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Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19 Pandemic in Ethiopia: an institution-based cross-sectional study

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Abstract

Objective: This study was conducted to assess the prevalence and risk factors of poor sleep quality among University of Gondar academic staff, Ethiopia.

Design: An institution-based cross-sectional study design was employed from March to April 2021. Self-reported poor sleep quality was measured using self-administered Pittsburgh Sleep Quality Index. The collected data were entered into EpiData version 4.6 and analyzed using STATA version 14 software. Binary logistic regressions were computed to determine the association between variables. The association was ascertained using an adjusted Odds ratio (AOR) with a 95% confidence interval (CI) at a p-value of < 0.05.

Setting: The study was conducted in the University of Gondar, Northwestern Ethiopia,

Participants: Six hundred and seven lecturers were participated in this study.

Outcome measures: The primary outcome is prevalence of poor sleep quality, which was measured using the Pittsburgh Sleep Quality Index.

Results: Overall response rate was 95.60% (N = 607). Age ranges from 21 to 70 with a mean of 32.39 (SD ±6.80) years. The magnitude of poor sleep quality during the last month was 60.30% (95% CI, 56.28%-64.21%). Working > 10 hours per day [AOR= 2.19, 95% CI (1.16, 4.27)], electronic device use before bedtime [AOR=1.53, 95% CI (1.04, 2.27)], high risk perception of COVID-19 infections [AOR =1.60, 95% CI (1.04, 2.46)], and perceived job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] were risk factors for poor sleep quality.

C**onclusion:** This study divulged that poor sleep quality was intrusive during the COVID-19 pandemic among university teaching staff in Ethiopia. Poor sleep quality was related to working hours per day, electronic device use, the risk of COVID-19 infections, and job stress. Therefore, we recommended that university administrators to develop, implement, and evaluate sleep health promotion programs in the workplace.

Keywords: Sleep quality, Poor sleep, Academic staff, Lecturers, COVID-19, Ethiopia.

Strengths and limitations of this study

- The study has focused on one of the most potential groups, i.e., Lecturers that had potential to affected by poor sleeping quality particularly during COVID-19.
- This study is the first in kind in exploring the magnitude and factors influencing poor sleep quality among academic staff in Ethiopia, which has the potential in rendering baseline information about the conditions and inspires other researchers to further replicate reliable results.
- As a limitation, the association between the poor sleep quality of sleep and influencing factors were based on the academician's subjective reports rather than objective measurements including actigraphy. Despite these limitations, we feel that the study provides a reasonably accurate assessment of sleep quality and associated risk factors among study participants. We recommend future studies to account for different sectors such as telecommunication, healthcare, transportation, etc. with interventional study design.

Background

Scholars described sleep quality (SQ) as "one's perception that they fall asleep easily, sleep for a sufficient amount of time so that they wake up feeling rested, and can get through their day without experiencing excessive daytime sleepiness," which could be measured both subjectively and objectively [1]. In contrast, poor SQ is marked by long sleep delays, low sleep efficiency, and sleep disorders [2]. Researchers regard SQ as a critical construct because of the high prevalence of poor SQ and the clear relevance of good SQ to optimal health and functioning [3]. Teaching has been identified as a profession associated with a high risk of poor sleep quality, particularly among elementary and secondary school teachers [4-6]; however, little research has been conducted to quantify the prevalence of poor sleep quality among university academic staff worldwide [7, 8].

Academic staffs are at a higher risk of poor sleep quality, burnout, depression, stress, and anxiety as a result of the current COVID-19 pandemic, which has serious consequences for occupational health both now and in the future [9]. Likewise, the World Health Organization (WHO) has classified poor sleep quality as a public health issue that exacerbates the risk of disease and death [10]. Recent research shows that during the pandemic, sleep quality was impaired and the prevalence of poor sleep increased in both the working and general population [11-13]. Furthermore, the global COVID-19 pandemic has compelled higher education institutions,

including Ethiopian universities, to shift from face-to-face to online instruction, which has an impact on sleep quality [14-16]. For example, during the COVID-19 pandemic, 44.2% of Brazilian university academic staff reported poor sleep quality [17]. Moreover, four out of ten people do not get enough sleep, and one in five sleep poorly most nights, making poor sleep the second most common health complaint after pain [18, 19]. So far, epidemiological data on the prevalence of poor sleep quality among university academic staff ranges from 38.9% [8] to 61.3% [7].

Sleep is a basic human requirement; it is necessary for effective daytime performance and is a predictor of physical and mental health, wellness, and overall quality of life [20, 21]. On the contrary, poor sleep has been linked to a variety of metabolic syndromes, poor glucose metabolism, and poor blood pressure control, all of which contribute to increased risks of cardiovascular disease, poor mental health, poor productivity, and poor quality of life [22-26]. Poor SQ also has significant economic consequences. In the USA, for example, the annual costs of poor sleep have been estimated to be as high as US$16 billion in healthcare costs and US$50 billion in lost productivity [27]. In Australia, the costs were estimated to be approximately US$1.8 billion for the health system and US$66.3 billion for financial loss and decreased well-being [21, 28, 29].

Though the cause of poor SQ is multifactorial; cognitive, behavioral, and physiological variables [30], sociodemographic (e.g. old age), low socioeconomic status, poor general health, psychological distress, workload, use of electronic devices, and poor lifestyle behaviors have all been identified as determinants of poor sleep quality [31-36].

Given the widespread and harmful consequences of poor SQ, it needs to be a top priority for public and occupational health. As previously stated, a thorough review of the literature revealed that even less is known about the prevalence and factors of poor sleep quality of academic staff and other university personnel in developing countries including Ethiopia [37]. The number of universities in Ethiopia is increasing, which is accompanied by an increase in academic staff. However, the lack of reliable and up-to-date data on mental health, especially on sleep quality, makes it difficult for officials to plan for prevention and control measures. Therefore, in the current study, we assessed the prevalence and associated factors of poor sleep quality among academic staff at the University of Gondar, Northwest Ethiopia.

Methods and materials

Study design and period

An institution-based cross-sectional study was employed from 17 March to 17 April in 2021.

Study setting and area

The study was conducted in the University of Gondar, which is found in the oldest and historical place of Gondar City, Northwestern Ethiopia, located 737 km from Addis Ababa, the capital of Ethiopia [38]. The establishment of the University dates back to 1954. The University has five campuses including the College of Medicine and Health Sciences and Comprehensive Specialized Referral Hospital (CMHS), Maraki, Atse Tewdros, Atse Fasil, and Teda [39]. During the study period, there were a total of 2,858 academic staff on all campuses.

Source and Study populations

All academic staff at the University of Gondar were the source population. Whereas, the randomly selected academic staff in each campus were the study population.

Inclusion and Exclusion Criteria

Academic staff who had at least one year of teaching experience and who were available during data collection time were included, while academic staff with critical illness, maternity leave, and sabbatical leave were excluded.

Sample size determination and sampling technique

The sample size was calculated by using single population proportion formula [40] by considering the following statistical assumptions:

Confidence level (Cl) of 95%

Proportion = 50% (no previous study in the study area)

Margin of error of 5%

Using the following single proportion formula:

$n = (Z\alpha/_2)^2 \frac{[p\ (1-p)]}{d^2}$ where:

n = initial sample size,

Z = 1.96, the corresponding Z-score for the 95% CI

P = Proportion = 50%

d = Margin of error = 5% = 0.05

$$n = (1.96)^2 \frac{[0.5\ (1-0.5)]}{0.05^2} = 384$$

By considering a 10% non-response rate, and a design effect of 1.5 as in the absence of previous literature taking a design effect of 1.5 to 2.0 is suggested [41], the final sample size was 635 participants. We employed a stratified sampling technique to select participants from the five campuses of the University of Gondar. The number of sample points was determined by a proportional allocation for each stratum. Hence, there are a total of 1027 academic staff in College of Medicine and Health Sciences (N1=1027), in Maraki campus a total of 630 academic staff (N2=630), in Tewdros campus a total of 509 academic staff (N3=509), in Fasil campus a total of 536 academic staff (N4=536), in Teda campus a total of 156 academic staff (N5=156). Consequently, the numbers of participants from each campus were 228, 140, 119, 113, and 35 from the College of Medicine and Health Sciences, Maraki, Fasil, Tewodros, and Teda campuses, respectively. Then, the required sample sizes were selected applying a simple random sampling technique and OpenEpi random program version 3 was used to randomize academic staff from each stratum.

Operational definitions

Poor sleep quality: this was measured using the Pittsburgh Sleep Quality Index (PSQI): if the summation score of the participant was >5 points out of 21 points, poor sleep quality was ascertained [42, 43].

Body mass index (BMI): weight in kilograms divided by the square of the height in meters (kg/m^2) categorized as underweight = BMI < 18, normal (health) = BMI 18.5– 24.9, overweight = BMI 25.0–29.9 =, and obese = BMI ≥ 30.0 [44].

Alcohol drinker: the consumption of any kind of alcohol at least two times per week [45].

Cigarette smoker: smoking at least one stick of cigarette per day [46].

Khat chewer: academician who had a history of chewing khat in the past one month [47].

Doing physical exercise: doing any kind of sports activity at least two times per week with a duration of at least 30 minutes [48].

Electronic device use: if the participant utilizes/ watches at least one of the following: television, computer, tablet, or mobile phone in bed before going to sleep [49].

Chronic illness: illnesses that can be managed, but cannot be cured and have a greater risk of developing a poor quality of sleep, such as asthma, diabetes mellitus, stroke, kidney stone, hypertension [50].

Risk perception of COVID-19 infection: which was assessed by three questions, with a response based on a 5-point Likert scale, with a higher total score indicating a high perceived risk of COVID-19 [51].

Job satisfaction: the sum of generic job satisfaction scale score of 32 or above [52].

Perceived job stress: a workplace stress scale score of 21 or above [53].

Data Collection Tools and Procedures

Data were collected through a validated self-administered standardized structured questionnaire. The questionnaire was adapted after an extensive review of related literature and similar study tools [7, 47, 50, 54-56]. The questionnaire embraces three sections containing different items. The first section, socio-demographic characteristics assesses information on age, sex, religion, educational status, working experience, and monthly salary. The second element of the questionnaire hugs information on sleep quality, which was assessed by using the PSQI, a 19-item self-rated scale that examined Sleep Quality and disturbances over a 1-month time interval. The tool mainly addresses seven sleep components including; sleep perception, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction during the last one month. The total PSQI score was calculated by summing up the seven component scores. Scoring of the answers is based on a 0 to 3 scale, whereby 3 reflects the negative extreme on the Likert scale. The sum of the score ranges from 0 to 21, in which the higher scores indicate poor sleep quality and the lower scores indicate good sleep quality [2]. Individuals scoring > 5 were considered poor sleep quality. The PSQI instrument has been validated as reliable for use in Ethiopia [43] and has been used in several studies in other countries [4, 57]. The last part of the questionnaire includes information used to assess behavioral factors and psychosocial factors like cigarette smoking (yes/no), BMI (kg/m2), physical activity (yes/no), alcohol

consumption (yes/no), use of the electronic device before bedtime (yes/no), history of chronic illness (yes/no), risk perception of COVID-19, job satisfaction, job stress, and workload.

Risk perception regarding COVID-19 in this study was measured using three questions: concern about their health, perceived risk of being infected with coronavirus, and the potential risk to their family, loved ones, or others due to their role in the academic environment. Responses for each question were rated on a 5-point Likert scale (ranging from 1 = not worried at all to 5 = extremely worried). The total score of the scale was the sum of the three items, ranging from 3 to 15, with a higher total score indicating a greater perceived risk of COVID-19 [51, 58]. We used the 10-item generic job satisfaction scale questionnaire to measure academician perceived job satisfaction [52]. Perceived job-related stress of the participants was collected using the 8-item workplace stress scale questionnaire [53]. The instruments used in the current study have been employed in previous studies conducted in the country's context [59-62].

Data quality control

The questionnaire was first developed in English and translated into the local language Amharic and back to English by language experts and professionals to ensure consistency. Two BSc psychiatric nurses working in the University of Gondar comprehensive specialized hospital were involved in data collection after they took adequate training and orientation. MSc psychiatric nurse supervisors working in the College of Medicine and Health Sciences at the University of Gondar were recruited. The data collectors and supervisor took the orientation on issues relating to the clarity of the questions, objectives of the study, confidentiality of information, and the voluntary involvement (consent) in the study, and on time of data collection as study participant's regular duties should not be compromised. The principal investigator supervised both data collectors and supervisors. To ensure the quality and reliability of the questionnaire, a pre-test was conducted on 5% (31) of the sample size at Teda Health Sciences College in Gondar city, and the College was not included in the final survey. Based on the finding from the pretest analysis, a few modifications such as some misinterpretations and ambiguities were corrected, and the time taken for the data collection was estimated. When any problem during the data collection, the feedback was given by discussing it with the principal investigator, supervisor and, data collectors.

Data processing and analysis

Data were checked for completeness and entered into Epi-data version 4.6 and then exported to STATA Version 14 for further analysis. We performed descriptive statistics and presented the results with narration, tabulation, and graphical presentation. Normality, outliers, and multicollinearity of the variables were checked before running bivariable and multivariable binary logistic regression analysis where multicollinearity assumption was checked by a variance inflation factor (VIF) and all variables showed values of <5. Thus, we found no evidence of multicollinearity. Also, the reliability of the questionnaire was tested using Cronbach's Alpha and found a reliable Cronbach's Alpha = 0.79, and therefore the questionnaire was tolerable for its consistency in repeating what have previously been measured using the tool [43].

The association between variables was computed with a binary logistic regression. Variables with p-values of <0.2 in the bivariable logistic regression analysis were exported to a multivariable logistic regression to control the potential effects of confounders. Lastly, statistically significant variables were established at p-value < 0.05 in a multivariable binary logistic regression model, and an adjusted odds ratio (AOR) with a confidence interval of 95% was reported to measure the strength of association. The final model was checked for goodness-of-fit using the Hosmer–Lemeshow test, and the result explained a good fit (p=0.65) [63].

Results

Socio-demographic characteristics of study participants

A total of 635 questionnaires were distributed giving a response rate of 95.59% (N = 607). The participants' age was ranged from 21 to 70 with a mean (±SD) of 32.39 (± 6.80) years old. More than two-thirds, (71.83%) of the participants were males and the majority of them, 362 (59.64%) of them indicated they were married. Regarding educational status, 416 (68.53%) of the participants were master degree holders. The median estimated (interquartile range (IQR) monthly income of the participants was 11305 (10700-13600) Ethiopian Birr (ETB) (**Table 1**).

Table 1: Socio-demographic characteristics of academic staff in University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Sex		
Male	436	71.83

Female	171	28.17
Age (years)		
21-29	226	37.23
30-39	301	49.59
≥40	80	13.18
Religion		
Orthodox	486	80.07
Muslim	69	11.37
Protestant	52	8.57
Marital status		
Single	245	40.36
Married	362	59.64
Educational status		
Bachelor	94	15.49
Master	416	68.53
Ph.D.	97	15.98
Work experience in years		
≤5	167	27.51
6-10	249	41.02
>10	191	31.47
Monthly salary (ETB)		
<10 000	99	16.31
10 000-13 000	331	54.53
>13 000	177	29.16

Key: ETB= Ethiopian Birr (currency)

Behavioral and psychosocial characteristics of study participants

Among the study participants, 414 (68.20%) of respondents were working between 6 and 10 hrs per day and 79 (13.01%) of respondents were working for more than 10 hrs per day. Of the study participants, 108 (17.79%) of them reported they were cigarette smokers. Whereas, 112 (18.45) stated they had alcohol drinking habits and almost one-third (33.28%) of them conveyed they were performing physical exercise at least two times per week. Majority of the respondents, 434 (71.50%) a normal (18.5–24.9 kg/m^2) BMI and 48 (7.91%) of them underweight (>18.5 kg/m^2).

Out of the study participants,188 (30.97%) of them clarified that they had a chronic illness, and almost half (51.24%) of the study participants have used an electronic device before bedtime. Regarding psychosocial characteristics, nearly one-fourth (24.38%) of respondents had high-risk perceptions of the COVID-19 virus. Meanwhile, 516 (85.01%) of respondents explained that they were satisfied with their job. Regarding job stress, 276 (45.47%) of the respondents stated they perceived stress due to their jobs (**Table 2**).

Table 2: Behavioral and psychosocial characteristics of academic staff in the University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Working hours per day		
≤5hr	114	18.78
6-10hr	414	68.20
>10hr	79	13.01
Cigarette smoker		
Yes	108	17.79
No	499	82.21
Alcohol consumption habit		
Yes	112	18.45
No	495	81.55
Khat chewing behavior		
Yes	19	3.13
No	588	96.87
Physical exercise		
Yes	202	33.28
No	405	66.72
Body mass index (BMI)		
Underweight	48	7.91
Normal	434	71.50
Overweight and obese	125	20.59
Chronic Illness		
Yes	188	30.97
No	419	69.03

The habit of taking breaks		
Yes	329	54.20
No	278	45.80
Electronic device use		
Yes	311	51.24
No	296	48.76
Risk perception towards COVID-19 virus		
High	148	24.38
Low	459	75.62
Colleagues relationship		
Good	539	88.80
Poor	68	11.20
Job satisfaction		
Satisfied	516	85.01
Not satisfied	91	14.99
Perceived job stress		
Stressed	276	45.47
Not stressed	331	54.53
Workload		
Yes	506	83.36
No	101	16.64

Prevalence of poor sleep quality and its components scores

The mean global score of PSQI (computed using the component scores) was 6.80, 95% CI (6.55, 7.04). The result of this study revealed that 60.30% (95% CI, 56.28%-64.21%) of academicians were classified as having poor sleep quality. Seven components of sleep quality in the present study were assessed and identified their sleep status. Accordingly, 514 (84.68%) of academicians had fairly good to very good sleep perception. From the total study participants, 342 (56.34%) had mild difficulty in falling asleep (PSQI latency). Regarding sleeping duration, only 165 (27.18%) of respondents had more than 7 hours of sleep per night, and 326 (53.71%) had a very high habitual sleep efficiency (>85%). Moreover, most (66.39%) of academicians reported that they had mild difficulty in the PSQI disturbance domain and only 39 (6.42%) of them used sleep medication to

sleep during the past month. Furthermore, 196 (32.29%) of them had mild to severe difficulty in PSQI day dysfunction due to sleepiness in the past month (**Table 3**).

Table 3: Sleep quality and its components scores of academic staff in the University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Sleep perception		
Very good	265	43.66
Fairly good	249	41.02
Fairly bad	80	13.18
Very bad	13	2.14
Sleep latency (falling asleep)		
0 to 15minutes (0)	27	4.45
16 to 30 minutes (1)	342	56.34
31 to 60 minutes (2)	161	26.52
>60 minutes (3)	77	12.69
Sleep duration		
>7hrs (0)	165	27.18
6h to 7hrs (1)	148	24.38
< 6hrs (2 & 3)	294	48.43
Sleep efficiency		
>85% (0)	326	53.71
75% to 84% (1)	143	23.56
65% to 74% (2)	60	9.88
<65% (3)	78	12.85
Sleep disturbance		
Never (0)	116	19.11
1 time a week (1)	403	66.39
1–2 times a week (2)	84	13.84
≥3 times a week (3)	4	0.66
Used sleep medication		
Never (0)	568	93.57
1 time a week (1)	27	4.45
1–2 times a week (2)	7	1.15

≥3 times a week (3)	5	0.82
Daytime dysfunction		
No problem (0)	411	67.71
1 time a week (1)	143	23.56
1–2 times a week (2)	44	7.25
≥3 times a week (3)	9	1.48
Total PSQI Global score		
≤ 5 (Good sleep quality)	241	39.70
> 5 (Poor sleep quality)	366	60.30

Key: 0= No difficulty, 1=Mild difficulty, 2=Moderate difficulty, 3=Sever difficulty

Factors associated with poor sleep quality

In bivariable binary logistic regression analysis, sex (p-value of 0.124), educational status (p-value of 0.179), working hours per day (p-value of 0.003), khat chewing (p-value of 0.042), not perform physical activities (p-value of 0.122), electronic devise use (p-value of 0.004), chronic illness (p-value of 0.002), risk perception towards COVID-19 virus (p-value of 0.005), job dissatisfaction (p-value of 0.112), and perceived job stress (p-value of ≤0.001) were the factors associated with poor sleep quality. However, after controlling for confounding variables in multivariable binary logistic regression analysis, only working hours per day, electronic device use before bedtime, risk perception towards COVID-19 infection, and perceived job stress remained to have a significant association with poor sleep quality.

The probability of developing poor sleep quality was 2.19 times greater in employees who worked more than 10 hours per day compared to those who worked for 5 hours or less per day [AOR= 2.19, 95% CI (1.16, 4.27)] at a p-value of 0.019. Similarly, participants who use electronic devices before bedtime were 1.53 times more likely to experience poor sleep quality compared to electronic device non-user counterparts [AOR=1.53, 95% CI (1.04, 2.27)] at a p-value of 0.031. Moreover, the odds of having poor sleep quality were 1.60 times more likely among workers who had a high-risk perception of COVID-19 infection than among those who had a low-risk perception about it [AOR =1.60, 95% CI (1.04, 2.46)] at a p-value of 0.032. Finally, the chances of suffering from poor sleep quality among academicians who had perceived job stress were 2.15 times higher

as compared to those who had no job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] at a p-value of ≤0.01as shown in (**Table 4**).

Table 4: Bivariable and multivariable logistic regression analysis of factors associated with poor sleep quality among academic staff, University of Gondar, Ethiopia, 2021 (N=607).

Variables	Poor sleep quality		COR with 95% CI	AOR with 95% CI	P-value
	Yes	No			
Sex					
Male	256	180	1	1	
Female	110	61	1.27 (0.88-1.83)	1.42 (.94-2.13)	0.091
Educational status					
Bachelor	62	32	1	1	
Master	243	173	0.72 (0. 45-1.16)	0.74 (0.44-1.23)	0.245
Ph.D.	61	36	0.87 (0. 48-1.58)	0.87 (0.46-1.65)	0.674
Working hours per day					
≤5hr	59	55	1	1	
6-10hr	249	165	1.41 (0.93- 2.13)	1.10 (0.76-1.85)	0.679
>10hr	58	21	2.57 (1.39-4.78)	**2.19 (1.16-4.27)***	**0.019**
Khat chewing					
Yes	16	3	3.63 (1.05-12.58)	3.00 (0.82-11.00)	0.097
No	350	238	1	1	
Physical exercise					
Yes	113	89	1	1	
No	253	152	1.31 (0.93-1.85)	1.40 (0.97-2.03)	0.068
Electronic device use					
Yes	205	106	1.62 (1.17-2.25)	**1.53 (1.04-2.27)***	**0.031**
No	161	135	1	1	
Chronic Illness					
Yes	131	57	1.80 (1.25-2.59)	1.45 (0.98-1.99)	0.059
No	235	184	1	1	
Risk perception of COVID-19 virus					
High	104	44	1.77 (1.19-2.65)	**1.60 (1.04-2.46)***	**0.032**
Low	262	197	1	1	
Job satisfaction					

Satisfied	318	198	1	1	
Not satisfied	48	43	0.70 (0.44-1.09)	0.67 (0.42-1.08)	0.099
Perceived job stress					
Stressed	197	79	2.39 (1.70-3.35)	**2.15(1.50-3.08)***	**≤0.01**
Not stressed	169	162	1	1	

Keys: 1=reference category, AOR=adjusted odds ratio, CI= confidence interval, COR=crudes odds ratio, COVID-19= Corona virus disease 19, *= significant at $p < 0.05$ in multivariable logistic regression analysis, Hosmer and Lemeshow test $p = 0.650$.

Discussion

Poor sleep quality incurs substantial health, economic and societal costs. Understanding the magnitude and various factors linked to the ailment would help researchers identify viable therapies to improve sleep quality in vulnerable populations. The higher education work environment is characterized by a highly competitive work nature. In Ethiopia, University teaching staff usually handle extracurricular tasks including conducting and preparing research for publication, providing community services, and managing administrative positions. Furthermore, their regular teaching activities shift from face-to-face to online instruction during the COVID-19 pandemic, which has an impact on their sleep quality. Understanding the magnitude and investigating etiologies of the condition plays a paramount role to establish effective prevention and control strategies. To our knowledge, the current study is the first to assess the prevalence and risk factors of poor sleep quality among university academic staff in Ethiopia. The prevalence of poor sleep quality in the last one- month was found to be 60.30% with 95% CI (56.28-64.21). Working for more than 10 hours per day, electronic device use before bedtime, high-risk perception of COVID-19 infection, and having job stress were factors positively associated with poor sleep quality in the current study.

Two investigations from Brazil (57.9%) [64] and (61.3%) [7] supported the current data. This agreement could be due to the nature of tasks in the academic environment including roles related to teaching and research activities usually resemble in every higher academic institution. Participants in those nations might be also obliged to work in a substandard workplace in an

unhealthy manner for prolonged periods, and fewer individuals are aware of sleep health and the effect of poor sleep quality. The other possible explanation might be due to study participants having a similar age group as compared to those countries.

On the contrary, the current study had a higher magnitude compared to the studies conducted in Turkey (38.9%) [8] and Malaysia (45%) [65]. This difference might be due to the unstable socioeconomic status of the respondents in this study. The respondents in this study might be an attempt to compensate for their low salaries by teaching different shifts at multiple colleges and schools. This may lead to longer working hours because they start their daily work activities much earlier in the day and conclude their working day much later. The difference might be also due to the sample size variation; previous reports were conducted among a small number of study participants compared to this study group. The other possible justifications for the difference might be due to variation in the educational system, study setting, workload, and cultural differences between Ethiopia and those countries.

There were no studies reports with a larger magnitude than the current finding. A possible reason for increased magnitude of sleep problems in the current study could be due to the study period, we conducted during the early phase of the COVID-19 pandemic. Higher education institutions need to look for alternate educational strategies to be adopted during the COVID-19 pandemic and the e-learning strategy emerged as an alternative solution to continued education. The educational institutions started using different educational platforms like Google classroom, Zoom, and Microsoft teams. Lecturers were subjected to excessive use of digital devices without breaks as they were shifted to online teaching. There has also been increased digitalization for recreational purposes. Hence, it was noted as exposure to light emitted from digital devices has been interfering with the circadian regulation/melatonin rhythm [42, 66], which may lead to poor sleep quality.

In this study long working hour per day (>10hrs/day) was significantly associated with poor sleep quality. The finding echoes the result of previous investigations [4, 67]. A possible justification for this report may be that employee with long working hours need more time to recover from work-induced fatigue [68]. However, long working hours reduces the amount of private time available to them, which may lead to sleep deprivation [69]. For recovery from fatigue, not only sleep but also relaxation is needed, for example, spending time with family and friends, resting, or reading, but long working hours may also reduce relaxation time [70]. Therefore, reduced private

time for workers due to long working hours may lead to sleeplessness, and cause sleep disorders. Also, due to the nature of their occupation, our study participants spend a lot of time working with computers and other electronic devices. The use of electronic devices for a long period was noted to be associated with sleep disorders [42, 71]. Another plausible explanation might be that employees who worked long working hours may take caffeinated drinks (e.g., coffee and tea), which can lead to poor sleep [72].

Electronic device use before bedtime showed a significant association with poor sleep quality. Similar results were reported from other studies [73-75]. This could be reasoned as sleep quantity and quality are significantly reduced when people use digital devices for an extended period [76]. For example, cell phones, tablets, readers, computers, and laptops emit short-wavelength enriched light, which has been found to suppress or delay the normal generation of melatonin in the evening and minimize feelings of sleepiness [77]. Moreover, workforces in a higher education context are often confronted with demanding responsibilities requiring work overload, long working hours, stress, and, in addition, the COVID-19 pandemic difficulties in the world of education. Because of the pandemic, universities were forced to conduct all of their activities online, including in the current study setting, which increased the usage of electronic devices, contributing to or exacerbating poor sleep quality [78].

Our current study revealed a high-risk perception of COVID-19 infections was found to be a determinant factor of poor sleep quality. This finding is in concordance with other research reports [79, 80]. This could be explained as those people who thought they were at a higher risk of developing COVID-19 had more fear than those who thought they were at a lower risk. Fear and rumination were also found to be adversely related to sleep quality, indicating that fear of infection and rumination did lead to poor sleep quality during the pandemic, which contribute to poorer sleep quality both directly and indirectly by increasing fear [79]. Several researchers had examined the influence of the COVID-19 pandemic on mental health, concluding that persons who are fearful of becoming infected are more likely to develop sleeping disturbances [81].

Participants who reported having job stress were 2.38 times more likely to have poor sleep quality than those who did not have stress. The result is in agreement with the studies conducted in Brazil [64], Malaysia [4, 82], and Indonesia [83]. The plausible reason might be due to the linkages between sleep, stress regulation, and alteration in the hypothalamic-pituitary-adrenal axis

implication of psychopathology and sleep-wake cycle. Job stress can lead to the release of an excessive level of glucocorticoids hormones like cortisol. A higher level of cortisol during stressful life events primes to sleep rhythm disruption that results in sleep deprivation [84, 85].

Conclusion

This study disclosed that poor sleep quality was intrusive during the COVID-19 pandemic among University teaching staff in Ethiopia, with two-thirds of our study participants having experienced poor sleep quality. Poor sleep quality was related to working hours per day, electronic device use, the risk of COVID-19 infections, and job stress in the current study. Therefore, we recommended that University administrators to develop, implement, and evaluate sleep health promotion programs in the workplaces. Moreover, strategy and structure to limit working for an extended period every day, and improve proper usage of electronic devices should be integrated with sleep health promotion programs to minimize the condition.

Data availability statement

Individual participant data after deidentification that underlie the results reported in this article will be made available upon requesting the primary author immediately following publication.

Author's contribution

AHT: Initiated the concept of the research, wrote up the research proposal, analyzed the data involved in the presentation and interpretation process of results and discussions, and drafted the manuscript document and the corresponding author. The author read and approved the final manuscript.

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Patient and public involvement

There was no patient or public involvement in the study.

Competing interest

None of the authors have any competing interests in the manuscript.

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Ethics approval and consent to participate

Ethical approval was secured from the Institutional Ethical Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (**Reference #: IPH/1425/2021**). The study followed the tenets of the Declaration of Helsinki and also complied with the ethical requirements set by the University of Gondar. Written informed consent was obtained from each respondent before commencing data collection after an explanation of the nature and possible consequences of the study. The information sheet that clearly shows the research topic, the objectives of the study, confidentiality of the participant's responses, the study benefits, and associated risks was prepared and presented. We removed any personal identifiers to assure confidentiality of the participants and only anonymous data were used for interpretations. Furthermore, since the data were collected during the COVID-19 pandemic, we implemented infection prevention protocols including social distancing and wearing of face masks.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 to 4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*7 to 8*
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	10 to 12
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	13
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19 Pandemic in Ethiopia: an institution-based cross-sectional study

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Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19 Pandemic in Ethiopia: an institution-based cross-sectional study

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Abstract

Objective: This study was conducted to assess the prevalence and risk factors of poor sleep quality among the University of Gondar academic staff, Ethiopia.

Design: An institution-based cross-sectional study was conducted from March to April 2021. A validated self-administered, standardized Pittsburgh Sleep Quality Index was used to quantify the amount of self-reported poor sleep quality. The collected data were entered into EpiData version 4.6 and analyzed using STATA version 14 software. Binary logistic regressions were computed to determine the association between variables. The association was determined using an adjusted Odds ratio (AOR) with a 95% confidence interval (CI) at a p-value of < 0.05.

Setting: The study was conducted at the University of Gondar, Northwestern Ethiopia.

Participants: Six hundred and seven lecturers participated in this study.

Outcome measures: The primary outcome is the prevalence of poor sleep quality, which was measured using the Pittsburgh Sleep Quality Index (PSQI).

Results: Overall response rate was 95.60% (N = 607). The age of the participants ranges from 21 to 70 with a mean of 32.39 (SD ±6.80) years. The magnitude of poor sleep quality during the COVID-19 pandemic in the last month was 60.30% [95% CI (56.28%-64.21%)]. Working > 10 hours per day [AOR= 2.19, 95% CI (1.16, 4.27)], electronic device use before bedtime [AOR=1.53, 95% CI (1.04, 2.27)], high risk perception of COVID-19 infections [AOR =1.60, 95% CI (1.04, 2.46)], and perceived job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] were risk factors for poor sleep quality.

Conclusion: The study revealed that the prevalence of poor sleep quality was high during the COVID-19 pandemic. The finding highlights the importance of optimizing the working hours per day, minimizing electronic device use before bedtime, promoting risk perception toward COVID-19 infection, and developing workplace coping strategies for stress, which play a substantial role in minimizing poor sleep quality.

Keywords: Sleep quality, Poor sleep, Academic staff, Lectures, COVID-19, Ethiopia

Strengths and limitations of this study

- The study has focused on one of the most potential groups affected by poor sleeping quality, particularly during COVID-19.
- This study is the first in its kind in exploring the magnitude and factors influencing poor sleep quality among academic staff in Ethiopia.
- Using the Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults.
- The study has limitations due to the cross-sectional nature of the data; it does not show a temporal relationship between independent variables and the outcome variable.
- The report of poor sleep quality may be underestimated or overstated because it relies on lecturers' subjective reports rather than objective measurements like actigraphy and polysomnography.

Background

Scholars describe sleep quality (SQ) as "one's perception that they fall asleep easily, sleep for a sufficient amount of time so that they wake up feeling rested, and can get through their day without experiencing excessive daytime sleepiness". An individual's subjective perception of his or her sleep can be evaluated using both subjective and objective methods [1]. The subjective method, Pittsburgh Sleep Quality Index (PSQI) is a widely used questionnaire to measure sleep quality [2]. General health and quality of life are directly correlated with sleep quality [3]. Sleep disorders involve problems with the quality, timing, duration, and amount of sleep [4]. Poor sleep quality is a global phenomenon, which leads to poor health, increased risk of mortality, hormonal and biochemical changes, higher health care costs, increased use of health resources, absenteeism, and increased risk of psychological morbidity and burnout [5, 6]. Poor SQ has been a typical occurrence among the various working population during the COVID-19 pandemic and is regarded as a public health crisis that frequently goes undetected, underreported, and has very large economic impacts [7, 8]. Teaching has been identified as a profession associated with a high risk of poor sleep quality [9-11]; however, little research has been conducted to quantify the prevalence and risk factors of poor sleep quality among university academic staff worldwide [12, 13].

Academic staffs are at a higher risk of poor SQ, burnout, depression, stress, and anxiety as a result of the current COVID-19 pandemic, which has serious consequences on occupational health both

now and in the future [14]. Likewise, the World Health Organization (WHO) has classified poor sleep quality as a public health issue that exacerbates the risk of disease and death [15]. Poor SQ also has significant economic consequences. In the USA, for example, the annual costs of poor sleep have been estimated to be as high as US$16 billion in healthcare costs and US$50 billion in lost productivity [16]. In Australia, the costs were estimated to be approximately US$1.8 billion for the health system and US$66.3 billion for financial loss and decreased well-being [17-19].

During the COVID-19 period, the prevalence of sleep quality was found to be at a poor level [20]. A couple of studies from Brazilian [12, 21], documented that 61.3% and 44.2% of university academic staff reported poor sleep quality. Scientific investigation showed that four out of ten people do not get enough sleep, and one in five sleep poorly most nights, making poor sleep the second most common health complaint after pain [22, 23]. According to a study done in Iran [24], 79.6% (n=133) of university staff reported having poor sleep quality. A similar finding was also found in a study conducted in Thailand [25], where 78.3% of respondents experienced poor sleep quality. So far, epidemiological data from Turkey indicated that 55.1% of adults had poor sleep quality [20]. In Ethiopia, the pooled prevalence of poor sleep quality was 53% among general populations and university students, with incidences ranging from 26% to 66.2% [26]. However, studies on sleep quality, particularly among university academic staff, are lacking.

Recent research shows that during the COVID-19 pandemic, sleep quality was impaired and the prevalence of poor sleep increased in both the working and general population [27-29]. Furthermore, the global COVID-19 pandemic has compelled higher education institutions, including Ethiopian universities, the shift from face-to-face to online instruction, which has an impact on sleep quality [30-32]. Prolonged use of uses of computers, coupled with the brightness of the light that they project onto the retina, are factors that are thought to trigger changes in sleep patterns [33]. The light emitted from computers is in close proximity to the retina [34]. This emitted optical radiation at short wavelengths is close to the peak sensitivity of melatonin suppression [33]. Since, the utilization of computers is fast during the COVID-19 pandemic among academic staff can be a source of computer light exposure, which can lead to poor sleep quality [35]. Moreover, poor sleep quality has been correlated to old age, low economic status, substance use, obesity, use of an electronic device before bedtime, higher risks of contracting COVID-19 at work, workload and job stress [36-44].

Given the widespread and harmful consequences of poor sleep quality, it needs to be a top priority for public and occupational health. As previously stated, a thorough review of the literature revealed that even less is known about the prevalence and factors of poor sleep quality among academic staff and other university personnel in developing countries including Ethiopia [45].The number of universities in Ethiopia is increasing, which is accompanied by an increase in academic staff workforces. However, the lack of reliable and up-to-date data on mental health, especially on sleep quality, makes it difficult for officials to plan for prevention and control measures. Therefore, in the current study, we aimed to assess the prevalence and associated factors of poor sleep quality among academic staff at the University of Gondar, Northwest Ethiopia.

Methods and materials

Study design, Period, and Setting

An institution-based cross-sectional study was conducted between March 17 to April 17, 2021. The research was carried out at the University of Gondar, which is situated in the oldest and most ancient city of Gondar , Northwestern Ethiopia, which is 737 kilometers far from Addis Ababa, the capital city of Ethiopia [46]. The College of Medicine and Health Sciences, Comprehensive Specialized Referral Hospital (CMHS), Maraki, Atse Tewdros, Atse Fasil, and Teda are the university's five campuses [47]. On all campuses, there were 2,858 academic staff members throughout the research period.

Study participants

The source population was the whole faculty members of the University of Gondar. The study population, however, consisted of a random sample of academic personnel from each campus. Academic personnel on critical illness, maternity leave, or sabbatical leave and individuals diagnosed with sleep-related disorders were excluded, while academic staff with at least one year of teaching experience and who were available throughout data collection were included.

Sample size determination and sampling procedure

The sample size was calculated by using a single population proportion formula [48] by considering the following statistical assumptions:

Confidence level (Cl) of 95%

Proportion = 50% (no previous study in the study area)

Margin of error of 5%

Using the following single proportion formula:

$n = (Z\alpha/_2)^2 \frac{[p\ (1-p)]}{d^2}$ where:

n = initial sample size,

Z = 1.96, the corresponding Z-score for the 95% CI

P = Proportion = 50%

d = Margin of error = 5% = 0.05

$n = (1.96)^2 \frac{[0.5\ (1-0.5)]}{0.05^2}$ =384

The final sample size was 635 people, after taking into account a 10% non-response rate and a design effect of 1.5 because, in the absence of prior literature, a design effect of 1.5 to 2.0 is endorsed [49]. We employed a stratified sampling technique to select participants from the five campuses of the University of Gondar. A proportional allocation for each stratum defined how many sample points were needed. Thus, there were a total of 1027 academic staff members in the College of Medicine and Health Sciences (N1=1027), 630 academic staff members on Maraki campus (N2=630), 509 academic staff members on Tewdros campus (N3=509), 536 academic staff members on the Fasil campus (N4=536), and 156 academic staff members on the Teda campus (N5=156). Consequently, the numbers of participants from each campus were 228, 140, 119, 113, and 35 from the College of Medicine and Health Sciences, Maraki, Fasil, Tewodros, and Teda campuses, respectively. The requisite sample sizes were then determined using a simple random sampling technique, and academic staff members from each stratum were randomly assigned using the OpenEpi random software version 3.

Variable measurement and definition of terms

Poor sleep quality: This was measured using the Pittsburgh Sleep Quality Index (PSQI) 19-item self-report measure of sleep quality over the past month was used to measure academician poor sleep quality during the COVID-19 pandemic period (**supplementary file**). The tool, which was free to use and designed to measure the outcome variable, has a diagnostic sensitivity of 89.6% and a specificity of 86.5% at greater than five cutoff values for identifying cases with sleep

disorders [50]. PSQI consists of 7 component scores (ranging from 0 to 3), measuring subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The 7 component scores are summed to give a global PSQI score ranging from 0 to 21, with higher scores reflecting greater overall sleep disturbances. A global PSQI score of greater than 5 indicates poor sleep quality [33, 51].

Body mass index (BMI): weight in kilograms divided by the square of the height in meters (kg/m^2) categorized as underweight = BMI < 18.5, normal (health) = BMI 18.5– 24.9, overweight = BMI 25.0–29.9 =, and obese = BMI ≥ 30.0 [52].

Alcohol drinker: a scholar who drinks alcohol of any kind at least twice each week [53]

Cigarette smoker: a scholar with a daily consumption of at least one stick of cigarettes [54].

Khat chewer: a scholar who had chewed khat in the previous month [42].

Doing physical exercise: doing any type of physical activity at least twice a week for at least 30 minutes [55].

Electronic device use: if the participant utilizes/ watches at least one of the following: television, computer, tablet, or mobile phone in bed before going to sleep [56].

Chronic illness: illnesses such as asthma, diabetes mellitus, stroke, kidney stone, hypertension that can be managed, but cannot be cured and have a greater risk of developing a poor quality of sleep, [57].

Risk perception of COVID-19 infection: was assessed by two psychological dimensions; perceived susceptibility and perceived severity. The first dimension was proxied by how likely one considered oneself (his/her family) would be infected with COVID-19 if no preventive measures will be taken. The second dimension was proxied by how one rated the seriousness of symptoms caused by COVID-19, their perceived chance of having COVID-19 cured and that of survival if infected with COVID-19. By combining the two dimensions, five items with five response options were asked to determine the respondents' levels of risk perception, with a higher total score indicating a high perceived risk of COVID-19 infection [58].

Job satisfaction: the total score of at least 32 on the general job satisfaction scale [59].

Perceived job stress: a score of at least 21 on the workplace-stress scale [60].

Data Collection Tools and Procedures

Data were collected through a validated self-administered standardized structured questionnaire. The questionnaire was adapted after an extensive review of related literature and similar study tools [12, 42, 57, 61-63]. The questionnaire embraces three sections containing different items. The first section, socio-demographic characteristics, assesses information on age, sex, religion, educational status, working experience, and monthly salary. The second element of the questionnaire hugs information on poor sleep quality, which was assessed by using the PSQI, which is a measure of sleep disturbance for the period of 1-month immediately preceding the time of administration. PSQI is an effective and the most widely used instrument in diagnosis of sleep disorders in different populations [9, 64]. The tool is easy to understand, patient compliant and requires about 5 min to be completed. 10]. The PSQI contains 19 items and 7 clinically important components in relation to sleep difficulties: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. The total PSQI score was calculated by summing up the seven component scores as cited in [50]. Scoring of the answers is based on a 0 to 3 scale, whereby 3 reflects the negative extreme on the Likert scale, as well a global score of between 0 and 21. Individuals scoring a global score of greater than 5 were deemed poor sleep quality [65]. The PSQI has been validated in many languages with acceptable psychometric properties [66] and is frequently used in clinical and research settings [67]. The PSQ has also been validated as reliable for use in Ethiopian community [51]. The PSQI's validity was supported by a comprehensive test used to diagnose sleep disorders like polysomnographic findings [68, 69]. The PSQI has a sensitivity of 89.6% and specificity of 86.5% for identifying cases with sleep disorder, using a cut-off score of 5 [50]. The last part of the questionnaire includes information used to assess behavioral factors and psychosocial factors like cigarette smoking (yes/no), BMI (kg/m2), physical activity (yes/no), alcohol consumption (yes/no), use of an electronic device before bedtime (yes/no), history of chronic illness (yes/no), risk perception of COVID-19, job satisfaction, job stress, and workload.

Risk perception regarding COVID-19 in this study was measured by using two psychological dimensions; perceived susceptibility and perceived severity. The first dimension (perceived susceptibility) contains two questions; including how likely they will be infected with COVID-19

and how likely one considered oneself (his/her family) would be infected with COVID-19 if no preventive measures will be taken. Responses of the two questions were rated on a 5-point Likert scale (ranging from 1 = very likely to 5 = very unlikely). The second dimension (perceived severity) contains three questions; including how one rated the seriousness of symptoms caused by COVID-19, their perceived chance of having COVID-19 cured, and that of survival if infected with COVID-19. Responses of the three questions were rated on a 5-point Likert scale (ranging from 1 = Very serious /Very low to 5 = Not serious at all/Very high). By combining the two dimensions, making five questions each answered on a Likert scale of 1 to 5 giving rise to a total score ranging from 5 to 25. The higher the score, the higher the risk perception of COVID-19 infection [70]. We used the 10-item generic job satisfaction scale questionnaire to measure academicians' perceived job satisfaction [59]. The scale comprised ten questions ranging from 1 to 5 each item and ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, according to their occurrence respectively, in 1 month before the survey. The scale had 10 items with a rating of 1 to 5, and the responses ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, depending on how frequently they occurred in the month before to the survey and then summing up all 10 items. The scale produced a single ranking, with high scores indicated higher job satisfaction vice versa. Perceived job-related stress of the participants was collected using the 8-item workplace stress scale questionnaire [60]. The scale comprised eight questions ranging from 1 to 5 each item and ranged from never, rarely, sometimes, often and very often, according to their occurrence respectively, in 1 month before the survey. The 8- item workplace stress scores are obtained by reversing scores on three positive items, e.g. 5 = 1, 4 = 2, 3 = 3, etc., and then summing up all 8 items. Items 6, 7 and 8 are positive items. The scale produced a single ranking, with high scores indicated higher stress levels and vice versa. The instruments used in the current study have been employed in previous studies conducted in the country's context [71-74].

Data quality control

To maintain uniformity, the questionnaire was initially created in English, translated into the local tongue of Amharic, and then translated back to English. Following appropriate training and orientation, three BSc nurses and MPH Environmental health specialist who were employed at the comprehensive specialized hospital of the University of Gondar participated in data collection. The data collectors and supervisor took the orientation on issues relating to the clarity of the

questions, objectives of the study, confidentiality of information, the voluntary involvement (consent) participants in the study, and on time of data collection as study participants' regular duties should not be compromised. Both data collectors and supervisors were under the lead investigator's supervision. The pre-test was carried out at Teda Health Sciences College in Gondar city on 5% (31) of the sample size to ensure the validity and reliability of the questionnaire, yet the College was not included in the final survey. Based on the results of the pretest analysis, various modifications were made including the clarification of a few ambiguities and misinterpretations, and an estimation of how long the data gathering process would take. Feedback was provided by discussing any issue that arose during data collection with the primary investigator, the supervisor, and the data collectors.

Data processing and analysis

Data were entered into Epi-data version 4.6 after being verified as complete and exported to STATA version 14 for additional analysis. We used descriptive statistics, narration, tabulation, and graphics to present the findings. Prior to doing bivariable and multivariable binary logistic regression analyses, the variables' normality, outliers, and multicollinearity were examined. A variance inflation factor (VIF) was used to test the multicollinearity assumption, and all variables displayed values of less than 5. As a result, multicollinearity was not observed to exist. Also, the reliability of the questionnaire was tested using Cronbach's Alpha and found a reliable Cronbach's Alpha = 0.79, and therefore the questionnaire was tolerable for its consistency in repeating what had previously been measured using the tool [51]. Additionally, Cronbach's Alpha was used to examine the questionnaire's reliability, and the reliability Cronbach's Alpha value was 0.79. As a result, the questionnaire was deemed satisfactory for its consistency in reproducing what had previously been measured using the instrument. A binary logistic regression was used to compute the relationship between the variables. To control the effects of potential confounders, variables with p-values of 0.2 in the bivariable logistic regression analysis were exported to a multivariable logistic regression. Last but not least, in the multivariable binary logistic regression model, statistically significant variables were established at a p-value of 0.05, and an adjusted odds ratio (AOR) with a confidence interval of 95% was provided to quantify the strength of the association. The Hosmer-Lemeshow test was used to determine the final model's goodness of fit, and the results revealed a good fit (p=0.65) [75].

Patient and public involvement statement

University lecturers were participated in this investigation by contributing useful information. However, they have never been involved in the study design, protocol, data collection tools, and reporting and disseminating the findings.

Results

Socio-demographic characteristics of study participants

A total of 635 questionnaires were distributed, giving a response rate of 95.59% (N = 607). The age of the participants ranged from 21 to 70, with a mean (±SD) of 32.39 (±6.80) years old. Moreover, more than two-thirds of the participants were male (71.83%), and the majority of them, 362 (59.64%), indicated that they were married. Regarding educational status, 416(68.53%) of the participants had master's degree. The participants' median estimated (interquartile range (IQR) monthly income was 11305 (10700-13600) Ethiopian Birr (ETB) (**Table 1**).

Table 1: Socio-demographic characteristics of academic staff in University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Sex		
Male	436	71.83
Female	171	28.17
Age (years)		
21-29	226	37.23
30-39	301	49.59
≥40	80	13.18
Religion		
Orthodox	486	80.07
Muslim	69	11.37
Protestant	52	8.57
Marital status		
Single	245	40.36
Married	362	59.64
Educational status		

Bachelor	94	15.49
Master	416	68.53
Ph.D.	97	15.98
Work experience in years		
≤5	167	27.51
6-10	249	41.02
>10	191	31.47
Monthly salary (ETB)		
<10 000	99	16.31
10 000-13 000	331	54.53
>13 000	177	29.16

Key: ETB= Ethiopian Birr (currency)

Behavioral and psychosocial characteristics of study participants

Four hundred fourteen (68.20%) of the participants were working between 6 and 10 hours per day, and 79 (13.11%) participants were working more than 10 hours per day. Of the study participants, the number of respondents who admitted to smoking cigarettes was 108 (17.79%). While 112 (18.45) said they had alcohol drinking habits, over one-third (33.28%) of respondents were performing physical exercise at least twice a week. The majority of the respondents, 434 (71.5%), had a normal (18.5-24.9 kg/m2) BMI, while 48 (7.91%) of them were underweight (>18.5 kg/m2) BMI. Out of the study participants, 188 (30.97%) of them clarified that they had a chronic illness, and almost half (51.24%) of the study participants have used an electronic device before bedtime. Regarding psychosocial characteristics, nearly one-fourth (24.38%) of the respondents had high-risk perceptions of the COVID-19 virus. Moreover, 516 (85.01%) respondents supposed they were satisfied with their jobs. Furthermore, when asked whether they felt stressed out by their work, 276 respondents (45.47 %) said they did (**Table 2**).

Table 2: Behavioral and psychosocial characteristics of academic staff in the University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Working hours per day		
≤5hr	114	18.78

6-10hr	414	68.20
>10hr	79	13.01
Cigarette smoker		
Yes	108	17.79
No	499	82.21
Alcohol consumption habit		
Yes	112	18.45
No	495	81.55
Khat chewing behavior		
Yes	19	3.13
No	588	96.87
Physical exercise		
Yes	202	33.28
No	405	66.72
Body mass index (BMI)		
Underweight	48	7.91
Normal	434	71.50
Overweight and obese	125	20.59
Chronic Illness		
Yes	188	30.97
No	419	69.03
The habit of taking breaks		
Yes	329	54.20
No	278	45.80
Electronic device use		
Yes	311	51.24
No	296	48.76
Duration of electronic device use		
≤3hrs/day	127	40.84
>hrs/day	184	59.16
Risk perception towards COVID-19 virus		
High	148	24.38
Low	459	75.62
Colleagues relationship		

Good	539	88.80
Poor	68	11.20
Job satisfaction		
Satisfied	516	85.01
Not satisfied	91	14.99
Perceived job stress		
Stressed	276	45.47
Not stressed	331	54.53
Workload		
Yes	506	83.36
No	101	16.64

Prevalence of poor sleep quality and its components scores

The mean global score of PSQI (computed using the component scores) was 6.80, 95% CI (6.55, 7.04). The result of this study revealed that 60.30% (95% CI, 56.28%-64.21%) of academicians were classified as having poor sleep quality. Seven components of sleep quality in the present study were assessed and the components identified their sleep status (**supplementary file**). Accordingly, 514 (84.68%) of the academicians had fairly good to very good sleep perception. From the total study participants, 342 (56.34%) had mild difficulty in falling asleep (PSQI latency). Regarding sleeping duration, only 165 (27.18%) of the respondents had more than 7 hours of sleep per night, and 326 (53.71%) had a very high habitual sleep efficiency (>85%). Moreover, most (66.39%) of academicians reported that they had mild difficulty in the PSQI disturbance domain and only 39 (6.42%) of them used sleep medication to sleep during the past month. Furthermore, 196 (32.29%) of them had mild to severe difficulty in PSQI day dysfunction due to sleepiness in the past month (**Table 3**).

Table 3: Poor sleep quality and its components scores of academic staff in the University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Sleep perception		
Very good	265	43.66
Fairly good	249	41.02

Fairly bad	80	13.18
Very bad	13	2.14
Sleep latency (falling asleep)		
0 to 15minutes (0)	27	4.45
16 to 30 minutes (1)	342	56.34
31 to 60 minutes (2)	161	26.52
>60 minutes (3)	77	12.69
Sleep duration		
>7hrs (0)	165	27.18
6h to 7hrs (1)	148	24.38
< 6hrs (2 & 3)	294	48.43
Sleep efficiency		
>85% (0)	326	53.71
75% to 84% (1)	143	23.56
65% to 74% (2)	60	9.88
<65% (3)	78	12.85
Sleep disturbance		
Never (0)	116	19.11
1 time a week (1)	403	66.39
1–2 times a week (2)	84	13.84
≥3 times a week (3)	4	0.66
Used sleep medication		
Never (0)	568	93.57
1 time a week (1)	27	4.45
1–2 times a week (2)	7	1.15
≥3 times a week (3)	5	0.82
Daytime dysfunction		
No problem (0)	411	67.71
1 time a week (1)	143	23.56
1–2 times a week (2)	44	7.25
≥3 times a week (3)	9	1.48
Total score of poor sleep quality		
≤ 5 (Good sleep quality)	241	39.70
> 5 (Poor sleep quality)	366	60.30

Key: 0= No difficulty, 1=Mild difficulty, 2=Moderate difficulty, 3=Sever difficulty

Factors associated with poor sleep quality

In the bivariable binary logistic regression analysis, sex (p-value of 0.124), educational status (p-value of 0.179), working hours per day (p-value of 0.003), khat chewing (p-value of 0.042), not perform physical activities (p-value of 0.122), electronic devise use (p-value of 0.004), chronic illness (p-value of 0.002), risk perception towards COVID-19 virus (p-value of 0.005), job dissatisfaction (p-value of 0.112), and perceived job stress (p-value of ≤0.001) were the factors associated with poor sleep quality. However, after controlling for confounding variables in the multivariable binary logistic regression analysis, only working hours per day, electronic device use before bedtime, risk perception towards COVID-19 infection, and perceived job stress remained to have a significant association with poor sleep quality.

The probability of developing poor sleep quality was 2.19 times greater in employees who worked more than 10 hours per day compared to those who worked for 5 hours or less per day [AOR= 2.19, 95% CI (1.16, 4.27)] at a p-value of 0.019. Similarly, participants who use electronic devices before bedtime were 1.53 times more likely to experience poor sleep quality compared to who didn't use electronic devices before bedtime counterparts [AOR=1.53, 95% CI (1.04, 2.27)] at a p-value of 0.031. Moreover, the odds of having poor sleep quality were 1.60 times more likely among workers who had a high-risk perception of COVID-19 infection than among those who had a low-risk perception about it [AOR =1.60, 95% CI (1.04, 2.46)] at a p-value of 0.032. Finally, the chances of suffering from poor sleep quality among academicians who had perceived job stress were 2.15 times higher as compared to those who had no job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] at a p-value of ≤0.01 as shown in **Table 4.**

Table 4: Bivariable and multivariable logistic regression analysis of factors associated with poor sleep quality among academic staff, University of Gondar, Ethiopia, 2021 (N=607).

Variables	Poor sleep quality		COR with 95% CI	AOR with 95% CI	P-value
	Yes	No			
Sex					
Male	256	180	1	1	
Female	110	61	1.27 (0.88-1.83)	1.42 (.94-2.13)	0.091
Educational status					

Bachelor	62	32	1	1	
Master	243	173	0.72 (0. 45-1.16)	0.74 (0.44-1.23)	0.245
Ph.D.	61	36	0.87 (0. 48-1.58)	0.87 (0.46-1.65)	0.674
Working hours per day					
≤5hr	59	55	1	1	
6-10hr	249	165	1.41 (0.93- 2.13)	1.10 (0.76-1.85)	0.679
>10hr	58	21	2.57 (1.39-4.78)	**2.19 (1.16-4.27)***	**0.019**
Khat chewing					
Yes	16	3	3.63 (1.05-12.58)	3.00 (0.82-11.00)	0.097
No	350	238	1	1	
Physical exercise					
Yes	113	89	1	1	
No	253	152	1.31 (0.93-1.85)	1.40 (0.97-2.03)	0.068
Electronic device use					
Yes	205	106	1.62 (1.17-2.25)	**1.53 (1.04-2.27)***	**0.031**
No	161	135	1	1	
Chronic Illness					
Yes	131	57	1.80 (1.25-2.59)	1.45 (0.98-1.99)	0.059
No	235	184	1	1	
Risk perception of COVID-19 virus					
High	104	44	1.77 (1.19-2.65)	**1.60 (1.04-2.46)***	**0.032**
Low	262	197	1	1	
Job satisfaction					
Satisfied	318	198	1	1	
Not satisfied	48	43	0.70 (0.44-1.09)	0.67 (0.42-1.08)	0.099
Perceived job stress					
Stressed	197	79	2.39 (1.70-3.35)	**2.15(1.50-3.08)***	**≤0.01**
Not stressed	169	162	1	1	

Keys: 1=reference category, AOR=adjusted odds ratio, CI= confidence interval, COR=crudes odds ratio, COVID-19= Corona virus disease 19, *= significant at $p < 0.05$ in multivariable logistic regression analysis, Hosmer and Lemeshow test $p = 0.650$.

Discussion

Poor sleep quality incurs substantial health, economic and societal costs. Understanding the magnitude and various factors linked to the ailment would help researchers identify viable therapies to improve sleep quality in vulnerable populations. The higher education work environment is characterized by a highly competitive work nature. The University teaching staff in addition to their normal teaching activities, handled various tasks including conducting and preparing research for publication, providing community services, and managing administrative positions. Furthermore, their regular teaching activities have shifted from face-to-face to online instruction during the COVID-19 pandemic, which has an impact on their sleep quality. Understanding the magnitude and investigating etiologies of the condition plays a paramount role to establish effective prevention and control strategies. To our knowledge, the current study is the first to assess the prevalence and risk factors of poor sleep quality among university academic staff in Ethiopia. The prevalence of poor sleep quality in the last one month was found to be 60.30% with 95% CI (56.28-64.21). Working for more than 10 hours per day, electronic device use before bedtime, high-risk perception of COVID-19 infection, and having job stress were factors positively associated with poor sleep quality in the current study.

Findings of two investigations from Brazil (57.9%) [76] and (61.3%) [12] supported the current data. This agreement could be due to the nature of tasks in the academic environments including roles related to teaching and research activities, which usually resemble in every higher academic institution. Participants in those nations might also be obliged to work in a substandard workplace in an unhealthy manner for prolonged periods, and fewer individuals are aware of sleep health and the effect of poor sleep quality. The other possible explanation might be due to study participants having a similar age group as compared to participants in those countries.

On the contrary, the current study had a higher magnitude of the risk of poor sleep quality compared to the studies conducted in Turkey (38.9%) [13] and Malaysia (45%) [77]. This difference might be due to the unstable socioeconomic status of the respondents in this study. The respondents in this study might attempt to compensate for their low salaries by teaching different shifts at multiple colleges and schools. This may lead to longer working hours because they start their daily work activities much earlier in the day and conclude their working day much later. The difference might be also due to the sample size variation; the previous studies were conducted among a small number of study participants compared to the number of participants in this study.

The other possible justifications for the difference might be the variation in the educational system, study setting, workload, and cultural differences between Ethiopia and those countries.

There were no study reports with a larger magnitude than the current finding. A possible reason for the increased magnitude of sleep problems in the current study could be due to the study period; we conducted the study during the early phase of the COVID-19 pandemic. Higher education institutions needed to look for alternate educational strategies to be adopted during the COVID-19 pandemic and the e-learning strategy emerged as an alternative solution to continue education. The educational institutions started using different educational platforms like Google classroom, Zoom, and Microsoft teams. Lecturers were subjected to excessive use of digital devices without breaks as they were shifted to online teaching. There has also been an increased digitalization for recreational purposes. Hence, it was noted as exposure to light emitted from digital devices has been interfering with the circadian regulation/melatonin rhythm [33, 78], which may lead to poor sleep quality.

In this study, long working hour per day (>10hrs/day) was significantly associated with poor sleep quality. The finding echoes the result of previous investigations [9, 79]. A possible justification for this report may be that employees with long working hours need more time to recover from work-induced fatigue [80]. However, long working hours reduce the amount of private time available to them, which may lead to sleep deprivation [81]. For recovery from fatigue, not only sleep but also relaxation, for example, spending time with family and friends, resting, or reading is needed, but long working hours may also reduce relaxation time [82]. Therefore, reduced private time for workers due to long working hours may lead to sleeplessness, and cause sleep disorders. In addition, due to the nature of their occupation, our study participants spend a lot of time working with computers and other electronic devices. Plausible investigations also confirmed that the utilization of electronic devices for a long period of time is associated with sleep disorders [33, 34].

Electronic device use before bedtime showed a significant association with poor sleep quality. Similar results were reported in other studies [83-85]. This could be reasoned as sleep quantity and quality are significantly reduced when people use digital devices for an extended period [86]. For example, cell phones, tablets, readers, computers, and laptops emit short-wavelength enriched light, which has been found to suppress or delay the normal generation of melatonin in the evening

and minimize feelings of sleepiness [87]. Moreover, workforces in a higher education context are often confronted with demanding responsibilities requiring work overload, long working hours, and stress, in addition to the COVID-19 pandemic difficulties in the world of education. Because of the pandemic, universities were forced to conduct all of their activities online, including in the current study setting, which increased the usage of electronic devices, contributing to or exacerbating poor sleep quality [88].

Our current study revealed a high-risk perception of COVID-19 infections was found to be a determinant factor of poor sleep quality. This finding is in concordance with other research reports [44, 89]. This could be explained as those people who thought they were at a higher risk of developing COVID-19 had more fear than those who thought they were at a lower risk. Fear and rumination were also found to be adversely related to sleep quality, indicating that fear of infection and rumination did lead to poor sleep quality during the pandemic, which contribute to poorer sleep quality both directly and indirectly by increasing fear [44]. Several researchers had examined the influence of the COVID-19 pandemic on mental health, concluding that persons who are fearful of becoming infected are more likely to develop sleeping disturbances [90].

Participants who reported having job stress were 2.38 times more likely to have poor sleep quality than those who did not have stress. The result is in agreement with results of the studies conducted in Brazil [76], Malaysia [9, 91], and Indonesia [92]. The plausible reason might be due to the linkages between sleep, stress regulation, and alteration in the hypothalamic-pituitary-adrenal axis implication of psychopathology and sleep-wake cycle. Job stress can lead to the release of an excessive level of glucocorticoids hormones like cortisol. A higher level of cortisol during stressful life events primes to sleep rhythm disruption that results in sleep deprivation [93, 94].

Conclusion

This study revealed that two-thirds of the participants had poor sleep quality during the COVID-19 pandemic, indicating a considerable prevalence of the condition. The finding highlights the importance of optimizing the working hours per day, minimizing electronic device use before bedtime, promoting risk perception toward COVID-19 infection, and developing workplace coping strategies for stress, which play a substantial role in minimizing poor sleep quality. We recommend future studies to account for different sectors such as telecommunication, healthcare,

transportation, etc. with interventional study design and objectively measuring sleep quality parameters.

Data availability statement

All the data generated in this study are included in this manuscript. The data sets used and analyzed to produce the current manuscript can be obtained from the corresponding author upon request via e-mail address of amensisahailu@gmail.com.

Ethics statements

Patient consent for publication

Consent obtained directly from patient (s).

Ethics approval and consent to participate

Ethical approval was secured from the Institutional Ethical Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (**Reference #: IPH/1425/2021**). The study followed the tenets of the Declaration of Helsinki and also complied with the ethical requirements set by the University of Gondar. Written informed consent was obtained from each respondent before commencing data collection after an explanation of the nature and possible consequences of the study. The information sheet that clearly shows the research topic, the objectives of the study, confidentiality of the participant's responses, the study benefits, and associated risks was prepared and presented. We removed any personal identifiers to assure confidentiality of the participants and only anonymous data were used for interpretations. Furthermore, since the data were collected during the COVID-19 pandemic, we implemented infection prevention protocols including social distancing and wearing of facemasks.

Abbreviations

AOR=Adjusted Odds Ratio; CI= Confidence Interval; COVID-19= Corona virus disease 19; COR= Crude Odds Ratio; ETB= Ethiopia Birr; OR= Odds Ratio; PSQI= Pittsburgh Sleep Quality Index, SD= Standard Deviation; SQ= Sleep Quality; STATA= Statistical software for data science

Conflicting interests

None declared.

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Author's contribution

AHT: Initiated the concept of the research, wrote up the research proposal, analyzed the data involved in the presentation and interpretation process of results and discussions, and drafted the manuscript document and the corresponding author. Author read and approved the final manuscript.

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Date of interview (DD/MM/YYYY:___/_____/_____
Questionnaire identification number_____
Name of the campus_____
Department_____

Part 1. Socio-demographic information			
Code	**Questions**	**Response (circle the appropriate option)**	**Skip**
101	What is your age?	_____years.	
102	What is your sex?	1. Female 2. Male	
103	What is your religion?	1. Orthodox Christian 2. Muslim 3. Protestant 4. Catholic 5. other (specify) _____	
104	What is your current marital status?	1. Married 2. Single 3. Divorced 4. Widowed 5. Separated	
105	What is your level of education?	1. Degree 2. Master 3. Ph.D. 4. Other (specify) _____	
106	Monthly salary in Ethiopia birr?	_____Ethiopian birr (ETB)	
107	Years of experience	_____(years)	

Part II. Poor sleep quality assessment (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleepduration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. What time have you usually gotten up in the morning? _____
4. A. How many hours of actual sleep did you get at night? _____
   B. How many hours were you in bed? _____

For each of the remaining questions, check the one best response. Please answer all questions. Mark "√" your best answers.

5. During the past month, how often have you had trouble sleeping because you	Not duringthe past month (0)	Less than once a week(1)	Once or twice a week (2)	Three or more times a week (3)
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				
I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
9. During the past month, how would you rate your sleep quality overall?	Very good(0)	Fairly good(1)	Fairly bad(2)	Very bad (3)

Scoring method of PSQI

Component 1	#9 Score	C1 ____
Component 2	#2 Score (<15min (0), 16-30min (1), 31-60 min (2), >60min (3))	
	+ #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3)	C2 ____
Component 3	#4 Score (>7(0), 6-7 (1), 5-6 (2), <5 (3)	C3 ____
Component 4	(total # of hours asleep) / (total # of hours in bed) x 100	
	>85%=0, 75%-84%=!, 65%-74%=2, <65%=3	C4 ____
Component 5	# sum of scores 5b to 5j (0=0; 1-9=1; 10-18=2; 19-27=3)	C5 ____
Component 6	#6 Score	C6 ____
Component 7	#7 Score + #8 score (0=0; 1-2=1; 3-4=2; 5-6=3)	C7 ____

***Add the seven component scores together*_____ *Global PSQI* _____

A total score of "5" or greater is indicative of poor sleep quality.

If you scored "5" or more, it is suggested that you discuss your sleep habits with a healthcare provider

Part III. Behavioral related characteristics			
Code	**Questions**	**Response code**	**Skip**
	Your weight in kilogram (kg)	_____kg	
	Your height in meter (m)	_____m	
	Working hours per day?	_____(Hours/day)	
401	Do you Smoke cigarette?	1. Yes 2. No	**If No skip to Q NO. 403**
402	If your answer is **yes** for question, number 401 how many cigarettes do you smoking per day?	_____sticks _____packet	
403	Do you consume any kind of alcohol at least twice per week?	1. Yes 2. No	
404	Do you experience of chewing khat in the past one month?	1. Yes 2. No	**If No skip to Q NO. 406**
405	If **yes** for question number 404, how frequently chew khat?	1. Daily. 2. Once during 2 or 3 days 3. Once in a week.	
	Do you have habit of doing any kind of physical exercise?	3. Yes 4. No	**If No skip to Q NO. 406**
	If **yes** for question number 404, how frequently doing physical exercise?	1. Daily. 2. Once in a week. 3. Two times per week 4. Three and above in a week	
	For how much you are doing the exercise?	_____minute	
408	Do you have a habit of taking break (after 1-2 hours of continuous work)?	1. Yes 2. No	**If No skip to Q NO. 410**
409	If the answer for question 408 is **'yes'**, for how many minute after work?	_____ minute	
413	Do you use/watch visual display technologies/terminals e.g. television, computer, tablet, smartphone etc. in bed before going to sleep?	1. Yes 2. No	**If No skip to Q NO. 415**
414	If question 413 '**yes**' mention electronic device you used frequently?	_____	
	What is average hours you used per day	_____hours./day	
417	Do you have medical history of systemic illness?	1. Yes 2. No	**If No skip to Q NO. 501**
418	If **'yes'** for question 421;	specify disease _____	
	Dou you doing high-loaded work?	1. Never 2. Sometimes 3. Always	

	How do you rate your relationship with your colleagues?	1. Very bad 2. Bad 3. Good 4. Very good	

Part VI: Risk perception of COVID-19 infection
(assuming no preventive measure)
605. How likely you will be infected? 1 = Very likely; 2 = Likely; 3 = Neutral; 4 = Unlikely; 5 = Very unlikely
606. How likely your families will be infected? 1 = Very likely; 2 = Likely; 3 = Neutral; 4 = Unlikely; 5 = Very unlikely
Perceived severity
607. Seriousness of symptoms caused by SARS-CoV-19 1 = Very serious; 2 = Serious; 3 = Neutral; 4 = Not serious; 5 = Not serious at all
608. Chance of having COVID-19 cured 1 = Very low; 2 = Low; 3 = Neutral; 4 = High; 5 = Very high
609. Chance of survival if infected with COVID-19. 1 = Very low; 2 = Low; 3 = Neutral; 4 = High; 5 = Very high

Part IV: Psychosocial factors

Questions to measure job stress (Q 401-408)

S. No	**Questions /variables**	**Job stress score**				
		Never	Rarely	Some times	Often	Very often
401	Conditions at work are unpleasant or sometimes even unsafe.	1	2	3	4	5
402	I feel that my job is negatively affecting my physical or emotional wellbeing	1	2	3	4	5
403	I have high loaded work to do and/or too many unreasonable deadlines.	1	2	3	4	5
404	I find it difficult to express my opinion or feelings about my jobconditions to my superiors.	1	2	3	4	5
405	I feel that job pressures interfere with my family or personal life.	1	2	3	4	5
406	I have adequate control or input over my work duties.	5	4	3	2	1

407	I receive appropriate recognition or rewards for good performance.	5	4	3	2	1
408	I am able to utilize my skills and talents to the fullest extent at work	5	4	3	2	1

Questions to measure job satisfaction (Q 409-418)

S. No	**Questions /variables**	**Job satisfaction score**				
		Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
409	I receive recognition for a job well done.	1	2	3	4	5
410	I feel close to the people at work.	1	2	3	4	5
411	I feel good about working at this company.	1	2	3	4	5
412	I feel secure about my job.	1	2	3	4	5
413	I believe management is concerned about me.	1	2	3	4	5
414	On the whole, I believe work is good for my physical health	1	2	3	4	5
415	My wages are good.	1	2	3	4	5
416	All my talents and skills are used at work.	1	2	3	4	5
417	I get along with my supervisors.	1	2	3	4	5
418	I feel good about my job	1	2	3	4	5

The End

Thank you

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 to 5
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6 to 7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*8 to 9*
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10
		(*b*) Describe any methods used to examine subgroups and interactions	10
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	11 to 13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14 to 15

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18 to 20
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19 Pandemic in Ethiopia: an institution-based cross-sectional study

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Abstract

Objective: This study was conducted to assess the prevalence and risk factors of poor sleep quality among the University of Gondar academic staff, Ethiopia.

Design: An institution-based cross-sectional study was conducted from March to April 2021. A validated self-administered, standardized Pittsburgh Sleep Quality Index was used to quantify the amount of self-reported poor sleep quality. The collected data were entered into EpiData version 4.6 and analyzed using STATA version 14 software. Binary logistic regressions were computed to determine the association between variables. The association was determined using an adjusted Odds ratio (AOR) with a 95% confidence interval (CI) at a p-value of < 0.05.

Setting: The study was conducted at the University of Gondar, Northwestern Ethiopia.

Participants: Six hundred and seven lecturers participated in this study.

Outcome measures: The primary outcome is the prevalence of poor sleep quality, which was measured using the Pittsburgh Sleep Quality Index (PSQI).

Results: Overall response rate was 95.60% (N = 607). The age of the participants ranges from 21 to 70 with a mean of 32.39 (SD ±6.80) years. The magnitude of poor sleep quality during the COVID-19 pandemic in the last month was 60.30% [95% CI (56.28%-64.21%)]. Working > 10 hours per day [AOR= 2.19, 95% CI (1.16, 4.27)], electronic device use before bedtime [AOR=1.53, 95% CI (1.04, 2.27)], high-risk perception of COVID-19 infections [AOR =1.60, 95% CI (1.04, 2.46)], and perceived job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] were risk factors for poor sleep quality.

Conclusion: The study revealed that the prevalence of poor sleep quality was high during the COVID-19 pandemic. The finding highlights the importance of optimizing the working hours per day, minimizing electronic device use before bedtime, promoting risk perception toward COVID-19 infection, and developing workplace coping strategies for stress, which play a substantial role in minimizing poor sleep quality.

Keywords: Sleep quality, Poor sleep, Academic staff, Lectures, COVID-19, Ethiopia

Strengths and limitations of this study

- The study has focused on one of the most potential groups affected by poor sleeping quality, particularly during COVID-19.
- This study is the first in its kind in exploring the magnitude and factors influencing poor sleep quality among academic staff in Ethiopia.
- Using the Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults.
- The study has limitations due to the cross-sectional nature of the data; it does not show a temporal relationship between independent variables and the outcome variable.
- The report of poor sleep quality may be underestimated or overstated because it relies on lecturers' subjective reports rather than objective measurements like actigraphy and polysomnography.

Background

Scholars describe sleep quality (SQ) as "one's perception that they fall asleep easily, sleep for a sufficient amount of time so that they wake up feeling rested, and can get through their day without experiencing excessive daytime sleepiness". An individual's subjective perception of his or her sleep can be evaluated using both subjective and objective methods [1]. The subjective method, Pittsburgh Sleep Quality Index (PSQI) is a widely used questionnaire to measure sleep quality [2]. General health and quality of life are directly correlated with sleep quality [3]. Sleep disorders involve problems with the quality, timing, duration, and amount of sleep [4]. Poor sleep quality is a global phenomenon, which leads to poor health, increased risk of mortality, hormonal and biochemical changes, higher health care costs, increased use of health resources, absenteeism, and increased risk of psychological morbidity and burnout [5, 6]. Poor SQ has been a typical occurrence among the various working population during the COVID-19 pandemic and is regarded as a public health crisis that frequently goes undetected, underreported, and has very large economic impacts [7, 8]. Teaching has been identified as a profession associated with a high risk of poor sleep quality [9-11]; however, little research has been conducted to quantify the prevalence and risk factors of poor sleep quality among university academic staff worldwide [12, 13].

Academic staffs are at a higher risk of poor SQ, burnout, depression, stress, and anxiety as a result of the current COVID-19 pandemic, which has serious consequences on occupational health both

now and in the future [14]. Likewise, the World Health Organization (WHO) has classified poor sleep quality as a public health issue that exacerbates the risk of disease and death [15]. Poor SQ also has significant economic consequences. In the USA, for example, the annual costs of poor sleep have been estimated to be as high as US$16 billion in healthcare costs and US$50 billion in lost productivity [16]. In Australia, the costs were estimated to be approximately US$1.8 billion for the health system and US$66.3 billion for financial loss and decreased well-being [17-19].

The prevalence of poor sleep quality was increased during the COVID-19 period.[20]. A couple of studies from Brazilian [12, 21], documented that 61.3% and 44.2% of university academic staff reported poor sleep quality. Scientific investigation showed that four out of ten people do not get enough sleep, and one in five sleeps poorly most nights, making poor sleep the second most common health complaint after pain [22, 23]. According to a study done in Iran [24], 79.6% (n=133) of university staff reported having poor sleep quality. A similar finding was also found in a study conducted in Thailand [25], where 78.3% of respondents experienced poor sleep quality. So far, epidemiological data from Turkey indicated that 55.1% of adults had poor sleep quality [20]. In Ethiopia, the pooled prevalence of poor sleep quality was 53% among general populations and university students, with incidences ranging from 26% to 66.2% [26]. However, studies on sleep quality, particularly among university academic staff, are lacking.

Recent research shows that during the COVID-19 pandemic, sleep quality was impaired and the prevalence of poor sleep increased in both the working and general population [27-29]. Furthermore, the global COVID-19 pandemic has compelled higher education institutions, including Ethiopian universities, to shift from face-to-face to online instruction, which has an impact on sleep quality [30-32]. Prolonged use of computers, coupled with the brightness of the light that they project onto the retina, are factors that are thought to trigger changes in sleep patterns [33]. The light emitted from computers is in close proximity to the retina [34]. This emitted optical radiation at short wavelengths is close to the peak sensitivity of melatonin suppression [33]. Academic staff members used computers more frequently during the COVID-19 outbreak, which may have increased their exposure to computer light and led them to poor sleep quality, and negatively affected their quality of sleep [35]. Moreover, poor sleep quality has been correlated to old age, low economic status, substance use, obesity, use of an electronic device before bedtime, higher risks of contracting COVID-19 at work, workload, and job stress [36-44].

Given the widespread and harmful consequences of poor sleep quality, it needs to be a top priority for public and occupational health. As previously stated, a thorough review of the literature revealed that even less is known about the prevalence and factors of poor sleep quality among academic staff and other university personnel in developing countries including Ethiopia [45].The number of universities in Ethiopia is increasing, which is accompanied by an increase in academic staff workforces. However, the lack of reliable and up-to-date data on mental health, especially on sleep quality, makes it difficult for officials to plan for prevention and control measures. Therefore, in the current study, we aimed to assess the prevalence and associated factors of poor sleep quality among academic staff at the University of Gondar, Northwest Ethiopia.

Methods and materials

Study design, Period, and Setting

An institution-based cross-sectional study was conducted between March 17 to April 17, 2021. The research was carried out at the University of Gondar, which is situated in the oldest and most ancient city of Gondar , Northwestern Ethiopia, which is 737 kilometers far from Addis Ababa, the capital city of Ethiopia [46]. The College of Medicine and Health Sciences, Comprehensive Specialized Referral Hospital (CMHS), Maraki, Atse Tewdros, Atse Fasil, and Teda are the university's five campuses [47]. On all campuses, there were 2,858 academic staff members throughout the research period.

Study participants

The source population was the whole faculty members of the University of Gondar. The study population, however, consisted of a random sample of academic personnel from each campus. Academic personnel on critical illness, maternity leave, or sabbatical leave and individuals diagnosed with sleep-related disorders were excluded, while academic staff with at least one year of teaching experience and who were available throughout data collection were included.

Sample size determination and sampling procedure

The sample size was calculated by using a single population proportion formula [48] by considering the following statistical assumptions:

Confidence level (Cl) of 95%

Proportion = 50% (no previous study in the study area)

Margin of error of 5%

Using the following single proportion formula:

$n = (Z\alpha/_2)^2 \frac{[p\ (1-p)]}{d^2}$ where:

n = initial sample size,

Z = 1.96, the corresponding Z-score for the 95% CI

P = Proportion = 50%

d = Margin of error = 5% = 0.05

$n = (1.96)^2 \frac{[0.5\ (1-0.5)]}{0.05^2}$ =384

The final sample size was 635 people, after taking into account a 10% non-response rate and a design effect of 1.5 because, in the absence of prior literature, a design effect of 1.5 to 2.0 is endorsed [49]. We employed a stratified sampling technique to select participants from the five campuses of the University of Gondar. A proportional allocation for each stratum defined how many sample points were needed. Thus, there were a total of 1027 academic staff members in the College of Medicine and Health Sciences (N1=1027), 630 academic staff members on Maraki campus (N2=630), 509 academic staff members on Tewdros campus (N3=509), 536 academic staff members on the Fasil campus (N4=536), and 156 academic staff members on the Teda campus (N5=156). Consequently, the numbers of participants from each campus were 228, 140, 119, 113, and 35 from the College of Medicine and Health Sciences, Maraki, Fasil, Tewodros, and Teda campuses, respectively. The requisite sample sizes were then determined using a simple random sampling technique, and academic staff members from each stratum were randomly assigned using the OpenEpi random software version 3.

Variable measurement and definition of terms

Poor sleep quality: The Pittsburgh Sleep Quality Index (PSQI), a 19-item self-assessment of sleep quality, was used to measure academicians' poor sleep quality. The tool was free to use and designed to measure the outcome variable in the past month. It has a diagnostic sensitivity of 89.6% and a specificity of 86.5% at greater than five cutoff values for identifying cases with sleep disorders [50]. PSQI consists of 7 component scores (ranging from 0 to 3), measuring subjective

sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The 7 component scores are summed to give a global PSQI score ranging from 0 to 21. A global PSQI score of greater than 5 indicates poor sleep quality [33, 51].

Body mass index (BMI): weight in kilograms divided by the square of the height in meters (kg/m^2) categorized as underweight = BMI < 18.5, normal (health) = BMI 18.5– 24.9, overweight = BMI 25.0–29.9 =, and obese = BMI ≥ 30.0 [52].

Alcohol drinker: a scholar who drinks alcohol of any kind at least twice each week [53]

Cigarette smoker: a scholar with a daily consumption of at least one stick of cigarettes [54].

Khat chewer: a scholar who had chewed khat in the previous month [42].

Doing physical exercise: doing any type of physical activity at least twice a week for at least 30 minutes [55].

Electronic device use: if the participant utilizes/ watches at least one of the following: television, computer, tablet, or mobile phone in bed before going to sleep [56].

Chronic illness: illnesses such as asthma, diabetes mellitus, stroke, kidney stone, hypertension that can be managed, but cannot be cured and have a greater risk of developing a poor quality of sleep, [57].

Risk perception of COVID-19 infection: was assessed by two psychological dimensions; perceived susceptibility and perceived severity. The first dimension was proxied by how likely one considered oneself (his/her family) would be infected with COVID-19 if no preventive measures will be taken. The second dimension was proxied by how one rated the seriousness of symptoms caused by COVID-19, their perceived chance of having COVID-19 cured and that of survival if infected with COVID-19. By combining the two dimensions, five items with five response options were asked to determine the respondents' levels of risk perception, with a higher total score indicating a high perceived risk of COVID-19 infection [58].

Job satisfaction: the total score of at least 32 on the general job satisfaction scale [59].

Perceived job stress: a score of at least 21 on the workplace-stress scale [60].

Data Collection Tools and Procedures

Data were collected through a validated self-administered standardized structured questionnaire. The questionnaire was adapted after an extensive review of related literature and similar study tools [12, 42, 57, 61-63]. The questionnaire embraces three sections containing different items. The first section, socio-demographic characteristics, assesses information on age, sex, religion, educational status, working experience, and monthly salary. The second element of the questionnaire hugs information on poor sleep quality, which was assessed by using the PSQI, which is a measure of sleep disturbance for the period of 1-month immediately preceding the time of administration. PSQI is an effective and the most widely used instrument in diagnosis of sleep disorders in different populations [9, 64]. The tool is easy to understand, patient compliant and requires about 5 min to be completed. 10]. The PSQI contains 19 items and 7 clinically important components in relation to sleep difficulties: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. The total PSQI score was calculated by summing up the seven component scores as cited in [50]. Scoring of the answers is based on a 0 to 3 scale, whereby 3 reflects the negative extreme on the Likert scale, as well a global score of between 0 and 21. Individuals scoring a global score of greater than 5 were deemed poor sleep quality [65]. The PSQI has been validated in many languages with acceptable psychometric properties [66] and is frequently used in clinical and research settings [67]. The PSQ has also been validated as reliable for use in Ethiopian community [51]. The PSQI's validity was supported by a comprehensive test used to diagnose sleep disorders like polysomnographic findings [68, 69]. The PSQI has a sensitivity of 89.6% and specificity of 86.5% for identifying cases with sleep disorder, using a cut-off score of 5 [50]. The last part of the questionnaire includes information used to assess behavioral factors and psychosocial factors like cigarette smoking (yes/no), BMI (kg/m2), physical activity (yes/no), alcohol consumption (yes/no), use of an electronic device before bedtime (yes/no), history of chronic illness (yes/no), risk perception of COVID-19, job satisfaction, job stress, and workload.

Risk perception regarding COVID-19 in this study was measured by using two psychological dimensions; perceived susceptibility and perceived severity. The first dimension (perceived susceptibility) contains two questions; including how likely they will be infected with COVID-19 and how likely one considered oneself (his/her family) would be infected with COVID-19 if no preventive measures will be taken. Responses of the two questions were rated on a 5-point Likert scale (ranging from 1 = very likely to 5 = very unlikely). The second dimension (perceived

severity) contains three questions; including how one rated the seriousness of symptoms caused by COVID-19, their perceived chance of having COVID-19 cured, and that of survival if infected with COVID-19. Responses of the three questions were rated on a 5-point Likert scale (ranging from 1 = Very serious /Very low to 5 = Not serious at all/Very high). By combining the two dimensions, making five questions each answered on a Likert scale of 1 to 5 giving rise to a total score ranging from 5 to 25. The higher the score, the higher the risk perception of COVID-19 infection [70]. We used the 10-item generic job satisfaction scale questionnaire to measure academicians' job satisfaction [59]. The scale comprised ten questions ranging from 1 to 5 each item and ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, according to their occurrence respectively, in 1 month before the survey. The scale had 10 items with a rating of 1 to 5, and the responses ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, depending on how frequently they occurred in the month before to the survey and then summing up all 10 items. The scale produced a single ranking, with high scores indicated higher job satisfaction vice versa. Perceived job-related stress of the participants was collected using the 8-item workplace stress scale questionnaire [60]. The scale comprised eight questions ranging from 1 to 5 each item and ranged from never, rarely, sometimes, often and very often, according to their occurrence respectively, in 1 month before the survey. The 8- item workplace stress scores are obtained by reversing scores on three positive items, e.g. 5 = 1, 4 = 2, 3 = 3, etc., and then summing up all 8 items. Items 6, 7 and 8 are positive items. The scale produced a single ranking, with high scores indicated higher stress levels and vice versa. The instruments used in the current study have been employed in previous studies conducted in the country's context [71-74].

Data quality control

To maintain uniformity, the questionnaire was initially created in English, translated into the local tongue of Amharic, and then translated back to English. Following appropriate training and orientation, three BSc nurses and MPH Environmental health specialist who were employed at the comprehensive specialized hospital of the University of Gondar participated in data collection. The data collectors and supervisor took the orientation on issues relating to the clarity of the questions, objectives of the study, confidentiality of information, the voluntary involvement (consent) participants in the study, and on time of data collection as study participants' regular duties should not be compromised. Both data collectors and supervisors were under the lead investigator's supervision. The pre-test was carried out at Teda Health Sciences College in Gondar

city on 5% (31) of the sample size to ensure the validity and reliability of the questionnaire, yet the College was not included in the final survey. Based on the results of the pretest analysis, various modifications were made including the clarification of a few ambiguities and misinterpretations, and an estimation of how long the data gathering process would take. Feedback was provided by discussing any issue that arose during data collection with the primary investigator, the supervisor, and the data collectors.

Data processing and analysis

Data were entered into Epi-data version 4.6 after being verified as complete and exported to STATA version 14 for additional analysis. We used descriptive statistics, narration, tabulation, and graphics to present the findings. Prior to doing bivariable and multivariable binary logistic regression analyses, the variables' normality, outliers, and multicollinearity were examined. A variance inflation factor (VIF) was used to test the multicollinearity assumption, and all variables displayed values of less than 5. As a result, multicollinearity was not observed to exist. Also, the reliability of the questionnaire was tested using Cronbach's Alpha and found a reliable Cronbach's Alpha = 0.79, and therefore the questionnaire was tolerable for its consistency in repeating what had previously been measured using the tool [51]. Additionally, Cronbach's Alpha was used to examine the questionnaire's reliability, and the reliability Cronbach's Alpha value was 0.79. As a result, the questionnaire was deemed satisfactory for its consistency in reproducing what had previously been measured using the instrument. A binary logistic regression was used to compute the relationship between the variables. To control the effects of potential confounders, variables with p-values of 0.2 in the bivariable logistic regression analysis were exported to a multivariable logistic regression. Last but not least, in the multivariable binary logistic regression model, statistically significant variables were established at a p-value of 0.05, and an adjusted odds ratio (AOR) with a confidence interval of 95% was provided to quantify the strength of the association. The Hosmer-Lemeshow test was used to determine the final model's goodness of fit, and the results revealed a good fit (p=0.65) [75].

Patient and public involvement statement

University lecturers were participated in this investigation by contributing useful information. However, they have never been involved in the study design, protocol, data collection tools, and reporting and disseminating the findings.

Results

Socio-demographic characteristics of study participants

A total of 635 questionnaires were distributed, giving a response rate of 95.59% (N = 607). The age of the participants ranged from 21 to 70, with a mean (±SD) of 32.39 (±6.80) years old. Moreover, more than two-thirds of the participants were male (71.83%), and the majority of them, 362 (59.64%), indicated that they were married. Regarding educational status, 416(68.53%) of the participants had master's degree. The participants' median estimated (interquartile range (IQR) monthly income was 11305 (10700-13600) Ethiopian Birr (ETB) (**Table 1**).

Table 1: Socio-demographic characteristics of academic staff in University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Sex		
Male	436	71.83
Female	171	28.17
Age (years)		
21-29	226	37.23
30-39	301	49.59
≥40	80	13.18
Religion		
Orthodox	486	80.07
Muslim	69	11.37
Protestant	52	8.57
Marital status		
Single	245	40.36
Married	362	59.64
Educational status		
Bachelor	94	15.49
Master	416	68.53
Ph.D.	97	15.98
Work experience in years		

≤5	167	27.51
6-10	249	41.02
>10	191	31.47
Monthly salary (ETB)		
<10 000	99	16.31
10 000-13 000	331	54.53
>13 000	177	29.16

Key: ETB= Ethiopian Birr (currency)

Behavioral and psychosocial characteristics of study participants

Four hundred fourteen (68.20%) of the participants were working between 6 and 10 hours per day, and 79 (13.11%) participants were working more than 10 hours per day. Of the study participants, the number of respondents who admitted to smoking cigarettes was 108 (17.79%). While 112 (18.45) said they had alcohol drinking habits, over one-third (33.28%) of respondents were performing physical exercise at least twice a week. The majority of the respondents, 434 (71.5%), had a normal (18.5-24.9 kg/m2) BMI, while 48 (7.91%) of them were underweight (>18.5 kg/m2) BMI. Out of the study participants, 188 (30.97%) of them clarified that they had a chronic illness, and almost half (51.24%) of the study participants have used an electronic device before bedtime. Regarding psychosocial characteristics, nearly one-fourth (24.38%) of the respondents had high-risk perceptions of the COVID-19 virus. Moreover, 516 (85.01%) respondents supposed they were satisfied with their jobs. Furthermore, when asked whether they felt stressed out by their work, 276 respondents (45.47 %) said they did (**Table 2**).

Table 2: Behavioral and psychosocial characteristics of academic staff in the University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Working hours per day		
≤5hr	114	18.78
6-10hr	414	68.20
>10hr	79	13.01
Cigarette smoker		
Yes	108	17.79
No	499	82.21

Alcohol consumption habit		
Yes	112	18.45
No	495	81.55
Khat chewing behavior		
Yes	19	3.13
No	588	96.87
Physical exercise		
Yes	202	33.28
No	405	66.72
Body mass index (BMI)		
Underweight	48	7.91
Normal	434	71.50
Overweight and obese	125	20.59
Chronic Illness		
Yes	188	30.97
No	419	69.03
The habit of taking breaks		
Yes	329	54.20
No	278	45.80
Electronic device use		
Yes	311	51.24
No	296	48.76
Duration of electronic device use		
≤3hrs/day	127	40.84
>hrs/day	184	59.16
Risk perception towards COVID-19 virus		
High	148	24.38
Low	459	75.62
Colleagues relationship		
Good	539	88.80
Poor	68	11.20
Job satisfaction		
Satisfied	516	85.01
Not satisfied	91	14.99

Perceived job stress		
Stressed	276	45.47
Not stressed	331	54.53
Workload		
Yes	506	83.36
No	101	16.64

Prevalence of poor sleep quality and its components scores

The mean global score of PSQI (computed using the component scores) was 6.80, 95% CI (6.55, 7.04). The result of this study revealed that 60.30% (95% CI, 56.28%-64.21%) of academicians were classified as having poor sleep quality. Seven components of sleep quality in the present study were assessed and the components identified their sleep status. Accordingly, 514 (84.68%) of the academicians had fairly good to very good sleep perception. From the total study participants, 342 (56.34%) had mild difficulty in falling asleep (PSQI latency). Regarding sleeping duration, only 165 (27.18%) of the respondents had more than 7 hours of sleep per night, and 326 (53.71%) had a very high habitual sleep efficiency (>85%). Moreover, most (66.39%) of academicians reported that they had mild difficulty in the PSQI disturbance domain and only 39 (6.42%) of them used sleep medication to sleep during the past month. Furthermore, 196 (32.29%) of them had mild to severe difficulty in PSQI day dysfunction due to sleepiness in the past month (**Table 3**).

Table 3: Poor sleep quality and its components scores of academic staff in the University of Gondar, Ethiopia, 2021 (N=607).

Variables	Frequency (n)	Percent (%)
Sleep perception		
Very good	265	43.66
Fairly good	249	41.02
Fairly bad	80	13.18
Very bad	13	2.14
Sleep latency (falling asleep)		
0 to 15minutes (0)	27	4.45
16 to 30 minutes (1)	342	56.34

31 to 60 minutes (2)	161	26.52
>60 minutes (3)	77	12.69
Sleep duration		
>7hrs (0)	165	27.18
6h to 7hrs (1)	148	24.38
< 6hrs (2 & 3)	294	48.43
Sleep efficiency		
>85% (0)	326	53.71
75% to 84% (1)	143	23.56
65% to 74% (2)	60	9.88
<65% (3)	78	12.85
Sleep disturbance		
Never (0)	116	19.11
1 time a week (1)	403	66.39
1–2 times a week (2)	84	13.84
≥3 times a week (3)	4	0.66
Used sleep medication		
Never (0)	568	93.57
1 time a week (1)	27	4.45
1–2 times a week (2)	7	1.15
≥3 times a week (3)	5	0.82
Daytime dysfunction		
No problem (0)	411	67.71
1 time a week (1)	143	23.56
1–2 times a week (2)	44	7.25
≥3 times a week (3)	9	1.48
Total score of poor sleep quality		
≤ 5 (Good sleep quality)	241	39.70
> 5 (Poor sleep quality)	366	60.30

Key: 0= No difficulty, 1=Mild difficulty, 2=Moderate difficulty, 3=Sever difficulty

Factors associated with poor sleep quality

In the bivariable binary logistic regression analysis, sex (p-value of 0.124), educational status (p-value of 0.179), working hours per day (p-value of 0.003), khat chewing (p-value of 0.042), not

perform physical activities (p-value of 0.122), electronic devise use (p-value of 0.004), chronic illness (p-value of 0.002), risk perception towards COVID-19 virus (p-value of 0.005), job dissatisfaction (p-value of 0.112), and perceived job stress (p-value of ≤0.001) were the factors associated with poor sleep quality. However, after controlling for confounding variables in the multivariable binary logistic regression analysis, only working hours per day, electronic device use before bedtime, risk perception towards COVID-19 infection, and perceived job stress remained to have a significant association with poor sleep quality.

The probability of developing poor sleep quality was 2.19 times greater in employees who worked more than 10 hours per day compared to those who worked for 5 hours or less per day [AOR= 2.19, 95% CI (1.16, 4.27)] at a p-value of 0.019. Similarly, participants who use electronic devices before bedtime were 1.53 times more likely to experience poor sleep quality compared to who didn't use electronic devices before bedtime counterparts [AOR=1.53, 95% CI (1.04, 2.27)] at a p-value of 0.031. Moreover, the odds of having poor sleep quality were 1.60 times more likely among workers who had a high-risk perception of COVID-19 infection than among those who had a low-risk perception about it [AOR =1.60, 95% CI (1.04, 2.46)] at a p-value of 0.032. Finally, the chances of suffering from poor sleep quality among academicians who had perceived job stress were 2.15 times higher as compared to those who had no job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] at a p-value of ≤0.01 as shown in **Table 4.**

Table 4: Bivariable and multivariable logistic regression analysis of factors associated with poor sleep quality among academic staff, University of Gondar, Ethiopia, 2021 (N=607).

Variables	Poor sleep quality		COR with 95% CI	AOR with 95% CI	P-value
	Yes	No			
Sex					
Male	256	180	1	1	
Female	110	61	1.27 (0.88-1.83)	1.42 (.94-2.13)	0.091
Educational status					
Bachelor	62	32	1	1	
Master	243	173	0.72 (0. 45-1.16)	0.74 (0.44-1.23)	0.245
Ph.D.	61	36	0.87 (0. 48-1.58)	0.87 (0.46-1.65)	0.674
Working hours per day					
≤5hr	59	55	1	1	

6-10hr	249	165	1.41 (0.93- 2.13)	1.10 (0.76-1.85)	0.679
>10hr	58	21	2.57 (1.39-4.78)	**2.19 (1.16-4.27)***	**0.019**
Khat chewing					
Yes	16	3	3.63 (1.05-12.58)	3.00 (0.82-11.00)	0.097
No	350	238	1	1	
Physical exercise					
Yes	113	89	1	1	
No	253	152	1.31 (0.93-1.85)	1.40 (0.97-2.03)	0.068
Electronic device use					
Yes	205	106	1.62 (1.17-2.25)	**1.53 (1.04-2.27)***	**0.031**
No	161	135	1	1	
Chronic Illness					
Yes	131	57	1.80 (1.25-2.59)	1.45 (0.98-1.99)	0.059
No	235	184	1	1	
Risk perception of COVID-19 virus					
High	104	44	1.77 (1.19-2.65)	**1.60 (1.04-2.46)***	**0.032**
Low	262	197	1	1	
Job satisfaction					
Satisfied	318	198	1	1	
Not satisfied	48	43	0.70 (0.44-1.09)	0.67 (0.42-1.08)	0.099
Perceived job stress					
Stressed	197	79	2.39 (1.70-3.35)	**2.15(1.50-3.08)***	**≤0.01**
Not stressed	169	162	1	1	

Keys: 1=reference category, AOR=adjusted odds ratio, CI= confidence interval, COR=crudes odds ratio, COVID-19= Corona virus disease 19, *= significant at $p < 0.05$ in multivariable logistic regression analysis, Hosmer and Lemeshow test $p = 0.650$.

Discussion

Poor sleep quality incurs substantial health, economic and societal costs. Understanding the magnitude and various factors linked to the ailment would help researchers identify viable therapies to improve sleep quality in vulnerable populations. The higher education work environment is characterized by a highly competitive work nature. The University teaching staff in addition to their normal teaching activities, handled various tasks including conducting and preparing research for publication, providing community services, and managing administrative

positions. Furthermore, their regular teaching activities have shifted from face-to-face to online instruction during the COVID-19 pandemic, which has an impact on their sleep quality. Understanding the magnitude and investigating etiologies of the condition plays a paramount role to establish effective prevention and control strategies. To our knowledge, the current study is the first to assess the prevalence and risk factors of poor sleep quality among university academic staff in Ethiopia. The prevalence of poor sleep quality in the last one month was found to be 60.30% with 95% CI (56.28-64.21). Working for more than 10 hours per day, electronic device use before bedtime, high-risk perception of COVID-19 infection, and having job stress were factors positively associated with poor sleep quality in the current study.

Results of two investigations conducted in Brazil (57.9%) [76] and (61.3%) [12] supported the current data. This agreement could be due to the nature of tasks in the academic environments including roles related to teaching and research activities, which usually resemble in every higher academic institution. Participants in those nations might also be obliged to work in a substandard workplace in an unhealthy manner for prolonged periods, and fewer individuals are aware of sleep health and the effect of poor sleep quality. The other possible explanation might be due to study participants having a similar age group as compared to participants in those countries.

On the contrary, the current study had a higher magnitude of the risk of poor sleep quality compared to the studies conducted in Turkey (38.9%) [13] and Malaysia (45%) [77]. This difference might be due to the unstable socioeconomic status of the respondents in this study. The respondents in this study might attempt to compensate for their low salaries by teaching different shifts at multiple colleges and schools. This may lead to longer working hours because they start their daily work activities much earlier in the day and conclude their working day much later. The difference might be also due to the sample size variation; the previous studies were conducted among a small number of study participants compared to the number of participants in this study. The other possible justifications for the difference might be the variation in the educational system, study setting, workload, and cultural differences between Ethiopia and those countries.

There were no study reports with a larger magnitude than the current finding. A possible reason for the increased magnitude of sleep problems in the current study could be due to the study period; we conducted the study during the early phase of the COVID-19 pandemic. Higher education institutions needed to look for alternate educational strategies to be adopted during the COVID-19

pandemic and the e-learning strategy emerged as an alternative solution to continue education. The educational institutions started using different educational platforms like Google classroom, Zoom, and Microsoft teams. Lecturers were subjected to excessive use of digital devices without breaks as they were shifted to online teaching. There has also been an increased digitalization for recreational purposes. Hence, it was noted as exposure to light emitted from digital devices has been interfering with the circadian regulation/melatonin rhythm [33, 78], which may lead to poor sleep quality.

In this study, long working hour per day (>10hrs/day) was significantly associated with poor sleep quality. The finding echoes the result of previous investigations [9, 79]. A possible justification for this report may be that employees with long working hours need more time to recover from work-induced fatigue [80]. However, long working hours reduce the amount of private time available to them, which may lead to sleep deprivation [81]. For recovery from fatigue, not only sleep but also relaxation, for example, spending time with family and friends, resting, or reading is needed, but long working hours may also reduce relaxation time [82]. Therefore, reduced private time for workers due to long working hours may lead to sleeplessness, and cause sleep disorders. In addition, due to the nature of their occupation, our study participants spend a lot of time working with computers and other electronic devices. Plausible investigations also confirmed that the utilization of electronic devices for a long period of time is associated with sleep disorders [33, 34].

Electronic device use before bedtime showed a significant association with poor sleep quality. Similar results were reported in other studies [83-85]. This could be reasoned as sleep quantity and quality are significantly reduced when people use digital devices for an extended period [86]. For example, cell phones, tablets, readers, computers, and laptops emit short-wavelength enriched light, which has been found to suppress or delay the normal generation of melatonin in the evening and minimize feelings of sleepiness [87]. Moreover, workforces in a higher education context are often confronted with demanding responsibilities requiring work overload, long working hours, and stress, in addition to the COVID-19 pandemic difficulties in the world of education. Because of the pandemic, universities were forced to conduct all of their activities online, including in the current study setting, which increased the usage of electronic devices, contributing to or exacerbating poor sleep quality [88].

Our current study revealed a high-risk perception of COVID-19 infections was found to be a determinant factor of poor sleep quality. This finding is in concordance with other research reports [44, 89]. This could be explained as those people who thought they were at a higher risk of developing COVID-19 had more fear than those who thought they were at a lower risk. Fear and rumination were also found to be adversely related to sleep quality, indicating that fear of infection and rumination did lead to poor sleep quality during the pandemic, which contribute to poorer sleep quality both directly and indirectly by increasing fear [44]. Several researchers had examined the influence of the COVID-19 pandemic on mental health, concluding that persons who are fearful of becoming infected are more likely to develop sleeping disturbances [90].

Participants who reported having job stress were 2.38 times more likely to have poor sleep quality than those who did not have stress. The result is in agreement with results of the studies conducted in Brazil [76], Malaysia [9, 91], and Indonesia [92]. The plausible reason might be due to the linkages between sleep, stress regulation, and alteration in the hypothalamic-pituitary-adrenal axis implication of psychopathology and sleep-wake cycle. Job stress can lead to the release of an excessive level of glucocorticoids hormones like cortisol. A higher level of cortisol during stressful life events primes to sleep rhythm disruption that results in sleep deprivation [93, 94].

This study is the first of its kind to examine the magnitude and factors influencing poor sleep quality among academic staff in Ethiopia, who are more likely to suffer from sleep disturbances, particularly during the COVID-19 pandemic. Nevertheless, there are few studies published in the scientific literature that address the prevalence and risk factors of sleep quality problems in higher education employees. This study would likely contribute significant evidence to literature regarding prevalence and the factors influencing occurrences of sleep problems. As part of this study, the following limitations should be considered while interpretation. First, the study was based on a cross-sectional study design which hinders the temporal relationship between the outcome of interest (poor sleep quality) and factors influencing its occurrences. Second, the study was based on participant's self-reported data. As a result, underestimation of the condition due to recall bias may be expected. Moreover, participants' responses may also be susceptible to social desirability bias, which leads them to give answers that are socially acceptable. To decrease social desirability, however, precautions were taken by making sure that only study participants were present during data collection and that data confidentiality was upheld. Finally, the finding was not supported by clinical diagnoses, like actigraphy and polysomnography testing that help to

identify sleep disorders objectively. However, we made use of the validated Pittsburgh Sleep Quality Index (PSQI) questionnaire, which is a standardized instrument used to measure the quality and patterns of sleep in adults.

Conclusion

This study revealed that two-thirds of the participants had poor sleep quality during the COVID-19 pandemic, indicating a considerable prevalence of the condition. The finding highlights the importance of optimizing the working hours per day, minimizing electronic device use before bedtime, promoting risk perception toward COVID-19 infection, and developing workplace coping strategies for stress, which play a substantial role in minimizing poor sleep quality. We recommend future studies to account for different sectors such as telecommunication, healthcare, transportation, etc. with an interventional study design and objectively measure sleep quality parameters.

Data availability statement

All the data generated in this study are included in this manuscript. The data sets used and analyzed to produce the current manuscript can be obtained from the corresponding author upon request via e-mail address of amensisahailu@gmail.com.

Ethics statements

Patient consent for publication

Consent obtained directly from patient (s).

Ethics approval and consent to participate

Ethical approval was secured from the Institutional Ethical Review Board (IRB) of the University of Gondar, College of Medicine and Health Sciences, Institute of Public Health (**Reference #: IPH/1425/2021**). The study followed the tenets of the Declaration of Helsinki and also complied with the ethical requirements set by the University of Gondar. Written informed consent was obtained from each respondent before commencing data collection after an explanation of the nature and possible consequences of the study. The information sheet that clearly shows the research topic, the objectives of the study, confidentiality of the participant's responses, the study benefits, and associated risks was prepared and presented. We removed any personal identifiers to assure confidentiality of the participants and only anonymous data were used for interpretations.

Furthermore, since the data were collected during the COVID-19 pandemic, we implemented infection prevention protocols including social distancing and wearing of facemasks.

Abbreviations

AOR=Adjusted Odds Ratio; CI= Confidence Interval; COVID-19= Corona virus disease 19; COR= Crude Odds Ratio; ETB= Ethiopia Birr; OR= Odds Ratio; PSQI= Pittsburgh Sleep Quality Index, SD= Standard Deviation; SQ= Sleep Quality; STATA= Statistical software for data science

Conflicting interests

None declared.

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Author's contribution

AHT: Initiated the research concept, wrote up the research proposal, analyzed the data, presented the results and discussions, wrote up of the draft manuscript, reviewed and finalized the manuscript document, and is the corresponding author. **MA:** Involved in presentation and interpretation process of results and discussions, and reviewed the final drafted manuscript document. **GA:** Involved in presentation and interpretation process of results and discussions, and reviewed the final drafted manuscript document. **GGK:** Involved in presentation and interpretation process of results and discussions, and reviewed the drafted manuscript document. All the authors read and approved the final manuscript.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 to 5
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6 to 7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*8 to 9*
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10
		(*b*) Describe any methods used to examine subgroups and interactions	10
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	11 to 13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14 to 15

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	3
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18 to 20
Generalisability	21	Discuss the generalisability (external validity) of the study results	
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.