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ORIGINAL RESEARCH

Sleep Quality and Associated Factors Among Adult Cancer Patients Under Treatment at Oncology Units in Amhara Region, Ethiopia

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Introduction: Poor sleep quality, a common, under-diagnosed, and under-treated problem in cancer patients, has negative physical and psychological consequences, but its prevalence and associated factors are not well studied in Ethiopia. Thus, the present study aimed to assess the prevalence of sleep quality and its associated factors among adult cancer patients receiving treatment at oncology units in Amhara region, Ethiopia.

Methods and Materials: An institution-based cross-sectional study was conducted among adult patients with cancer under treatment at the oncology units in the Amhara region from April 12 to May 12/2021. A systematic random sampling technique was used to select 423 samples. Data were collected using a structured Interviewer-administered questionnaire. Sleep quality and depression were assessed by the Pittsburgh Sleep Quality Index and depression subscale of Hospital Anxiety and Depression Scale, respectively. Bivariable and multivariable logistic regression analyses were computed, considering $p < 0.25$ to select candidate variables for multivariable analysis and $p < 0.05$ to be statistically significant in the final model.

Results: A total of 410 cancer patients participated in this study. The mean of the participant's age was 44.2 (range: 20–77) years. More than half (52.7%) of participants received chemotherapy and the remaining were treated with a combination of treatments. Two-hundred ninety-three (71.5%) of participants had poor sleep quality and 28.5% had good sleep quality. The factors found to be significantly associated with poor sleep quality were advanced age [AOR = 1.037, 95% CI: (1.012–1.062)]; having depressive symptoms [AOR = 2.862, 95% CI: (1.133, 7.228)]; having distant metastasis cancer [AOR = 3.758, 95% CI: (1.585, 8.909)]; and increased severity of pain [AOR = 1.331, 95% CI: (1.106, 1.601)].

Conclusion: The study found a high prevalence of poor sleep quality among cancer patients. Early screening and management of sleep problems are crucial in patients with cancer.

Keywords: cancer patients, Ethiopia, Pittsburgh Sleep Quality Index, PSQI, sleep quality

Introduction

Sleep is an essential component of human life that delivers necessary restorative, protective, and energy-conserving functions to the body. It must be of sufficient duration, timing, and regularity to be effective.[1,2] However, it is affected by different medical conditions including cancer.[3] Patients with cancer often experience several symptoms, which will be associated with the disease or treatment. Among these symptoms, poor sleep quality is the commonest problem in this particular population.[4]

Poor sleep quality may be described as the inability of initiating and maintaining sleep, frequent awakening, and feeling of unrest.[5] Sleep-related complaints are extremely common in patients with cancer but often are not recognized, and they are rarely treated.[6] In cancer patients, disturbed sleep is rated the second most bothersome symptom.[7] According to different studies, 20% to 78% of cancer patients have poor sleep quality.[8–20] This rate is higher than the rate in the

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general population, which ranges from 15% to 25%.[21] Despite its high prevalence and clinical significance, sleep problems are rarely addressed in cancer practice and patients may fail to report it, assuming it to be a normal and temporary reaction to a cancer diagnosis or treatment.[22]

Although little is known about the prevalence of poor sleep quality in Africa, a Moroccan study found that 71.8% of cancer patients had poor sleep quality.[19] In Ethiopia, a meta-analysis of studies conducted among general populations and university students indicated a 53% pooled prevalence of poor sleep quality.[23] However, studies on sleep, particularly in cancer patients, are lacking.

Oncology services in Ethiopia are inadequate, and the country is ill-equipped to deal with the rising cancer burden. The number of oncology centers in the country is not keeping pace with the country's growing population and rising cancer burden.[24] Ethiopia has only one fully functional public radiation center, which is situated in the country's capital and is attempting to serve the entire country.

In patients with cancer, the causes of poor sleep quality are multifactorial. It is affected by socio-demographic characteristics of patients like age,[18,25] gender,[25,26] marital, employment, and educational status.[27–29] Furthermore, cancer treatments, cancer symptoms, and psychological and behavioral stressors associated with cancer and its treatment contribute to poor sleep.[22,30,31] Sleep quality is also associated with the primary location of cancer,[19] the location of cancer metastasis,[14] the stage of cancer,[11] the types of treatment provided to patients,[17,32,33] and the duration of time passed since diagnosis.[34] Moreover, poor functional performance status, poor social support, and higher body mass index are significant factors associated with poor sleep quality.[14,35–37]

Poor sleep quality in patients with cancer has detrimental physical and psychological consequences including lower quality of life and early mortality.[38,39] Poor sleep quality causes serious cardiovascular problems, reduced immune function, poor healing, increased chances of cancer recurrence, impaired performance, impaired cognitive functioning, medication misuse and abuse, poor relationships, and increased healthcare costs.[40–44]

Recognition of the frequency and characteristics of cancer-related poor sleep quality can provide a base of new approaches to supportive care during the treatment trajectory of cancer. Therefore, a study on the quality of sleep and its associated factors is extremely important but scarce in Ethiopia. Thus, the present study aimed to assess the prevalence of sleep quality and its associated factors among cancer patients at oncology units in the Amhara region, Ethiopia.

We hypothesized that age, gender, marital status, unemployment, educational status, and clinical variables such as cancer stage, type of treatment, time since diagnosis, poor performance status, poor social support, and a higher body mass index would all be connected to poor sleep quality in cancer patients. A positive relationship would also exist between poor sleep quality and symptom severity in patients with cancer.

Methods and Materials

Study Design, Period, and Setting

An institution-based cross-sectional study design was employed from April 12 to May 12/2021 at hospitals that have oncology units in the Amhara region. Only three hospitals in the region have an oncology unit to provide care and treatment for cancer patients: Felege Hiwot Comprehensive Specialized Hospital (FHCSH), Dessie Comprehensive Specialized Hospital (DCSH), and University of Gondar Comprehensive Specialized Hospital (UoGCSH). The three hospitals; FHCSH, DCSH, and UoGCSH are located in Bahir Dar, Dessie, and Gondar cities, which are 565, 401, and 735 kilometers far from Addis Ababa, the capital city of Ethiopia, respectively. More than 1800 cancer patients were receiving cancer treatment at the three hospitals on an annual basis.

Inclusion and Exclusion Criteria

Patients who were over the age of 18 years, with a pathologically confirmed cancer diagnosis, and who were receiving a cancer treatment were included in this study; however, those with a critical medical condition who were unable to comprehend and respond to questions throughout the data collection period were excluded.

Sample Size Determination and Sampling Technique

The sample size was calculated using the single population proportion formula and by adding a 10% non-response rate the final sample size was calculated to be 423. A systematic random sampling technique was used to approach study participants from each hospital. The sampling interval was determined by dividing the total study population who had follow-up and were under treatment during one typical month (1090) by the total sample size (423). Based on this, the sampling interval (K) was calculated to be 1090/423 ≈ 2. The first participant was selected randomly by a lottery method from 1 or 2, and the next respondent was chosen at regular intervals (every 2).

Study Variables

The dependent variable was sleep quality and the independent variables were socio-demographic variables (age, sex, marital status, occupation, religion, residence, level of education, and social support), behavioral variables (coffee drinking, smoking status, alcohol use, and khat use), clinical factors (type of cancer, stage of cancer, presence of metastasis, site of metastasis, duration of time since diagnosis, the duration of time between diagnosis and treatment, treatment type, performance status, comorbid disease, and body mass index), and disease and treatment-related symptoms (pain, fatigue, anxiety, depression, numbness, dyspnea, nausea, vomiting, anorexia, sadness, drowsiness, psychological distress, dryness of mouth and problem in remembering).

Operational Definition

Sleep quality: a global Pittsburgh Sleep Quality Index (PSQI) score of greater than 5 indicates poor sleep quality and a global PSQI score of less than or equal to 5 indicates good sleep quality.[45]

Anxiety and depression: In our study, a patient with more than 10 points on each scale of the Hospital Anxiety and Depression Scale has anxiety and depression problems.[46]

Symptom severity: For all MD Anderson Symptom Inventory core symptoms, the severity scale was 0 (no symptom), 1–4 (mild symptom), and ≥5 (moderate-to-severe symptom).[47]

Smoking status: Never smoker was an individual who had never tried a cigarette in his/her lifetime. Former smoker was an individual who had smoked in the past but stopped smoking 30 days before the data collection period. Current smoker was an individual who smoked a cigarette one or more in the past 30 days before the survey.[48]

Khat chewing: Former khat chewer was an individual who had ever used khat at least once in his/her lifetime but never used it in the last 30 days. Current khat chewer was an individual who had used khat at least once in the last month before the study. Never khat chewer was an individual who never tried khat chewing in his/her lifetime at all.[49]

Alcohol drinking status: Former alcohol user was an individual who admitted to having ever used alcohol but stopped in the last 30 days. Current alcohol user was an individual who took alcoholic drinks within 30 days preceding the study. Never user was an individual who never used alcohol in his/her lifetime.[49,50]

Performance status: by using the Eastern Cooperative Oncology Group (ECOG) performance status scale, a grade of 0–1 indicates good performance status and a grade of 2–4 indicates poor performance status.[35]

Social support: by using the three-item Oslo social support scale (OSSS-3), a score of 3–8 represents "poor support", 9–11 "moderate support", and 12–14 "strong support".[51]

Body mass index (BMI) was classified as underweight (BMI <18.5), normal (BMI 18.5–24.99), overweight (BMI 25.0–29.99), and obese (BMI ≥ 30.0).[52]

Khat is a herbal product consisting of the leaves and shoots of the shrub *Catha edulis* Forsk, a member (genera) of the evergreen Celastraceae (moonseed or spindle-tree) family.[53]

Measurements and Data Collection Technique

Data Collection Tool

A pretested, structured, interviewer-administered questionnaire and data extraction checklist were used to collect data. The following subsections make up the questionnaire.

Socio-demographic, behavioral, and clinical factors: The tools for these variables were adapted from the review of different pieces of literature.[8,14,30,54]

Sleep Quality

It was assessed by a widely used Pittsburgh Sleep Quality Index. The tool was designed to evaluate the subjective quality of sleep in the past month. It contains 19 self-rated questions, including seven subscale components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction). Each component score ranges from 0 (no difficulty) to 3 (severe difficulty). The sleep component score is summed to yield a total score (referred to as global score) ranging from 0 to 21 with higher total scores indicating poor sleep quality. A global Pittsburgh Sleep Quality Index score greater than 5 yielded a diagnostic sensitivity of 89% and specificity of 86.5% (kappa = 0.75, $P \leq 0{:}001$) in distinguishing "poor" from "good" sleepers.[45] The construct validity and internal consistency are further evaluated and supported in cancer patients with a Cronbach's α value of 0.81.[55] This tool was validated in Ethiopian adults with a good psychometric validity.[56] For the present study, the internal consistency measurement of the tool's subscales found a Cronbach's α coefficient of 0.761 which was acceptable for this study.

Anxiety and Depression

The Hospital Anxiety and Depression Scale was used to assess these variables. The 14-item measure examines depression and anxiety symptoms and is divided into two subscales, each having seven items that are assessed on a four-point scale (0–3). Each subscale's total score runs from 0 to 21. Based on their results, the respondents can be classified as normal (0–7), borderline (8–10), or abnormal cases (11–21).[57] This scale was also validated in Ethiopian cancer patients.[46] In the current study, the Cronbach's α value was 0.931 and 0.932 for anxiety and depression subscales, respectively.

The Severity of Symptoms

This was assessed by the core symptom severity subscale of the MD Anderson Symptom Inventory, a brief, valid, reliable, easily understood questionnaire. The tool measures the intensities of thirteen symptoms (pain, fatigue, numbness, dyspnea, nausea, vomiting, anorexia, sadness, drowsiness, psychological distress, dryness of mouth, sleep disturbance, and problem in remembering) on a 0 to 10 scale, with higher scores indicating more severe symptoms.[58] This tool has been validated in Ethiopia, and the Amharic version was used in this study, with Cronbach's alpha at 0.82.[59]

Social Support

It was measured using the three-item Oslo social support scale, which includes questions about the primary support group, others' interest and concern, and the ease of obtaining practical help. The first item was rated on a four-point scale, while the other two were graded on a five-point scale, resulting in a total score of 14 when the three items were added together.[60] Cronbach's alpha was 0.763 in this study.

Performance status: The patients' performance status (the patient's level of functioning seen from their daily activity, physical ability, and self-care) was measured using the one-item Eastern cooperative oncology group (ECOG) score, which ranges from 0 (fully active) to 4 (completely disabled).[61]

Data Collection Technique

Data were collected by five trained nurses who have a Bachelor of Science degree through interviews, and the process was closely monitored by three trained nurses who have a Masters of Science degree. Participants were approached for the interview after finishing their examination at the oncology outpatient department. After each interview, data collectors took measurements of the participant's weight and height. Weight was measured with a light cloth while standing, and height was measured using a straight, upright body posture. Clinical characteristics (type of cancer, stage of cancer, presence of metastasis, site of metastasis, duration of time since diagnosis, the duration of time between diagnosis and treatment, treatment type, and comorbid disease) were retrieved from medical records. To avoid the risk of COVID-19 transmission, necessary measures were taken by data collectors.

Data Management and Analysis

Data were coded and entered into Epi-data version 4.6 and then exported to SPSS version 23.0 for analysis. Data were cleaned and descriptive statistics like median, mean, frequencies, and proportions were computed for continuous as well as categorical variables accordingly and presented by using tables and texts. Model fitness was checked by the Hosmer–Lemeshow goodness of fit test. The p-value for the test was 0.830 which was greater than 0.05 indicating that the model fitted the data. The presence or absence of multi-collinearity was checked using the Variance Inflation Factor (VIF) and all its values were less than 10, which was interpreted as multi-collinearity was not problematic. Binary logistic regression analysis was computed to examine the association between the dependent and independent variables. Bivariable logistic regression analysis was performed to select candidate variables for multivariable logistic regression analysis and variables with p-values of less than 0.25 were entered into the multivariable logistic regression analysis model.[62] After running multiple logistic regression analysis with the backward LR method, those with $p < 0.05$ were considered statistically significant.

Result

Socio-Demographic Characteristics

Out of 423 samples, data were collected from a total of 410 randomly selected patients with a response rate of 97%. Of the total respondents, nearly two-thirds (62.7%) were female. The mean age of the participants was 44.2 (range: 20–77) years. Slightly more than two-fifths (44.4%) of the participants were between the ages of 35 and 50. In terms of residency, slightly more than half of the participants (52.7%) were from rural areas. According to the unadjusted analysis, the prevalence of poor sleep was higher for participants aged 30–35 years, married, housewives, and who had poor social support (Table 1).

Table 1 Socio-Demographic Characteristics of Study Participants Attending Oncology Units in Amhara Region Hospitals, 2021 (n = 410)

Variables		Total n (%)	Sleep Quality		X^2 value	P value
			Poor n (%)	Good n (%)		
Sex	Male	153 (37.3)	97 (33.1)	56 (47.9)	7.79	**0.005**
	Female	257 (62.7)	196 (66.9)	61 (52.1)		
Age (year)	20–34	113 (27.6)	64 (21.8)	49 (41.9)	29.21	**<0.001**
	35–50	182 (44.4)	127 (43.3)	55 (47.0)		
	50–64	76 (18.5)	67 (22.9)	9 (7.7)		
	≥65	39 (9.5)	35 (11.9)	4 (3.4)		
Residence	Rural	216 (52.7)	162 (55.3)	54 (46.2)	2.80	0.094
	Urban	194 (47.3)	131 (44.7)	63 (53.8)		
Marital status	Married	275 (67)	200 (68.3)	75 (64.1)	19.82	**<0.001**
	Single	49 (12.0)	23 (7.8)	26 (22.2)		
	Divorced	48 (11.7)	37 (12.6)	11 (9.4)		
	Widowed/widower	38 (9.3)	33 (11.3)	5 (4.3)		
Occupation	Unemployed	30 (7.3)	23 (7.8)	7 (6.0)	13.86	**0.017**
	Student	19 (4.6)	7 (2.4)	12 (10.3)		
	Employed	55 (13.4)	37 (12.6)	18 (15.4)		
	Farmer	101 (24.6)	74 (25.3)	27 (23.1)		
	Merchant	81 (19.8)	57 (19.5)	24 (20.5)		
	Housewife	124 (30.2)	95 (32.4)	29 (24.8)		
Religion	Orthodox Christian	328 (80.0)	239 (81.6)	89 (76.1)	1.97	0.373
	Muslim	70 (17.1)	47 (16.0)	23 (19.7)		
	Protestant	12 (2.9)	7 (2.4)	5 (4.3)		

(*Continued*)

Table 1 (Continued).

Variables		Total n (%)	Sleep Quality		X^2 value	P value
			Poor n (%)	Good n (%)		
Educational status	Uneducated	210 (51.2)	156 (53.2)	54 (46.2)	2.94	0.400
	Completed elementary school	97 (23.7)	70 (23.9)	27 (23.1)		
	Completed high school	62 (15.1)	40 (13.7)	22 (18.8)		
	Higher education and above	41 (10.0)	27 (9.2)	14 (12.0)		
Social support (OSSS)	Poor	216 (52.7)	183 (62.5)	33 (28.2)	40.26	**<0.001**
	Moderate	160 (39.0)	93 (31.7)	67 (57.3)		
	Strong	34 (8.3)	17 (5.8)	17 (14.5)		

Abbreviation: OSSS, Oslo Social Support Scale.

Behavioral Characteristics

Of 410 study participants, more than half (55.1%) drink coffee daily. Only 12% of the participants were current users of alcohol, whereas slightly more than half (51.5%) were former drinkers. Only a few of them (3.4%) and (2.4%) were current khat chewers and current cigarette smokers, respectively. The majority (49.8%) of the poor sleepers were daily coffee drinkers, followed by occasional (24.9) and never (25.3) coffee drinkers (Table 2).

Clinical Characteristics

Cancers of the gastrointestinal tract (32.0%), breast cancer (24.9%), and gynecological cancers (15.4%) were the most common malignancies in this study. Slightly more than half (52.7%) of participants were treated with chemotherapy alone, while 35.4% were treated with a combination of surgery and chemotherapy. Around two-fifths of patients (41%) were diagnosed with early-stage cancer (stage I and II), whereas the remaining three-fifths (59%) were diagnosed with advanced cancer (stage III and IV). In terms of psychological problems, 33.9% and 33.2% of participants, respectively, experienced anxiety and depression symptoms. In this study, those who underwent chemotherapy had more sleeping difficulty than those who received surgery and chemotherapy (60.1% vs 28.3%, p-value <0.001). Likewise, cancer patients who had anxiety symptoms experienced more sleep difficulty than their counterparts (Table 3).

Table 2 Behavioral Characteristics of Study Participants Attending Oncology Units in Amhara Region Hospitals, 2021 (n = 410)

Variables		Total n (%)	Sleep Quality		X^2 value	P value
			Poor n (%)	Good n (%)		
Coffee drinking	Never	91 (22.2	73 (24.9)	18 (15.4)	11.64	**0.003**
	Daily	226 (55.1)	146 (49.8)	80 (68.4)		
	Occasionally	93 (22.7)	74 (25.3)	19 (16.2)		
Alcohol drinking	Never drinker	150 (36.6)	106 (36.2)	44 (37.6)	4.16	0.125
	Former drinker	211 (51.5)	146 (49.8)	65 (55.6)		
	Current drinker	49 (12.0)	41 (14.0)	8 (6.8)		
Khat chewing	Never chewer	361 (88.0)	256 (87.4)	105 (89.7)	1.66	0.437
	Former chewer	35 (8.5)	28 (9.6)	7 (6.0)		
	Current chewer	14 (3.4)	9 (3.1)	5 (4.3)		
Cigarette smoking	Never smoker	389 (94.9)	282 (96.2)	107 (91.5)	4.01	0.135
	Former smoker	11 (2.7)	6 (2.0)	5 (4.3)		
	Current smoker	10 (2.4)	5 (1.7)	5 (4.3)		

Table 3 Clinical Characteristics of Study Participants Attending Oncology Units in Amhara Region Hospitals, 2021 (n = 410)

Variables		Total n (%)	Sleep Quality		X^2 value	P value
			Poor n (%)	Good n (%)		
Type of cancer	Breast cancer	102 (24.9)	71 (24.2)	31 (26.5)	3.68	0.596
	Cancer of GIT	131 (32.0)	90 (30.7)	41 (35)		
	Gynecological cancer	63 (15.4)	49 (16.7)	14 (12.0)		
	Lymphomas	24 (5.9)	17 (5.8)	7 (6.0)		
	Ca of skin, bone, and soft tissues	46 (11.2)	31 (10.6)	15 (12.8)		
	Others[a]	44 (10.7)	35 (11.9)	9 (7.7)		
Treatment type	Chemotherapy	216 (52.7)	176 (60.1)	40 (34.2)	25.12	**<0.001**
	Surgery + Chemotherapy	145 (35.4)	83 (28.3)	62 (53.0)		
	Others[b]	49 (12.0)	34 (11.6)	15 (12.8)		
Distant metastasis	No	292 (71.2)	183 (62.5)	109 (93.2)	38.46	**<0.001**
	Yes	118 (28.8)	110 (37.5)	8 (6.8)		
Stage of cancer	Early stage	168 (41)	107 (36.5)	61 (52.1)	8.43	**0.004**
	Advanced	242 (59)	186 (63.5)	56 (47.9)		
Comorbid disease	Absent	362 (88.3)	253 (86.3)	109 (93.2	3.756	0.053
	Present	48 (11.7)	40 (13.7)	8 (6.8)		
Anxiety (HADS)	No	271 (66.1)	159 (54.3)	112 (95.7)	64.14	**<0.001**
	Yes	139 (33.9)	134 (45.7)	5 (4.3)		
Depression (HADS)	No	274 (66.8)	164 (56.0)	110 (94.0)	54.59	**<0.001**
	Yes	136 (33.2)	129 (44.0)	7 (6.0)		
BMI	Underweight	122 (29.8)	87 (29.7)	35 (29.9)	0.573	0.751
	Normal weight	261 (63.7)	185 (63.1)	76 (65.0)		
	Overweight	27 (6.6)	21 (7.2)	6 (5.1)		
Performance status (ECOG)	Good	260 (63.4)	158 (53.9)	102 (87.2)	39.85	**<0.001**
	Poor	150 (36.6)	135 (46.1)	15 (12.8)		
Time since diagnosis	≤ 6 month	271 (66.1)	179 (61.1)	92 (78.6)	11.48	**0.001**
	> 6 month	139 (33.9)	114 (38.9)	25 (21.4)		
The duration of time between diagnosis and treatment (days)	≤ 28 days	260 (63.4)	178 (60.8)	82 (70.1)	3.14	0.076
	> 28 days	150 (36.6)	115 (39.2)	35 (29.9)		

Notes: [a]Others include (lung cancer, bladder cancer, prostatic cancer, sinonasal cancer, hepatocellular cancer, pharyngeal cancer, testicular cancer, nasopharyngeal cancer, thyroid cancer, laryngeal cancer, pancreatic cancer, and cancer of unknown). [b]Others include (surgery + hormonal therapy, surgery + chemotherapy+ hormonal therapy, chemotherapy + radiotherapy, chemotherapy+ hormonal therapy).

Abbreviations: HADS, Hospital Anxiety and Depression Scale; BMI, body mass index; ECOG, Eastern Cooperative Oncology Group; GIT, gastrointestinal tract.

Symptom Severity of Study Participants

Almost one-third of study participants (32.4%) experienced moderate-to-severe pain based on the MD Anderson Symptom Inventory core symptom severity scale. On the other hand, one-third of participants (33.4%) reported moderate-to-severe lack of appetite, whereas one-fifth (20.2%) of them reported moderate-to-severe numbness (Table 4).

Sleep Quality

In this study, the majority (71.5%) (95% CI: 66.8, 75.8) of study participants had poor sleep quality and the remaining 28.5% (95% CI: 24.2, 33.2) had good sleep quality.

The median PSQI global score was 7 with an IQR of 5–10. The median sleep efficiency score was 75% with a minimum of 13% and a maximum of 95%. The minimum actual sleep duration time was 2 hours and the maximum was 12 hours (Table 5).

Table 4 Descriptive Statistics of Symptom Severity Points Among Patients with Cancer Attending Oncology Units in Amhara Region Hospitals, 2021 (n = 410)

MDASI Core Symptoms	Median	IQR (Q1-Q3)	% of No Symptom	% of Mild Symptom	% of Moderate to Severe Symptom
Pain	3	1–5	24.1	43.4	32.4
Fatigue	3	0–5	30.7	37.3	32.0
Nausea	1	0–5	46.1	22.9	31.0
Psychological distress	2	0–5	44.9	23.4	31.7
Shortness of breath	0	0–5	57.6	12.2	30.2
Difficulty of remembering	0	0–4	67.8	10.7	21.5
Lack of appetite	3	0–5	36.6	30.0	33.4
Drowsiness	0	0–3	57.3	23.7	19.0
Dry mouth	0	0–4	54.6	21.0	24.4
Feeling sad	1	0–5	47.8	20.0	32.2
Vomiting	0	0–5	57.8	14.6	27.6
Numbness	0	0–3	63.4	16.3	20.2

Abbreviations: IQR, interquartile range; MDASI, MD Anderson Symptom Inventory Q1, quartile 1; Q3, quartile 3.

Table 5 Descriptive Statistics of Component and Global Sleep Quality Index Score Among Patients with Cancer Attending Oncology Units in Amhara Region Hospitals, 2021 (n = 410)

Components of Sleep Quality	Median	IQR (Q1-Q3)	Minimum	Maximum
Subjective sleep quality	1	1–2	0	3
Sleep latency score	2	1–3	0	6
Sleep duration (hour)	8	6–8	2	12
Habitual sleep efficiency (%)	75.0	63.6–87.5	13.3	94.7
Sleep disturbance score	4	1–10	0	21
Medication use	0	0–0	0	3
Daytime dysfunction score	2	0–3	0	6
Global PSQI score	7	5–10	0	19

Abbreviations: IQR, interquartile range; Q1, quartile 1; Q3, quartile 3.

Factors Associated with Sleep Quality

In bi-variable logistic regression analysis, thirty independent variables (age, sex, marital status, residence, occupation, coffee drinking, smoking status, alcohol use, time since diagnosis, cancer type, stage of cancer, treatment type, comorbid disease, presence of metastasis, performance status, pain, fatigue, anxiety, depression, numbness, dyspnea, nausea, vomiting, psychological distress, drowsiness, anorexia, sadness, problem in remembering, dry mouth, and social support) were found to have P-value <0.25 (Table 6 and Supplementary Table 1). Subsequently, these variables were entered into the multivariable analysis.

In multivariable analysis, age, depressive symptoms, presence of distant metastasis, and severity of pain showed statistically significant association with poor sleep quality among cancer patients. Accordingly, when the age of a patient increases by one year, the odds of having poor sleep quality increase by a factor of 1.037 [AOR = 1.037, 95% CI: (1.012–

Table 6 Factors Associated with Poor Sleep Quality of Study Participants at Oncology Units in Amhara Region Hospitals, 2021

Characteristics	Crude Odds Ratio (95% C.I)	Adjusted Odds Ratio (95% C.I)
Depressive symptom		
Yes	12.36 (5.57, 27.46)	2.86 (1.13, 7.23)*
No (reference)	–	–
Distant metastasis		
Yes	8.19 (3.85, 17.44)	3.76 (1.59, 8.91)**
No (reference)	–	–
Age	1.06 (1.04, 1.08)	1.04 (1.01, 1.06)**
Severity of pain	1.78 (1.56, 2.04)	1.33 (1.11, 1.60)**
Psychological distress	1.77 (1.53, 2.05)	1.20 (0.98, 1.47)***
Lack of appetite	1.66 (1.47, 1.88)	1.17 (0.98, 1.39)***

Notes: Age, severity of pain, psychological distress, and lack of appetite were entered as continuous variables. *Indicates variables significant at a p-value less than 0.05. **Indicates variables significant at a p-value less than 0.01. ***Indicates variables significant at a p-value less than 0.1. NB: Since the step-wise backward LR method was used in the multiple logistic regression, only variables displayed at the final step were reported here.

1.062)]. The odds of having poor sleep quality were 2.9 times among patients who had depressive symptoms as compared to those patients who do not have depressive symptoms [AOR = 2.862, 95% CI: (1.133, 7.228)]. Regarding distant metastasis, the odds of having poor sleep quality among patients who had distant metastasis cancer were 3.8 times compared with those who do not have distant metastasis [AOR = 3.758, 95% CI: (1.585, 8.909)]. On the other hand, when the severity of pain increased by one point on a 0–10 scale, the odds of having poor sleep quality increased by a factor of 1.331 [AOR = 1.331, 95% CI: (1.106, 1.601)].

Discussion

This study aimed to assess the prevalence and associated factors of sleep quality among patients with cancer at oncology units in Amhara region hospitals by using a cross-sectional study. Based on this objective, the prevalence of poor sleep quality in this study was 71.5% (95% CI: 66.8, 75.8). This finding was consistent with previous studies conducted in Taiwan (72%) and Morocco (71.8%).[16,19] On the other hand, it was lower than a multicenter study conducted in five countries in Europe (78%).[8] This discrepancy could be explained by the difference in study populations. In the current study, patients with all stages of cancer were included, whereas, in the European study, patients with advanced cancer were included. Since pieces of evidence showed that patients with advanced cancer had a higher risk of poor sleep quality than those with localized disease, including those with all stages of cancer in the current study may lower the prevalence of poor sleep quality compared to the European study.[30]

In contrast, the prevalence of poor sleep quality in the current study was higher than the study done in Italy (58.8%), and Denmark (57.9%).[13,18] This inconsistency might be due to differences in characteristics of study participants in terms of the inclusion and exclusion criteria they used. In the present study, patients with all grades of ECOG performance status ranging from 0 to 4 were included but in the Italian study, only patients with performance status grades less than two were included. This performance status difference between the Italian and current study participants makes the prevalence of poor sleep quality high in the present study because pieces of evidence indicated that patients with higher scores of ECOG performance status are more likely to become poor sleepers.[14,35] In Denmark, patients who had distant metastasis cancer were excluded from the study, which lowers the prevalence of poor sleep quality in that study. Similarly, the prevalence of poor sleep quality in the current study was also higher than the studies conducted in India (57.6%), Turkey (40.4%), Iran (51.4%), and America (64%).[11,14,17,20] This discrepancy might be due to the variation in the country's level of healthcare provision. In low-income countries including Ethiopia, the access to quality cancer treatment and palliative care is often poor which may affect patients' sleep quality negatively.[24,63] This implies that

strengthening the healthcare system in general and expanding quality oncology services, in particular, may reduce the prevalence of poor sleep quality.

In the present study, the odds of having poor sleep quality were increased when the age of the patient increases. Even though contradicting results are available from studies conducted in Morocco and the Netherlands,[19,26] the current study result was in line with the studies conducted in Denmark and Iran where older age is associated with poor sleep quality in patients with cancer.[18,25] The possible justification for this association might be due to the reduction of melatonin levels during aging. The possible mechanism for age-related melatonin changes is age-related degenerative alterations of the suprachiasmatic nucleus in the hypothalamus, which regulates the melatonin levels. Consequently, when melatonin levels become low there may be impairment of homeostatic sleep regulation and circadian rhythm, which ultimately results in poor sleep quality.[64] Since age is a non-modifiable risk factor, the finding of this study points out the requirement of higher emphasis for elderly cancer patients.

On the other hand, the odds of poor sleep quality in the current study were higher among patients who had depressive symptoms than those who do not have it. This finding was in line with the studies conducted in Turkey and Brazil.[15,65] The reason for this association might be because depressed individuals have a disruption in both homeostatic and circadian drives to sleep which might be related to deficiencies in key neurotransmitters, such as serotonin (5-HT), noradrenaline, or acetylcholine.[66] This disruption finally leads to a symptom of daytime sleepiness, which consequently decreases the number of hours slept per night and had frequent waking up in the night. On the other hand, sleep problems have also a significant role in the development of depression. This suggests the presence of a bidirectional association between sleep problems and depression.[66,67] This implies that targeted management of one may improve the other. Therefore, treating depression might improve sleep quality, and addressing sleep problems may relieve psychological morbidity.

As revealed by the result of this study, the odds of having poor sleep quality were significantly higher among patients who had distant metastasis cancer than those with no distant metastasis. This might be justified by the fact that patients with metastatic cancer have a high symptom burden due to multi-organ involvement of the disease. As a result, patients may expose to maladaptive behaviors like spending prolonged time in bed at day time, napping, and reduced daily activity. All these practices lead to dysregulation of sleep-wake cycles and make it difficult for individuals to fall and stay asleep during regular sleep hours at night.[30] It is also true that those with distant metastases are also more likely to receive more intensive treatment (eg, additional rounds of radiation), which might also cause sleep disturbances.[33]

Increased pain intensity as measured with a 0 to 10 numeric pain scale was also significantly associated with poor sleep in the current study. This finding was supported by studies conducted in America, Iran, and different European countries.[8,17,68] Pain is a common symptom in patients with cancer that negatively affects falling and staying asleep. The possible mechanism might be due to the neurotransmitter dopamine dysregulation in the brain. When there are alterations or disturbances in the signaling of dopamine induced by pain, it could lead to prolonged periods of sleep loss and greater disruption of sleep continuity. However, the presence of poor sleep quality has also the potential to increase pain and its sensitivity. This states the reciprocal association between them which creates a self-perpetuating cycle of sleep disruption and pain intensification.[69] This indicates the complexity of the problem and the need for more effective symptom management for patients with cancer.

Although not seen in our study, anxiety has a clinical and statistical relationship with sleep quality.[30] Anxiety causes mental hyperarousal, which can keep the patient from falling asleep. It also prevents someone from staying asleep long enough to feel fully rested.[70] Besides, anxiety disturbs sleep by causing vivid dreams via influencing rapid eye movement (REM) sleep.[71]

Cancer treatment type has also a significant relationship with poor sleep quality. Chemotherapy and radiotherapy have been linked to significantly lower sleep quality because they increase the production of pro-inflammatory cytokines, which act on the central nervous system, altering rest-activity cycles and influencing sleep negatively.[17,32,33] Although this clinical importance is known, our research found no statistically significant relationship between them. Furthermore, as shown in the previous literature, cancer and cancer treatment symptoms like fatigue, dyspnea, numbness, drowsiness, nausea, and vomiting significantly affect sleep quality.[17,68,72,73] However, these variables had no statistically significant relationship with sleep quality in our study. These could be due to differences in sample characteristics between studies,

such as different types of cancer and different cancer treatment regimens, which strengthen the link between sleep disturbance and other variables. This suggests that more research may be required to reconcile these inconsistencies.

Limitation of the Study

There are some limitations to this research. A temporal relationship between the outcome variable and independent variables could not be established because of the cross-sectional nature of the study design. Another limitation is that the self-reported questionnaire measures of sleep quality are prone to recall bias, which may misestimate the prevalence. Aside from the aforementioned limitations, using the step-wise backward LR method of analysis may be regarded as a limitation because it needs model selection by parameter inference, which can lead to parameter biases, over-fitting, and incorrect significance tests.

Conclusion and Recommendation

The present study found a high prevalence of poor sleep quality. Advanced age, presence of depressive symptoms, presence of distant metastasis, and increased severity of pain were factors that significantly affect sleep quality in cancer patients.

Health professionals shall integrate the assessment of sleep problems into routine care and provide appropriate management through a multi-disciplinary approach for patients with cancer. Furthermore, they need to provide special consideration to those whose age is advanced, have metastatic cancer, and experiencing severe pain. During treatment trajectory, cancer patients must be carefully screened for depression and given appropriate medication. Policymakers and program planners should think about developing a practical method for screening and managing sleep quality problems in cancer patients and integrating it into the current cancer treatment and palliative care program. Additionally, they need to consider expanding quality oncology service centers with the appropriate resources. Future researchers also consider conducting a study at the country level since our study is not generalizable to a country as a whole.

Abbreviations

ECOG, Eastern Cooperative Oncology Group; PSQI, Pittsburgh Sleep Quality Index.

Ethics Approval and Consent to Participate

The research was conducted in accordance with the Declaration of Helsinki. Ethical clearance was obtained from the University of Gondar College of Medicine and Health Sciences School of Nursing Ethical Committee (Ref No. S/N/164/7/2013). A formal letter was written to all three hospitals, and written informed consent was obtained from each participant. Confidentiality was maintained by omitting the participant's name and personal identification, and the collected information was not revealed to anyone except the principal investigators and kept locked with a key. Privacy was maintained by arranging a quiet place during the interview.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; have drafted or written, or substantially revised or critically reviewed the article; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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