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Poor sleep quality and its determinants among stroke survivors in Northwest Ethiopia

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Sleep disorders are highly prevalent and linked bidirectionally to stroke as risk factors for stroke to worsen the outcomes. To date, most of the studies on post-stroke sleep were conducted in Western countries. Quality of sleep among stroke patients is masked by other physical and medical complications and limited attention is given in Ethiopia. To address this gap the current study aims to estimate the incidence of poor sleep quality and its determinants among stroke survivors in Northwest Ethiopia. A prospective cohort study was conducted in three public referral hospitals from June 2022 to December 2022. The study included 403 stroke survivors at the three-month follow-up. We conducted analyses of bivariable and multivariable logistic regression to look into the relationship between the outcome and the explanatory variables. Statistics were given as odds ratios and 95% confidence intervals, with a significance level of $p < 0.05$. The overall incidence of poor sleep quality was 50.1%, with a mean Global Sleep Quality (GSQ score) of 5.15 (SD ± 0.16). According to Pittsburgh Sleep Quality Index (PSQI) data, the mean sleep hour was 6.15. History of alcohol consumption, complications during admission, and time between the onset of symptoms and hospital arrival were predictors of sleep quality. Sleep quality was observed in half of stroke survivors. The study's findings point to the significance of screening for sleep quality following a stroke and further research is needed including admitted and non-admitted stroke patients.

Keywords Poor sleep quality, Determinants, Stroke survivors

Abbreviations

AF	Atrial fibrillation
CHF	Congestive heart failure
DM	Diabetes mellitus
DVT	Deep venous thrombosis
GBD	Global burden of disease
GCS	Glasgow Coma Scale
GSQ	Global sleep quality
ICP	Intra cranial pressure
mRS	Modified Rankin Scale
NIHSS	National Institute of Health and Stroke Scale
PSQI	Petersburg Sleep Quality Index
UTI	Urinary tract infection
VIF	Variance inflation factor

Stroke is a major global cause of death and disability, and its treatment and aftercare have significant financial burden[1]. According to the most recent Global Burden of Diseases (GBD) estimate, Over 80 million people worldwide suffer from stroke[1]. Stroke incidence and death exhibit considerable inter-regional disparities,

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compared to Western countries, twice as many patients died in Africa[2]. However, there are still significant obstacles to preventing the increasing disability linked to stroke recurrence and altering the course of stroke recovery for the great majority of patients who do not qualify for or remain impaired following these treatments[3].

People living with stroke often have various complications and complex brain symptoms such as cognitive impairment, memory loss, dementia, depression, fatigue, and insomnia[4–7]. Previous research has shown that sleep-related problems are common in patients with stroke[4,8,9]. A wide range of sleep disorders occur in patients with stroke including insomnia, hypersomnia, breathing-related sleep disorders, and parasomnias[10]. Sleep disorders are highly prevalent and linked in a bidirectional fashion to stroke from being risk factors for stroke to worsening the functional outcomes[11]. Till date underestimated, the majority of studies on post-stroke sleep were conducted in Western countries, most of which were focused on a certain sleep disease[8,12–14].

Low-quality sleep is linked to all sleep disorders, which lowers patients' quality of life and impedes their recovery. The spectrum of people experiencing poor sleep quality following a stroke does, however, exhibit some considerable variability[10].

Sleep disorders after a stroke are underestimated and overlooked because stroke patients frequently are unaware of their sleep difficulties. Stroke clinicians' lack of knowledge on sleep disturbances is the reason for the low screening rate[3,5]. Poor sleep quality raises serious concerns because it can affect modifiable risk factors and raise the risk of stroke, both in terms of incidence and recurrence. Moreover, poor sleep quality bidirectionally affects the rehabilitation of stroke patients[4,5,13].

Stroke patients' poor sleep quality is often concealed by other physical and medical issues, and in Africa, particularly in Ethiopia, there is a dearth of attention to this problem. The current study intends to fill this gap by estimating the prevalence of poor sleep quality and its contributing factors among stroke survivors in Northwest Ethiopia.

Statement of significance
While post-stroke rehabilitation focuses on physical and cognitive recovery, sleep quality is often overlooked despite its crucial role in overall health and well-being. Investigating the prevalence and contributing factors of poor sleep quality among stroke survivors in Northwest Ethiopia addresses a critical gap in knowledge. The findings will not only benefit individual patients by informing treatment plans but also contribute to improved public health policies and overall stroke treatment outcomes in the region.

Methods
This study report is aligned with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines[15].

Study design and settings
A multicenter prospective cohort study was conducted at the University of Gondar Referral Hospital located in Gondar and Tibebe Ghion Comprehensive Specialized Hospital and Felege Hiwot Referral Hospital, located in Bahir Dar, Northwest Ethiopia, from June 2022 to December 2022. Data were collected from stroke patients who were on follow-up from the neurology department of the three hospitals.

Participants of the study
The study participants were all stroke survivors who were alive after three months of stroke onset. The participants were 403 stroke patients who were admitted for in-hospital treatment and on follow-up after discharge on completion of in-hospital treatment at the neurology departments. The inclusion criteria were all adult stroke patients who were alive after 3 months of stroke onset, those with first stroke event, stroke diagnosis confirmed by CT scan and not taking medications related to sleep disorder. The exclusion criteria were specified to exclude participants with severe or unstable medical conditions, those with pre-existing sleep disorders before the stroke, previous history of psychiatric disorders, uncontrolled depression, and patients who cannot communicate as well as those who did not provide informed written consent.

Study variables
Dependent variable
Post-stroke sleep quality was assessed using the Amharic version of the Pittsburgh Sleep Quality Index (PSQI) which has been validated for use in Ethiopia[16]. PSQI measures sleep quality by assessing factors like subjective sleep quality, sleep latency, duration, efficiency, disturbances, medication use, and daytime dysfunction. Sleep quality was assessed after three months of stroke onset and classified as good sleep quality when PSQI score was five or less while poor sleep quality was defined as PSQI was greater than five[17].

Independent variable
Age, sex, place of residence, marital status, employment, educational attainment, alcohol consumption, smoking, eating habits, and level of activity are examples of sociodemographic and behavioural variables. The independent variables of the study also included the patient's characteristics (clinical presentation, co-morbidities and complications, duration of symptoms before hospital admission, time to CT scan and treatment initiation after diagnosis confirmation), type of stroke, length of hospital stay, GCS score, mRS score, NIHSS score, respiratory rate, temperature, pulse rate, and blood pressure.

Data collection
One internal medicine resident (R-3) and a psychiatrist from each hospital collected data after receiving training on the purpose and scope of the study. Data collectors collected all relevant data from patients' charts and interviewed the patients using the prepared data extraction form and questionnaire. Trained data collectors conducted in-person interviews with patients at the time of admission to the hospital and after three months. Baseline data were collected at the time of admission, comprising demographic, behavioral, and clinical data (medical history) as well as scores (GCS, mRS, and NIHSS). NIHSS score was assessed during discharge while PSQI was measured after three months of stroke onset. The history used for the study was taken from the patients in the language they understood (in Amharic).

Ethical approval and consent for participation
All participants completed the written informed consent and accepted to take part in this study. The study was conducted in accordance to the Declaration of Helsinki. Ethical approval of the study was obtained from the College of Health Science, Debre Tabor University with reference number CHS/3238/2014 E.C.

Data processing and analysis
Data were entered and cleaned using Epi Info 7 and analyzed using Stata version 16. Descriptive statistics (frequencies and means) were used to summarize demographic and clinical characteristics. Bivariate logistic regression analysis was used to identify potential predictors of poor sleep quality. Variables with a p-value < 0.05 in the bivariate analysis were included in the multivariable logistic regression model. Multicollinearity was assessed using the variance inflation factor (VIF), with a cut-off of ten. Odds ratios (ORs) with 95% confidence intervals were calculated to estimate the strength of the association between predictors and poor sleep quality. Statistical significance was set at $p < 0.05$.

Results
Sociodemographic and baseline clinical characteristics of study participants
Four hundred-three stroke survivors who were admitted to the three hospitals were included in this study. Of these, 273 (67.7%) were ischemic while the remaining 130 (32.2%) were hemorrhagic stroke patients. The study's participants were 56% female, with a mean age of 61.3 years (SD = 0.7). Preexisting comorbidity was found in more than half of stroke patients (54.6%), whereas complications were reported by 39.7% of admitted patients to hospitals (Table 1).

The incidence of poor sleep quality
The overall incidence of poor sleep quality was 50.1%, with a mean GSQ score of 5.15 (SD ± 0.16). According to PSQI data, individuals' sleep hour ranges from three to nine, with a mean sleep hour of 6.15 (SD ± 0.18).

The components of sleep quality were assessed using PSQI, and accordingly, around 46% of the participants had 5–6 h' sleep duration while 11.7% had < 5 h' sleep duration. In the meantime, nearly one third (36%), had sleep latency of 1-times a week. According to subjective sleep quality, most of the participants (42.7%) rate their sleep very good, while 12.4% rate as very bad. However, none of the participants reported using sleep medication in the previous month before data collection. Besides, about one-third reported ≥ 85% sleep efficiency whereas 9.7% had less than 65% sleep efficiency (Table 2).

Determinants of poor sleep quality
Multivariable analysis revealed that the determinant factors of poor sleep quality were past alcohol drinking, the presence of complications during hospital admission, and time from symptom onset to hospital arrival (Table 3). Poor sleep quality was 1.53 times more common among past alcohol drinkers (AOR = 1.53, 95% CI = 1.330–1.859) compared to their counterparts. Furthermore, one one-hour delay from symptom onset to hospital arrival (AOR = 1.008, 95%CI = 1.0007–1.04) results in about 1% increased risk of developing poor sleep quality after three months. At the end of three months follow-up, the probability of having poor sleep quality in patients who presented to the hospital with complications were three times higher (AOR = 3.14, 95% CI = 1.34–8.54) compared to patients who presented without complications during admission.

Discussion
After three months of follow-up, half of stroke survivors had poor sleep quality. This study also found past alcohol drinking, time from symptom onset to hospital arrival, and the presence of complications during admission as determinant factors of poor sleep quality in stroke survivors after three months of hospital admission.

This Prospective cohort study found out 50.1% of stroke patients had poor sleep quality which was comparable with a systematic review result (53%) conducted by Ye Luo et al.[18]. However, the result was lower compared to studies conducted in Iran (84%) and Brazil (70.6%)[19,20]. On the contrary, the incidence of poor sleep quality was higher than the study conducted in Central Taiwan (15.6%)[12]. The possible variation in sleep quality might be with differences in sampling, assessment methods, cut-of-point, and study population.

Our study found that being a past alcohol drinker is related to poor sleep quality among stroke survivors. A growing number of studies conducted on the general population supported our finding sleep symptoms are associated with alcohol drinking[21–24]. Possibly, with repeated administration, alcohol exhibits tolerance and dependency. This tolerance is accompanied by neurotransmitter system adaptation, which might take the form of altered release patterns or altered response mechanism sensitivity. In alcohol-dependent people, alcohol withdrawal can cause neurological symptoms of the ensuing neurochemical imbalance[25]. Our finding is novel, as

Variables	Category	Good sleep quality No (%)	Poor sleep quality No (%)
Age	20–29	3 (0.74)	1(0.24)
	30–39	10 (2.48)	5 (1.24)
	40–49	30 (7.44)	17 (4.23)
	50–59	54 (13.4)	45 (11.17)
	60–69	48 (11.9)	61 (15.13)
	70–79	47 (11.66)	59 (14.64)
	> 80	9 (2.23)	14 (3.47)
Sex	Male	93 (23.1)	86 (21.34)
	Female	108 (26.8)	116 (28.8)
Residence	Urban	70 (17.37)	60 (14.9)
	Rural	131 (32.5)	142 (35.2)
Marital status	Unmarried	10 (2.48)	5 (1.24)
	Married	162 (40.2)	167 (41.44)
	Divorced	16 (4.0)	14 (3.47)
	Widowed	13 (3.22)	16 (4.0)
Education	No formal education	131 (32.5)	138 (34.24)
	Able to read and write	2 (0.5)	27 (6.7)
	Primary and secondary	26 (6.45)	23 (5.7)
	Tertiary +	16 (4.0)	14 (3.47)
Alcohol use	Non-drinker	100 (24.8)	128 (31.7)
	Past drinker	54 (13.4)	77 (0.19)
	Current drinker	24 (6.0)	20 (5.0)
Cigarette smoking	Non-smoker	193 (47.9)	196 (48.6)
	Past smoker	8 (2.0)	6 (1.5)
Physical activity level	Extremely inactive	10 (2.48)	10 (2.48)
	Sedentary	48 (11.9)	75 (18.6)
	Moderately active	127 (31.5)	269 (66.7)
	Vigorously active	5 (1.24)	10 (2.48)
	Extremely active	11 (2.7)	29 (7.2)
Presence of Comorbidity	Yes	107 (26.5)	113 (28.0)
	No	94 (23.3)	89 (22.1)
Type of comorbidity	Hypertension	50 (12.4)	54 (13.4)
	CHF	23 (5.7)	21 (5.2)
	DM	11 (2.7)	4 (1.0)
	Hyperlipidemia	4 (1.0)	6 (1.5)
	AF	2 (0.5)	3 (0.7)
	Migraine headache	3 (0.7)	2 (0.5)
Presence of complications during admission	Yes	46 (11.4)	114 (28.3)
	No	149 (37.0)	94 (23.3)
Neurologic complication	Increased ICP	16 (4.0)	34 (8.4)
	Herniation	8 (2.0)	17 (4.2)
	Epileptic seizure	2 (0.5)	5 (1.24)
	Delirium	3 (0.7)	4 (1.0)
	others	3 (0.7)	9 (2.2)
Medical complication	Aspiration pneumonia	31 (7.7)	51 (12.6)
	DVT	4 (1.0)	8 (2.0)
	UTI	3 (0.7)	7 (1.7)
	Bedsores	3 (0.7)	3 (0.7)
Type of stroke	Hemorrhagic	57 (14.1)	73 (18.1)
	Ischemic	144 (35.7)	129 (32.0)
Time from symptom onset to hospital Arrival (in hour)	< = 24	130 (32.2)	134 (33.2)
	24–48	24 (6.0)	26 (6.4)
	> = 48	42 (10.4)	47 (11.7)
Continued			

Variables	Category	Good sleep quality No (%)	Poor sleep quality No (%)
Time from admission to start of treatment (in hour)	< = 3	149 (37.0)	164 (40.7)
	4–12	34 (8.4)	46 (11.4)
	13–24	2 (0.5)	3 (0.7)
	> 24	2 (0.5)	3 (0.7)
Admission GCS score	Poor (3–8)	13 (3.2)	17 (4.2)
	Moderate (9–12)	82 (20.3)	83 (20.6)
	Good (13–15)	102 (25.3)	106 (26.3)
Admission mRS score	No symptoms (0)	0	0
	No significant disability (1)	4 (1.0)	1 (0.25)
	Slight disability (2)	0	0
	Moderate disability (3)	6 (1.5)	9 (2.2)
	Moderately severe disability (4)	132 (32.7)	151 (37.5)
	Severe disability (5)	40 (10.0)	60 (14.9)
	Death (6)	0	0
Admission NIHSS score	Mild	9 (2.2)	6 (1.5)
	Moderate	90 (22.3)	88 (21.8)
	Sever	85 (21.1)	85 (21.1)
	Very severe	17 (4.2)	23 (5.7)
Discharge NIHSS score	Mild	5 (1.2)	4 (1.0)
	Moderate	128 (31.7)	126 (31.2)
	Sever	59 (14.6)	56 (13.9)
	Very severe	9 (2.2)	26 (6.4)
Medications given during in-hospital treatment			
Recombinant tissue plasminogen activator	Yes	0	0
	No	201 (49.9)	202 (50.1)
Statins	Yes	142 (35.2)	128 (31.7)
	No	59 (14.6)	74 (18.3)
ACE inhibitors	Yes	2 (0.5)	3 (0.7)
	No	200 (49.6)	198 (49.1)
Anti-coagulants	Yes	68 (16.9)	70 (17.4)
	No	133 (33.0)	132 (32.7)
CC-blockers	Yes	65 (16.1)	74 (18.3)
	No	136 (33.7)	128 (31.7)
Beta-blockers	Yes	10 (2.5)	5 (1.2)
	No	191 (47.4)	197 (48.9)
Antidiabetics	Yes	14 3.5)	12 (3.0)
	No	187 (46.4)	190 (47.1)
Diuretics	Yes	3 (0.7)	2 (0.5)
	No	198 (49.1)	200 (49.6)
Antibiotics	Yes	43 (10.7)	43 (10.7)
	No	158 (39.2)	159 (39.4)
Ant-ulcer	Yes	187 (46.4)	195 (48.4)
	No	14 (3.5)	7 (1.7)
Anticonvulsant	Yes	4 (1.0)	4 (1.0)
	No	197 (48.9)	198 (49.1)
Continued			

Variables	Category	Good sleep quality No (%)	Poor sleep quality No (%)
Antipain	Yes	4 (1.0)	15 (3.7)
	No	197 (48.9)	187 (46.4)
Laxatives	Yes	4 (1.0)	1 (0.2)
	No	197 (48.9)	201 (49.9)
Others	Yes	19 (4.7)	26 (6.4)
	No	176 (43.7)	164 (40.7)

Table 1. Sociodemographic and clinical profile of stroke survivors in Northwest Ethiopia, 2022. mRS, modified Rankin Scale; NIHSS, National Institute of Health Stroke Scale; GCS, Glasgow Coma Scale.

Variables	Values	Stroke sub-type		Total no of participants (%)
		Hemorrhagic N (%)	Ischemic N (%)	
Sleep duration (in hour)	> 7	17 (4.2)	48 (11.9)	65 (16.1)
	6–7	31 (7.7)	75 (18.6)	106 (26.3)
	5–6	62 (15.4)	125 (31)	187 (46.4)
	< 5	20 (4.9)	25 (6.2)	45 (11.7)
Sleep latency	Never (0)	10 (2.5)	27 (6.7)	37 (9.2)
	< 1 time a week (1)	42 (10.4)	100 (24.8)	142 (35.2)
	1–2 times a week (2)	53 (13.1)	92 (22.8)	145 (36)
	> = 3 times a week (3)	25 (6.2)	54 (13.4)	79 (19.6)
Sleep efficiency	> = 85%	42 (10.4)	96 (23.8)	138 (34.2)
	75–84%	48 (11.9)	86 (21.3)	134 (33.2)
	65–74%	26 (6.4)	66 (16.4)	92 (22.8)
	< 65%	14 (3.5)	25 (6.2)	39 (9.7)
Day time dysfunction	Never (0)	49 (12.1)	112 (27.8)	161 (39.9)
	< 1 time a week (1)	37 (9.2)	82 (20.3)	119 (29.5)
	1–2 times a week (2)	25 (6.2)	52 (12.9)	77 (19.1)
	> = 3 times a week (3)	19 (4.7)	27 (6.7)	46 (11.4)
Sleep disturbance	Never (0)	35 (8.7)	105 (26.0)	140 (34.7)
	< 1 time a week (1)	50 (12.4)	97 (24.0)	147 (36.5)
	1–2 times a week (2)	24 (5.9)	45 (11.1)	69 (17.1)
	> = 3 times a week (3)	21 (5.2)	26 (6.4)	47 (11.6)
Use of sleep medication	Never (0)			403 (100)
	< 1 time a week (1)			0
	1–2 times a week (2)			0
	> = 3 times a week (3)			0
Subjective sleep quality	Very good (0)	54 (13.4)	118 (29.3)	172 (42.7)
	Fairy good (1)	37 (9.2)	82 (20.3)	119 (29.5)
	Fairly bad (2)	21 (5.2)	41 (10.2)	62 (15.4)
	Very bad (3)	18 (4.4)	32 (8.0)	50 (12.4)
Sleep quality category	Good	54 (13.4)	144 (35.7)	201 (49.8)
	Poor	73 (18.1)	129 (32.0)	202 (50.1)

Table 2. Sleep quality and its component scores among stroke survivors, Northwest, Ethiopia.

we are not aware of any previous study identifying alcohol use with poor sleep quality in stroke. Further research is needed to examine the impact of alcohol use on sleep quality in stroke survivors.

A statistically significant association between the presence of complications and poor sleep quality was observed among stroke patients in this study, This is supported by Cai et al.[3]. While study conducted in Australia disagrees with our finding stating there was no association between sleep quality and stroke characteristics[4]. This might be due to patients with complications during hospital admission who may have long hospital stays, pain, noise, and medications that interfere with sleep.

Among stroke survivors, the probability of having poor sleep quality was higher for patients who came one hour late compared to those who came one hour earlier. We cannot find any study on the role of time on sleep quality in stroke patients, meanwhile, it is clearly stated that the treatment of stroke is critical time-dependent[26].

	Sleep quality		OR (95% CI)			
Variables	Good	Poor	COR	P-value	AOR	P-value
Alcohol drinking						
Nondrinker	100	128	1		1	
Past drinker	54	77	1.438 (1.006–1.876)	0.05	1.53 (1.330–1.859)*	**0.01**
Current drinker	24	20	1.361 (0.751–2.008)	0.273	1.70 (0.340–1.474)	0.3
Presence of complications during admission						
No	149	94	1		1	
Yes	46	114	3.14 (1.34–8.54)		4.0 (2.45–6.36)*	**0.0001**
Admission mRS score	201	202	1.363 (1.021–2.704)	0.03	1.21 (0.783–1.882)	0.8
Admission NIHSS score	201	202	1.018 (1.013–1.05)	0.05	1.95 (0.885–1.023)	0.18
Time from symptom on set to hospital arrival	201	202	1.002 (1.0009–2.058)	0.01	1.008 (1.0007–1.04)*	**0.01**

Table 3. Bivariable and multivariable logistic regression model of factors independently associated with poor sleep quality among stroke survivors in Northwest Ethiopia, 2022. *Statistically significant at p-value < 0.05; COR, Crude odds ratio; AOR, Adjusted odds ratio. Significant values are in bold.

Strength and limitation

The fact that our study was multicentered and had a 100% response rate was a significant strength. The study's longitudinal design adds to its strength in identifying the predictors three months after stroke. Stroke severity extremes may not have been included in our study because it only included individuals who were admitted to the hospital. To comprehend the long-term evolution of sleep quality, a longer follow-up involving baseline and follow-up sleep quality outcomes would be appropriate.

Conclusion

This study found that poor sleep quality was prevalent among stroke survivors at three months post-stroke. Past alcohol consumption, delayed hospital arrival, and in-hospital complications were identified as significant predictors of poor sleep quality. The study's findings point to the significance of screening for sleep quality following a stroke. Further research is needed to explore the long-term impact of these factors and to develop effective interventions to improve sleep quality in stroke survivors.

Data availability

The raw data supporting the conclusions of this article will be made available by the corresponding author, without undue reservation.

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Author contributions
GWA, AAT, NDB, and GYY involved in the conception of the research idea, study design and questionnaire development. GWA, ATA, and AT prepared tables. GWA, SA and DA analyzed the data, interpreted the results and drafted the manuscript. All authors revised and approved the final manuscript.

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Competing interests
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Additional information
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