski et al. 2020),China(Xu et al. 2021), Sweden(Bjurström et al. 2021) and Ethiopia (Tegegne and Alemnew 2022). Pain acts as a physiological alarm, signaling bodily distress, which can negatively affect mood and sleep quality. Additionally, pain-induced alterations in dopamine signaling, a key neurotransmitter involved in sleep regulation, may lead to prolonged sleep loss and fragmented sleep. This mechanism explains why individuals in pain are more likely to wake frequently during the night and remain conscious of their discomfort(Whibley et al. 2019; Herrero Babiloni et al. 2020).

This study revealed that patients experiencing mild, moderate, or severe pain were increasingly more likely to develop postoperative sleep disturbances compared to those without pain. This observation aligns with evidence from studies conducted in the USA (Nowakowski et al. 2020), China (Xu et al. 2021), Sweden (Bjurström

et al. 2021), and Ethiopia (Tegegne and Alemnew 2022). This association may be explained by the role of pain as a physiological alarm, signaling bodily distress. Pain can negatively affect mood, further diminishing sleep quality. Additionally, dopamine, a key neurotransmitter in the brain, plays a crucial role in sleep regulation. Alterations or disruptions in dopamine signaling induced by pain may result in prolonged sleep loss and fragmented sleep. This mechanism could explain why individuals in pain are more likely to wake frequently during the night and remain conscious of their discomfort (Whibley et al. 2019; Herrero Babiloni et al. 2020).

This study found that postoperative patients undergoing emergency surgery were more likely to experience poor sleep quality compared to those who had elective procedures. Similar findings have been reported in studies conducted in Australia (Caruana et al. 2018) and Ethiopia (Tegegne and Alemnew 2022). This could be attributed to the hemodynamic instability often observed in emergency surgical cases, which may adversely impact postoperative sleep.

In addition; the finding of this study showed that postoperative surgical patients who were anxious were more likely to develop a poor quality of sleep compared with those who were non-anxious individuals. This finding was supported by a study from Japan (Yamawaki et al. 2017). The possible reason might be the negative effects of anxiety on the normal functions of the central nervous system which will end up with sleep disturbance (Lindberg et al. 1997; Cheng et al. 2018).

On the other hand, those individuals who had poor social support were more likely to experience poor sleep quality compared with those surgical patients who had moderate and good social support from their family or society. This aligns with findings from the USA (Chung 2017). Social support can mitigate negative emotions such as stress and anxiety, improve self-efficacy, and foster empathy, all of which contribute to better sleep quality (Xiao et al. 2020).

Patients exposed to sound or noise in their recovery rooms were more likely to report poor sleep quality compared to those in quieter environments, consistent with findings from China(Meng et al. 2020). Environmental noise, such as air and vehicle traffic, disrupts sleep architecture by increasing stage 1 sleep and reducing slow-wave and REM sleep. Additionally, nighttime noise triggers the release of stress hormones like adrenaline and cortisol, elevates heart rate and blood pressure, and induces measurable biological stress responses. These changes not only alter sleep architecture but also negatively affect subjective sleep quality (Halperin 2014).

Patients exposed to light disturbances were more likely to report poor sleep quality compared to those without such exposure, a finding supported by studies from Australia(Hillman 2021) and China (Chen et al. 2017). Artificial lighting at night can disrupt sleep by interfering with REM sleep and causing awakenings. This disruption occurs because exposure to even dim artificial light alters the natural sleep-wake cycle, leading to fragmented and lower-quality sleep(Cho et al. 2016).

Patients who received regional anesthesia were more likely to report poor sleep quality compared to those who received general anesthesia. This may be attributed to the prolonged sensory and motor blockade associated with regional anesthesia, which can cause discomfort or anxiety. In contrast, general anesthesia often includes sedative agents that not only induce unconsciousness but may also promote a more restful postoperative sleep environment. However, this finding contrasts with a study from Beijing, China, where regional anesthesia was associated with improved sleep quality. The discrepancy may be due to differences in the types of surgeries performed and variations in postoperative care protocols.

Limitations of the study

The cross-sectional design limits our ability to infer causal relationships between the variables. Also, this study's reliance on self-reported data may introduce recall bias. Moreover, the study was conducted in a specific geographic region, which may limit the generalizability of the findings.

Furthermore, a limitation of this study is that official authorization for the translation of the Pittsburgh Sleep Quality Index (PSQI) was not obtained prior to the study. Although the translation followed standard protocols, including bilingual translation from English to Amharic and back-translation to English, no prior authorization was obtained.

Conclusion

This study found that relatively high level of poor sleep quality among patients who underwent major surgery. Significant associations with poor sleep quality included the type of anesthesia, type of surgery, sound disturbances, anxiety, social support, and pain. Healthcare providers should address these factors in postoperative care to improve sleep quality among patients following major surgery.

Abbreviations

PSQI	Pittsburgh sleep quality index
PHQ	Patient health questionnaire
GAD	Generalized anxiety disorder

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Author contributions
Contributions BA designed the study. Both BA and AA wrote the first draft. AA and WY participated in the study implementation while BA performed the statistical analyses. BA, WY, and JM supervised all stages of study implementation. All the authors read and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical clearance was taken from the ethical review committee of Wollo University with approval Reference Number: CMHS/08/14. Then, after permission letter was taken from selected south Wollo Zone general hospital administrators. The purpose, benefit, and risk of the study were explained to the participants, they were informed about the right to withdraw from the study at any stage, and written informed consent was obtained from all the study participants. This study was carried out under the Helsinki Declaration's ethical principles.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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