

# Sleep Deprivation among Health-Care Workers: A Cross-sectional Study at the University of Gondar Comprehensive Specialized Hospital

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## Research Article

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# Abstract

**Background:** Sleep disturbance is a common problem among health care workers and it has been associated with poor clinical services including medical errors.

**Objective:** This study aimed to determine the prevalence of sleep deprivation and identify factors impacting among health care workers at the University of Gondar Comprehensive Specialized Hospital, Gondar, Ethiopia.

**Methods:** Health care workers were approached to subjectively assessed their sleep quality. Study participants completed the Pittsburgh Sleep Quality Index (PSQI), and they reported demographic, working departments, and behavioral information. Poor sleep quality was defined as a PSQI score >5. Multiple binary logistic regression was used to estimate the strength of the association between risk factors and sleep deprivations. P value  $\leq 0.05$  was used to declare statistically significant.

**Results:** A total of 418 surveys were completed. The mean age of the study participants was 30.7 years (SD  $\pm$  6.3). The overall prevalence of poor sleepers was 58.9% [95% CI (54.2, 63.6%)]. Being female [AOR=1.9, 95%CI (1.2, 2.9)], working in night shifts [AOR=5.7, 95%CI (2.3, 14.3), physically inactive [AOR=2.08(1.2-3.6)], chewing khat [AOR = 3.1, 95% CI (1.2, 7.6)], and the presence of depressive symptoms [AOR = 2.6, 95% CI (1.3, 6.8)] were significantly associated with sleep deprivation.

**Conclusion:** Based on the PSQI scoring, the prevalence of sleep deprivation among health care workers was high. Night shiftwork schedule, lack of regular physical activity, chewing khat, and the presence of depressive symptoms were associated with sleep deprivation. This research suggests sleep interventions for health care workers.

## Introduction

Sleep is fundamental to overall health, and quality sleep is best described as a good feeling of sleep experience upon awakening(1). According to the American Academy of Sleep Medicine, an adult person should sleep about 7 or more hours per day(2). Poor sleep quality can lead to physical and mental abnormalities, which increases the incidence of chronic medical conditions, poor productivity at work, and increased workplace injuries and harm(3-6).

Worldwide, the prevalence of sleep problems in the general population ranges from 1.6% to 56.0%(7–9). The overall magnitude of poor sleep quality in the general population in Ethiopia has been estimated to be 53 % (15).

Sleep deprivation is also common among health care workers and significantly affects their quality of life, productivity, and clinical service(10). The prevalence of poor sleep quality among healthcare workers is 56.3% in Turkey (11), 86.8% in Malaysia (12), 42.3% in Saudi Arabia (13), 85.9% in Riyadh (10), and 54.2% in Nigeria(14).

Sleep quality can be affected by different factors. Several lines of evidence outlined that female sex (16,17), aging (16,18), night shift work (14,20–22), coffee consumption (11), khat chewing (23,24), alcohol consumption (18), depression (25), poor physical activity (26–28), and self-rated health (29) were factors associated with perceived poor sleep quality.

Taking the nature of the profession and the working areas into consideration, we assumed that health care workers at hospitals are prone to sleep problems. However, hospital-based studies showing the magnitude of sleep deprivation among health care workers in Ethiopia are limited. The purpose of this study, therefore, was to determine the degree of sleep deprivation among health care workers at the University of Gondar Comprehensive Specialized Hospital (UoGCSH).

## **Methods And Materials**

### **Study Design**

A hospital based cross-sectional study was conducted at UoGCSH, Gondar, northwest Ethiopia, from February 1 to June 20, 2020. University of Gondar Comprehensive Specialized Hospital is the largest teaching hospital in Amhara National Regional State, providing tertiary level care for more than five million people annually.

### **Study Participants**

During the study period, there were a total of 938 full-time healthcare workers in different disciplines. In our study, we surveyed sleep quality among nurses, doctors, pharmacists, laboratory technologists, midwives, and others (anesthetists, psychiatric nurses, and physiotherapists) who were active in their duties. Qualifying participants for our study were at least 18 years of age and served for at least six months at this hospital.

### **Sample Size**

The sample size was determined using a single population proportion formula by assuming the prevalence of poor sleep quality ( $p=50\%$ ) as there was no previous similar study done in Ethiopia, with 95% confidence interval, and 5% margin of error. After adding a non-response rate of 5%, the final sample size calculated was 423. We used a simple random sampling technique to select the study participants.

### **Data collection methods**

A self-administered questionnaire adapted by the authors from different literatures was used to collect the demographic, life style, health status and work-related information. Participants were said to be current substance users when they used cigarettes, khat, alcohol, or coffee at least once in the past

month prior to the survey (34–36). Physical activity level was determined by the habit of regular exercise. Shiftwork was defined as more than one night shift per week during the last month.

The study participants perceived sleep quality was assessed using Pittsburgh Sleep Quality Index (PSQI) tool. The PSQI is a validated questionnaire that measures sleep quality over 1 month(31). The instrument contains seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each domain is rated on a 4-point scale (0–3), which generates a total score ranging between 0 and 21. A global score of greater than 5 indicates a “poor” sleep quality(poor sleepers) and a score of less than or equal to 5 is good sleep quality(good sleepers)(32).

The presence of depressive symptoms was measured by the Beck’s Depression Inventory version II (BDI-II). Study participants with BDI-II scores of between 0 and 13 would be considered normal. Participants with BDI-II scores between 14 and 19, 20 and 28, and between 29 and 63 would be considered to have mild, moderate, and severe depression, respectively (33).

Ethical clearance was obtained from the ethical review committee of the School of Medicine, University of Gondar. A permission letter was obtained from the University of Gondar Comprehensive Specialized Hospital and written informed consent was obtained from each study participant, whose information was kept confidential.

## **Statistical Analysis**

Descriptive statistics were used to quantify the participants’ demographics, behavioral, work related information. The primary outcome was poor sleep quality as measured by the PSQI score. Multivariable logistic regression was used to test for independent associations between the primary outcome and factors affecting it. Variables with a p-value of  $\leq 0.05$  were considered statistically significant. The data was entered into Epi-data version 3.02 and then exported to SPSS version 25 for analysis. Both the crude odds ratio (COR) and the adjusted odds ratio (AOR) with a 95% confidence interval (CI) were computed.

## **Results**

### **Sociodemographic characteristics**

A total of 418 health care workers participated in this study, giving a response rate of 98.8%. The mean age of the participants was 30.7 years, with a standard deviation (SD) of  $\pm 6.3$  years. Two hundred thirteen (51%) of them were females, and one-third (33.3%) of the participants were married. More than half the study participants were nurses (226, 54.1%), followed by midwives (60, 14.4%)(Table 1).

Table 1  
Sociodemographic characteristics of HCPs working at UoGCSH, Gondar, northwest Ethiopia, 2020 (n = 418).

Variables	Category	Frequency	Percentage
Age (in years)	20–30	265	63.4%
	31–40	119	28.5%
	41–50	26	6.2%
	> 50	8	1.9%
Sex	Male	205	49%
	Female	213	51%
Marital status	Single	261	62.4%
	Married	139	33.3%
	Divorced	18	4.3%
Family size	1	277	66.3%
	3	101	24.2%
	≥ 4	40	9.6%
Profession	Nurses	226	54.0%
	Medical doctor	27	6.5%
	Pharmacist	35	8.4%
	Laboratory technologist	46	11.0%
	Midwifery	64	15.3%
	Others*	20	4.8%
*Anesthetists, psychiatric nurses and physiotherapist			

Table 2 shows the health status and work-related characteristics of the study participants. Three hundred eighty-five (92.1%) participants were working the night shift. Four hundred six (97.8%) of them were working less than 56 hours per week. Regarding substance use, 45 (10.8%), 260 (62.2%), and 35 (8.4%) participants were current khat chewers, alcohol drinkers, and cigarette smokers, respectively. Thirty-five (8.4%) of the partakers had a history of chronic illness (Table 2).

Table 2  
Health and work-related characteristics of health care workers at  
UoGCSH, in Gondar, northwest Ethiopia, 2020 (n = 418).

<b>Variables Categories</b>		<b>Frequency</b>	<b>Percentage</b>
Shift working	Yes	385	92.1%
	No	33	7.9%
Work experience(years)	1–9	310	74.2%
	10–19	81	19.4%
	20–29	22	5.3%
	≥ 30	5	1.2%
Working hours per week	≤ 56	409	97.8%
	> 56	9	2.2%
Current khat chewing	Yes	45	10.8%
	No	375	89.2%
Current alcohol drinking	Yes	260	62.2%
	No	158	37.8%
Current cigarette smoking	No	383	91.6%
	Yes	35	8.4%
Drinking coffee	Yes	306	73.2%
	No	112	26.8%
History of chronic illness	Yes	35	8.4%
	No	383	91.6%
Regular exercise	Yes	76	18.2%
	No	342	81.8%
Self-rated health	Excellent	119	28.5%
	Very good	152	36.4%
	Good	120	28.7%
	Fair	27	6.5%

Variables Categories		Frequency	Percentage
Depression status	Normal	323	77.3%
	Mild	47	11.2%
	Moderate	27	6.5%
	Sever	21	5%

## Prevalence of sleep deprivation

The overall prevalence of poor sleepers (PSQI > 5) in this study was 58.9% [95% CI (54.2, 63.6%)]. The average night sleep duration and sleep latency of the study participants were 6.5 hours (SD ± 1.27) and 18.6 minutes (SD ± 16.6), respectively. Three hundred and five (73%) of the participants had less than 7 hours of sleep per day (Table 3).

Table 3  
Sleep quality and its component scores among health care professionals working at  
UoGCSH, Gondar, Northwest Ethiopia, 2020(n = 418).

Variables Category		Frequency	Percentage
Subjective sleep quality (score)	Very good (0)	158	37.8%
	Fairly good (1)	129	30.9%
	Fairly bad (2)	61	14.6%
	Very bad (3)	70	16.7%
Sleep latency(score)	Never (0)	95	22.7%
	< 1 time per week (1)	234	56%
	1–2 times a week (2)	74	17.7%
	≥ 3 times a week (3)	15	3.6%
Sleep duration	> 7 hours	113	27%
	6–7 hours	206	49.3%
	5–6 hours	71	17%
	< 5 hours	28	6.7%
Sleep efficacy	> 85%	209	50%
	75–84%	127	30.4%
	65–74%	49	11.7%
	< 65%	33	7.9%
Sleep disturbance(score)	Never (0)	6	1.4%
	< 1 time a week (1)	290	69.4%
	1–2 times a week (2)	118	28.2%
	≥ 3 times a week (3)	4	1%
Use of sleep medication (score)	Never (0)	345	82.5%
	< 1 time a week (1)	48	11.5%
	1–2 times a week (2)	10	2.4%
	≥ 3 times a week (3)	15	3.6%

Variables Category		Frequency	Percentage
Day time dysfunction (score)	Never (0)	121	28.9%
	< 1 time a week (1)	185	44.3%
	1–2 times a week (2)	95	22.7%
	≥ 3 times a week (3)	17	4.1%

## Factors associated with sleep deprivation healthcare workers

In the bivariable logistic regression analysis, variables with a p value < 0.25 were included in the multivariable logistic regression model. Accordingly, being female, night shift work, chewing khat, having depressive symptoms, and lack of regular exercise were significantly associated with poor sleep quality ( $p \leq 0.05$ ). In this study, females were 1.9 times [AOR = 1.9, 95%CI: 1.2, 2.9] more likely to experience sleep disturbances compared to male counterparts. The odds of poor sleep quality was 5.7 times [AOR = 5.7, 95%CI: 2.3, 14.3] higher among night shift workers compared to non-shift workers. Current khat chewers were 3.1 times [AOR = 3.1, 95% CI: 1.2, 7.6] more likely to experience poor sleep quality than those who don't chew khat. Participants with moderate to severe depression were 2.6 times [AOR = 2.6, 95% CI: 1.3, 6.8] more likely to incur poor sleep quality than those with no depression (Table 4).

Table 4

Bivariable and Multivariable logistic regression analysis of factors associated with poor sleep quality among HCPs working at UoGCSH, Gondar, Northwest Ethiopia, 2020(N = 418)

Variables	Categories	Poor sleep quality (PSQI > 5)		OR (95% CI)	
		Yes	No	COR	AOR
Sex	Male	102(24.4%)	103(24.6%)	1.0	1.0
	Female	144(39.4%)	69(16.5%)	2.1(1.4–3.1)	1.9(1.2–2.9)*
Shift working	Yes	239(57.2%)	146(34.9%)	6.1(2.5–14.3)	5.7(2.3–14.3)*
	No	7(1.7%)	26(6.2%)	1.0	1.0
Current khat chewing	Yes	38(9.1%)	7(1.7%)	4.3(1.8–9.8)	3.1(1.2–7.6)*
	No	208(49.8%)	165(39.5%)	1.0	1.0
Drinking coffee	Yes	191(45.7%)	115(27.5%)	1.7(1.1–2.6)	1.2(0.7–2.04)
	No	55(13.2%)	57(13.6%)	1.0	1.0
Self-rated health	Excellent	60(14.4%)	59(14.1%)	1.0	1.0
	Very good	81(19.4%)	71(17%)	1.1(0.6–1.8)	0.9(0.5–1.7)
	Good	80(19.1%)	40(9.6%)	1.9(1.1–3.3)	1.3(0.7–2.4)
	Fair	25(6%)	2(0.5%)	1.2(0.7–2.2)	1.2(0.4–3.1)
Regular exercise	Yes	29(6.9%)	47(11.2%)	1.0	1.0
	No	217(51.9%)	125(29.9%)	2.8(1.6–4.6)	2.08(1.2–3.6)*
Depression	Normal	175(41.9%)	148(35.4%)	1.0	1.0
	Mild	35(8.4%)	12(2.9%)	2.4(1.23–4.92)	2.1(0.9–4.5)
	Moderate to severe	36(8.6%)	12(2.9%)	2.1(0.9–4.6)	2.6(1.3–6.8)*

\*= P ≤ 0.05, OR = odds ratio, COR = crude Odds Ratio, AOR = adjusted odds ratio

## Discussion

To the best of our knowledge, this is the first study to evaluate self-reported sleep disturbances among health care workers at UoGCSH using PSQI. Our study demonstrates that nearly 60% (58.9%) [95% CI (54.2, 63.6%)] of the surveyed health care workers reported some degree of sleep deprivation. This finding is comparable with the results of studies conducted in Turkey (55.3%) (11), Malaysia (57.8%) (12) and Nigeria (54.2%) (14). However, the prevalence of poor sleepers in our study is lower than studies done in Saudi Arabia (85.9%) (10), China (75%) (37), Malaysia (86.8%) (12), and Ethiopia (70.6%) (38). The possible reason for this variation could be the differences in the study population and the workload that can be responsible for the discrepancy in the prevalence of poor sleep quality among studies. Unlike our study, these studies only include nurses or medical doctors.

However, the current study is higher than the finding in Saudi Arabia (42.3%) (13) and another study done in Ethiopia (25.6%) (39). The reason for this difference could be because of variations in the instrument used and sample size differences. For instance, a previous study conducted in Ethiopia used the shift work sleep disorder questionnaire to determine sleep quality, whereas PSQI was used in this study.

One important finding from this study is that being female health care worker was associated with poor sleep quality. Similar findings were reported from studies done in Pakistan(17), Spain (16) and Saudi Arabia (40). This could be due to increased household and family responsibilities in females, which are typically associated with late-night sleeping and may have an impact on their sleep quality.

The current study revealed that shift workers have an increased likelihood of poor sleep quality than non-shift workers. This finding is in line with studies in China (21), Spain (20), and Ethiopia (38). People working the night shifts usually have an increased risk of sleep deprivations than those working without shifts. The plausible reason behind this could be because of the impact of the night shift on sleep architecture and disruption of circadian rhythm, as it is associated with unpredictable working conditions that restrict the opportunity for good sleep (14, 39).

As expected, khat chewers have demonstrated three times higher odds of poor sleep quality than non-chewers. This finding agrees with studies conducted in Yemen and Ethiopia (23, 24, 41). This could be due to khat's effect on sleep architecture. Because it includes cathinone, an active component with an amphetamine-like action, the first effect of Khat is to excite the brain (24, 42). However, despair, irritability, anorexia, and difficulty sleeping are common side effects of the transient euphoria. The stimulatory effect of khat is assumed to be due to cathinone-induced increases in dopamine concentration in the synaptic cleft, which activates post-synaptic neurons in a sustained way, causing sleep disturbances (18, 24, 43).

Our study also revealed that participants who did not engage in regular physical activity were more likely to be poor sleepers, which is consistent with the findings of research done in China (26). This is due to the fact that regular physical activity causes favorable changes in circadian rhythms and raises adenosine levels in the body, both of which help to regulate sleep (44). Regular physical activity is also said to promote the production and release of melatonin, which is known to improve the quality of sleep (45). In

support of these physiological correlations, the World Health Organization (46) and the American Sleep Disorder Association (47) recommend engaging in regular physical exercise to mitigate sleep problems.

Finally, there was a positive relationship between sleep quality and the presence of moderate-to-severe depressive symptoms. This finding is consistent with studies done in Turkey, Saudi Arabia, China and Ethiopia (25, 48–50). This link could be due to melatonin secretion being reduced and the circadian rhythm of melatonin being delayed in people who experience depressive symptoms (51, 52).

## **Limitations**

The present study has its own limitations. First, since the study is cross-sectional, it is difficult to show the cause-effect relationship between predictor variables and sleep deprivations. Second, because the tool is based on a subjective questionnaire, recall bias and subjective perception about sleep disturbances may not show the actual magnitude of the problem. Third, we didn't address the impact of sleep deprivation on clinical services (e.g. self-harm, patient harm). Therefore, future comprehensive research work is warranted to fill these limitations.

## **Conclusion**

The current study found that sleep deprivation was highly prevalent among healthcare workers and had significant associations with female workers, night shift work, khat chewing, lack of regular exercise, and depression. To reduce the overall impact of sleep deprivation, measures should be taken to improve the quality of sleep in this study population.

## **Declarations**

## **Ethics approval and consent to participate**

Ethical clearance was obtained from the ethical review committee of the School of Medicine, University of Gondar. A permission letter was obtained from the University of Gondar Comprehensive Specialized Hospital and written informed consent was obtained from each study participant, whose information was kept confidential.

## **Consent for publication**

Not applicable

## **Availability of data and materials**

The dataset is available from the corresponding author upon reasonable request

# Competing interests

The authors declare that they have no competing interests

# Funding

Not applicable

# Authors' contributions

W.T. conceived the study, coordinated the process of data collection, was involved in data cleaning and statistical analysis, and prepared the first draft of the manuscript. Y.Y., B.D., Y.A., and A.G. supervise the data collection process, and participated in statistical analysis and interpretation of the results, manuscript reviewing, and editing. All authors reviewed and approved the final manuscript.

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