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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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3 1 **Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19**
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5 2 **Pandemic in Ethiopia: an institution-based cross-sectional study**
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23 Abstract

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

26 **Design:** An institution-based cross-sectional study design was employed from March to April
27 2021. Self-reported poor sleep quality was measured using self-administered Pittsburgh Sleep
28 Quality Index. The collected data were entered into EpiData version 4.6 and analyzed using
29 STATA version 14 software. Binary logistic regressions were computed to determine the
30 association between variables. The association was ascertained using an adjusted Odds ratio
31 (AOR) with a 95% confidence interval (CI) at a p-value of < 0.05.

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

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

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

36 **Results:** Overall response rate was 95.60% (N = 607). Age ranges from 21 to 70 with a mean of
37 32.39 (SD ±6.80) years. The magnitude of poor sleep quality during the last month was 60.30%
38 (95% CI, 56.28%-64.21%). Working > 10 hours per day [AOR= 2.19, 95% CI (1.16, 4.27)],
39 electronic device use before bedtime [AOR=1.53, 95% CI (1.04, 2.27)], high risk perception of
40 COVID-19 infections [AOR =1.60, 95% CI (1.04, 2.46)], and perceived job stress [AOR = 2.15
41 (95% CI, (1.50, 3.08))] were risk factors for poor sleep quality.

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

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

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51 **Strengths and limitations of this study**

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

64 **Background**

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

74 Academic staffs are at a higher risk of poor sleep quality, burnout, depression, stress, and anxiety
75 as a result of the current COVID-19 pandemic, which has serious consequences for occupational
76 health both now and in the future [9]. Likewise, the World Health Organization (WHO) has
77 classified poor sleep quality as a public health issue that exacerbates the risk of disease and death
78 [10]. Recent research shows that during the pandemic, sleep quality was impaired and the
79 prevalence of poor sleep increased in both the working and general population [11-13].
80 Furthermore, the global COVID-19 pandemic has compelled higher education institutions,

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3 81 including Ethiopian universities, to shift from face-to-face to online instruction, which has an
4 82 impact on sleep quality [14-16]. For example, during the COVID-19 pandemic, 44.2% of
5 83 Brazilian university academic staff reported poor sleep quality [17]. Moreover, four out of ten
6 84 people do not get enough sleep, and one in five sleep poorly most nights, making poor sleep the
7 85 second most common health complaint after pain [18, 19]. So far, epidemiological data on the
8 86 prevalence of poor sleep quality among university academic staff ranges from 38.9% [8] to 61.3%
9 87 [7].

10 88 Sleep is a basic human requirement; it is necessary for effective daytime performance and is a
11 89 predictor of physical and mental health, wellness, and overall quality of life [20, 21]. On the
12 90 contrary, poor sleep has been linked to a variety of metabolic syndromes, poor glucose metabolism,
13 91 and poor blood pressure control, all of which contribute to increased risks of cardiovascular
14 92 disease, poor mental health, poor productivity, and poor quality of life [22-26]. Poor SQ also has
15 93 significant economic consequences. In the USA, for example, the annual costs of poor sleep have
16 94 been estimated to be as high as US\$16 billion in healthcare costs and US\$50 billion in lost
17 95 productivity [27]. In Australia, the costs were estimated to be approximately US\$1.8 billion for
18 96 the health system and US\$66.3 billion for financial loss and decreased well-being [21, 28, 29].

19 97 Though the cause of poor SQ is multifactorial; cognitive, behavioral, and physiological variables
20 98 [30], sociodemographic (e.g. old age), low socioeconomic status, poor general health,
21 99 psychological distress, workload, use of electronic devices, and poor lifestyle behaviors have all
22 100 been identified as determinants of poor sleep quality [31-36].

23 101 Given the widespread and harmful consequences of poor SQ, it needs to be a top priority for public
24 102 and occupational health. As previously stated, a thorough review of the literature revealed that
25 103 even less is known about the prevalence and factors of poor sleep quality of academic staff and
26 104 other university personnel in developing countries including Ethiopia [37]. The number of
27 105 universities in Ethiopia is increasing, which is accompanied by an increase in academic staff.
28 106 However, the lack of reliable and up-to-date data on mental health, especially on sleep quality,
29 107 makes it difficult for officials to plan for prevention and control measures. Therefore, in the current
30 108 study, we assessed the prevalence and associated factors of poor sleep quality among academic
31 109 staff at the University of Gondar, Northwest Ethiopia.

32 110 **Methods and materials**

111 **Study design and period**

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

113 **Study setting and area**

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

120 **Source and Study populations**

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

123 **Inclusion and Exclusion Criteria**

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

127 **Sample size determination and sampling technique**

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

130 Confidence level (CI) of 95%

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

132 Margin of error of 5%

133 Using the following single proportion formula:

$$134 \quad n = (Z\alpha/2)^2 \frac{[p(1-p)]}{d^2} \text{ where:}$$

135 n = initial sample size,

136 $Z = 1.96$, the corresponding Z -score for the 95% CI

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3 137 P = Proportion = 50%

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5 138 d = Margin of error = 5% = 0.05

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8 139 $n = (1.96)^2 \frac{[0.5(1-0.5)]}{0.05^2} = 384$
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11 140 By considering a 10% non-response rate, and a design effect of 1.5 as in the absence of previous
12 141 literature taking a design effect of 1.5 to 2.0 is suggested [41], the final sample size was 635
13 142 participants. We employed a stratified sampling technique to select participants from the five
14 143 campuses of the University of Gondar. The number of sample points was determined by a
15 144 proportional allocation for each stratum. Hence, there are a total of 1027 academic staff in College
16 145 of Medicine and Health Sciences (N1=1027), in Maraki campus a total of 630 academic staff
17 146 (N2=630), in Tewdros campus a total of 509 academic staff (N3=509), in Fasil campus a total of
18 147 536 academic staff (N4=536), in Teda campus a total of 156 academic staff (N5=156).
19 148 Consequently, the numbers of participants from each campus were 228, 140, 119, 113, and 35
20 149 from the College of Medicine and Health Sciences, Maraki, Fasil, Tewodros, and Teda campuses,
21 150 respectively. Then, the required sample sizes were selected applying a simple random sampling
22 151 technique and OpenEpi random program version 3 was used to randomize academic staff from
23 152 each stratum.

24 153 **Operational definitions**

25 154 **Poor sleep quality:** this was measured using the Pittsburgh Sleep Quality Index (PSQI): if the
26 155 summation score of the participant was >5 points out of 21 points, poor sleep quality was
27 156 ascertained [42, 43].

28 157 **Body mass index (BMI):** weight in kilograms divided by the square of the height in meters (kg/m²)
29 158 categorized as underweight = BMI < 18, normal (health) = BMI 18.5– 24.9, overweight = BMI
30 159 25.0–29.9 =, and obese = BMI ≥ 30.0 [44].

31 160 **Alcohol drinker:** the consumption of any kind of alcohol at least two times per week [45].

32 161 **Cigarette smoker:** smoking at least one stick of cigarette per day [46].

33 162 **Khat chewer:** academician who had a history of chewing khat in the past one month [47].

34 163 **Doing physical exercise:** doing any kind of sports activity at least two times per week with a
35 164 duration of at least 30 minutes [48].

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3 165 **Electronic device use:** if the participant utilizes/ watches at least one of the following: television,
4 166 computer, tablet, or mobile phone in bed before going to sleep [49].

7 167 **Chronic illness:** illnesses that can be managed, but cannot be cured and have a greater risk of
8 168 developing a poor quality of sleep, such as asthma, diabetes mellitus, stroke, kidney stone,
9 169 hypertension [50].

12 170 **Risk perception of COVID-19 infection:** which was assessed by three questions, with a response
14 171 based on a 5-point Likert scale, with a higher total score indicating a high perceived risk of
15 172 COVID-19 [51].

18 173 **Job satisfaction:** the sum of generic job satisfaction scale score of 32 or above [52].

20 174 **Perceived job stress:** a workplace stress scale score of 21 or above [53].

23 175 **Data Collection Tools and Procedures**

25 176 Data were collected through a validated self-administered standardized structured questionnaire.
26 177 The questionnaire was adapted after an extensive review of related literature and similar study
27 178 tools [7, 47, 50, 54-56]. The questionnaire embraces three sections containing different items. The
28 179 first section, socio-demographic characteristics assesses information on age, sex, religion,
30 180 educational status, working experience, and monthly salary. The second element of the
31 181 questionnaire hugs information on sleep quality, which was assessed by using the PSQI, a 19-item
32 182 self-rated scale that examined Sleep Quality and disturbances over a 1-month time interval. The
33 183 tool mainly addresses seven sleep components including; sleep perception, sleep latency, sleep
34 184 duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime
35 185 dysfunction during the last one month. The total PSQI score was calculated by summing up the
36 186 seven component scores. Scoring of the answers is based on a 0 to 3 scale, whereby 3 reflects the
37 187 negative extreme on the Likert scale. The sum of the score ranges from 0 to 21, in which the higher
38 188 scores indicate poor sleep quality and the lower scores indicate good sleep quality [2]. Individuals
39 189 scoring > 5 were considered poor sleep quality. The PSQI instrument has been validated as reliable
40 190 for use in Ethiopia [43] and has been used in several studies in other countries [4, 57]. The last
41 191 part of the questionnaire includes information used to assess behavioral factors and psychosocial
42 192 factors like cigarette smoking (yes/no), BMI (kg/m²), physical activity (yes/no), alcohol

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

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

205 **Data quality control**

206 The questionnaire was first developed in English and translated into the local language Amharic
207 and back to English by language experts and professionals to ensure consistency. Two BSc
208 psychiatric nurses working in the University of Gondar comprehensive specialized hospital were
209 involved in data collection after they took adequate training and orientation. MSc psychiatric nurse
210 supervisors working in the College of Medicine and Health Sciences at the University of Gondar
211 were recruited. The data collectors and supervisor took the orientation on issues relating to the
212 clarity of the questions, objectives of the study, confidentiality of information, and the voluntary
213 involvement (consent) in the study, and on time of data collection as study participant's regular
214 duties should not be compromised. The principal investigator supervised both data collectors and
215 supervisors. To ensure the quality and reliability of the questionnaire, a pre-test was conducted on
216 5% (31) of the sample size at Teda Health Sciences College in Gondar city, and the College was
217 not included in the final survey. Based on the finding from the pretest analysis, a few modifications
218 such as some misinterpretations and ambiguities were corrected, and the time taken for the data
219 collection was estimated. When any problem during the data collection, the feedback was given
220 by discussing it with the principal investigator, supervisor and, data collectors.

221 **Data processing and analysis**

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

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

238 Results

239 Socio-demographic characteristics of study participants

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

246 **Table 1:** Socio-demographic characteristics of academic staff in University of Gondar, Ethiopia,
 247 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

248 **Key:** ETB= Ethiopian Birr (currency)

249 Behavioral and psychosocial characteristics of study participants

250 Among the study participants, 414 (68.20%) of respondents were working between 6 and 10 hrs
 251 per day and 79 (13.01%) of respondents were working for more than 10 hrs per day. Of the study
 252 participants, 108 (17.79%) of them reported they were cigarette smokers. Whereas, 112 (18.45)
 253 stated they had alcohol drinking habits and almost one-third (33.28%) of them conveyed they were
 254 performing physical exercise at least two times per week. Majority of the respondents, 434
 255 (71.50%) a normal (18.5–24.9 kg/m²) BMI and 48 (7.91%) of them underweight (>18.5 kg/m²).

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

262 **Table 2:** Behavioral and psychosocial characteristics of academic staff in the University of
 263 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

264

265 Prevalence of poor sleep quality and its components scores

266 The mean global score of PSQI (computed using the component scores) was 6.80, 95% CI (6.55,
 267 7.04). The result of this study revealed that 60.30% (95% CI, 56.28%-64.21%) of academicians
 268 were classified as having poor sleep quality. Seven components of sleep quality in the present
 269 study were assessed and identified their sleep status. Accordingly, 514 (84.68%) of academicians
 270 had fairly good to very good sleep perception. From the total study participants, 342 (56.34%) had
 271 mild difficulty in falling asleep (PSQI latency). Regarding sleeping duration, only 165 (27.18%)
 272 of respondents had more than 7 hours of sleep per night, and 326 (53.71%) had a very high habitual
 273 sleep efficiency (>85%). Moreover, most (66.39%) of academicians reported that they had mild
 274 difficulty in the PSQI disturbance domain and only 39 (6.42%) of them used sleep medication to

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

277 **Table 3:** Sleep quality and its components scores of academic staff in the University of Gondar,
 278 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

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

280

281 **Factors associated with poor sleep quality**

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

291 The probability of developing poor sleep quality was 2.19 times greater in employees who worked
 292 more than 10 hours per day compared to those who worked for 5 hours or less per day [AOR=
 293 2.19, 95% CI (1.16, 4.27)] at a p-value of 0.019. Similarly, participants who use electronic devices
 294 before bedtime were 1.53 times more likely to experience poor sleep quality compared to
 295 electronic device non-user counterparts [AOR=1.53, 95% CI (1.04, 2.27)] at a p-value of 0.031.
 296 Moreover, the odds of having poor sleep quality were 1.60 times more likely among workers who
 297 had a high-risk perception of COVID-19 infection than among those who had a low-risk perception
 298 about it [AOR =1.60, 95% CI (1.04, 2.46)] at a p-value of 0.032. Finally, the chances of suffering
 299 from poor sleep quality among academicians who had perceived job stress were 2.15 times higher

300 as compared to those who had no job stress [AOR = 2.15 (95% CI, (1.50, 3.08)] at a p-value of
301 ≤ 0.01 as shown in (Table 4).

302 **Table 4:** Bivariable and multivariable logistic regression analysis of factors associated with poor
303 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					
≤ 5 hr	59	55	1	1	
6-10hr	249	165	1.41 (0.93-2.13)	1.10 (0.76-1.85)	0.679
> 10 hr	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

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

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

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

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

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3 359 time for workers due to long working hours may lead to sleeplessness, and cause sleep disorders.
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5 360 Also, due to the nature of their occupation, our study participants spend a lot of time working with
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7 361 computers and other electronic devices. The use of electronic devices for a long period was noted
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9 362 to be associated with sleep disorders [42, 71]. Another plausible explanation might be that
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11 363 employees who worked long working hours may take caffeinated drinks (e.g., coffee and tea),
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13 364 which can lead to poor sleep [72].

14 365 Electronic device use before bedtime showed a significant association with poor sleep quality.
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16 366 Similar results were reported from other studies [73-75]. This could be reasoned as sleep quantity
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18 367 and quality are significantly reduced when people use digital devices for an extended period [76].
19
20 368 For example, cell phones, tablets, readers, computers, and laptops emit short-wavelength enriched
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22 369 light, which has been found to suppress or delay the normal generation of melatonin in the evening
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24 370 and minimize feelings of sleepiness [77]. Moreover, workforces in a higher education context are
25
26 371 often confronted with demanding responsibilities requiring work overload, long working hours,
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28 372 stress, and, in addition, the COVID-19 pandemic difficulties in the world of education. Because of
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30 373 the pandemic, universities were forced to conduct all of their activities online, including in the
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32 374 current study setting, which increased the usage of electronic devices, contributing to or
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34 375 exacerbating poor sleep quality [78].

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36 376 Our current study revealed a high-risk perception of COVID-19 infections was found to be a
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38 377 determinant factor of poor sleep quality. This finding is in concordance with other research reports
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40 378 [79, 80]. This could be explained as those people who thought they were at a higher risk of
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42 379 developing COVID-19 had more fear than those who thought they were at a lower risk. Fear and
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44 380 rumination were also found to be adversely related to sleep quality, indicating that fear of infection
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46 381 and rumination did lead to poor sleep quality during the pandemic, which contribute to poorer
47
48 382 sleep quality both directly and indirectly by increasing fear [79]. Several researchers had examined
49
50 383 the influence of the COVID-19 pandemic on mental health, concluding that persons who are
51
52 384 fearful of becoming infected are more likely to develop sleeping disturbances [81].

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54 385 Participants who reported having job stress were 2.38 times more likely to have poor sleep quality
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56 386 than those who did not have stress. The result is in agreement with the studies conducted in Brazil
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58 387 [64], Malaysia [4, 82], and Indonesia [83]. The plausible reason might be due to the linkages
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60 388 between sleep, stress regulation, and alteration in the hypothalamic-pituitary-adrenal axis

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

392 **Conclusion**

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

401 **Data availability statement**

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

404 **Author's contribution**

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

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412 **Patient and public involvement**

413 There was no patient or public involvement in the study.

414 **Competing interest**

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

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419 Ethics approval and consent to participate

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

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443 **References**

- 444 1. Landry GJ, Best JR, Liu-Ambrose T: **Measuring sleep quality in older adults: a comparison**
 445 **using subjective and objective methods.** *Frontiers in aging neuroscience* 2015, 7:166.
- 446 2. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ: **The Pittsburgh Sleep Quality**
 447 **Index: a new instrument for psychiatric practice and research.** *Psychiatry research* 1989,
 448 **28(2):193-213.**
- 449 3. Kline C: **Sleep Quality.** In: *Encyclopedia of Behavioral Medicine.* edn. Edited by Gellman MD,
 450 Turner JR. New York, NY: Springer New York; 2013: 1811-1813.
- 451 4. Musa NA, Moy FM, Wong LP: **Prevalence and factors associated with poor sleep quality**
 452 **among secondary school teachers in a developing country.** *Industrial health* 2018.
- 453 5. Souza JcD, Sousa ICd, Belísio AS, Azevedo CVMd: **Sleep habits, daytime sleepiness and sleep**
 454 **quality of high school teachers.** *Psychology & Neuroscience* 2012, 5:257-263.
- 455 6. Kottwitz MU, Gerhardt C, Pereira D, Iseli L, Elfering A: **Teacher's sleep quality: linked to social**
 456 **job characteristics?** *Industrial health* 2017.
- 457 7. Freitas AMC, Araújo TMd, Pinho PdS, Sousa CC, Oliveira PCS, Souza FdO: **Sleep quality and**
 458 **associated factors among professors.** *Revista Brasileira de Saúde Ocupacional* 2021, 46.
- 459 8. Teker AG, Luleci NE: **Sleep quality and anxiety level in employees.** *Northern clinics of Istanbul*
 460 **2018, 5(1):31.**
- 461 9. Burdorf A, Porru F, Rugulies R: **The COVID-19 (Coronavirus) pandemic: consequences for**
 462 **occupational health.** *Scandinavian Journal of Work, Environment & Health* 2020, 46(3):229-230.
- 463 10. Stranges S, Tigbe W, Gómez-Olivé FX, Thorogood M, Kandala N-B: **Sleep problems: an**
 464 **emerging global epidemic? Findings from the INDEPTH WHO-SAGE study among more**
 465 **than 40,000 older adults from 8 countries across Africa and Asia.** *Sleep* 2012, 35(8):1173-1181.
- 466 11. Huang Y, Zhao N: **Generalized anxiety disorder, depressive symptoms and sleep quality**
 467 **during COVID-19 outbreak in China: a web-based cross-sectional survey.** *Psychiatry research*
 468 **2020, 288:112954.**
- 469 12. Gualano MR, Lo Moro G, Voglino G, Bert F, Siliquini R: **Effects of Covid-19 lockdown on**
 470 **mental health and sleep disturbances in Italy.** *International journal of environmental research*
 471 **and public health 2020, 17(13):4779.**
- 472 13. Marelli S, Castelnuovo A, Somma A, Castronovo V, Mombelli S, Bottoni D, Leitner C, Fossati A,
 473 Ferini-Strambi L: **Impact of COVID-19 lockdown on sleep quality in university students and**
 474 **administration staff.** *Journal of Neurology* 2021, 268(1):8-15.
- 475 14. Dowla SU: **Evaluating the effects of COVID-19 on mental health.** Brac University; 2021.
- 476 15. Rwigema P: **Impact of COVID-19 lockdowns on the education sector. The case of Rwanda.**
 477 *The Strategic Journal of Business & Change Management* 2021, 8(1):150-169.
- 478 16. Salehinejad MA, Majidinezhad M, Ghanavati E, Kouestanian S, Vicario CM, Nitsche MA, Nejati
 479 V: **Negative impact of COVID-19 pandemic on sleep quantitative parameters, quality, and**
 480 **circadian alignment: implications for health and psychological well-being.** *EXCLI journal*
 481 **2020, 19:1297.**
- 482 17. Crepaldi T, Carvalhais J, Cotrim T: **Sleep Quality and Quality of Working Life Among**
 483 **Brazilian University Professors in Telework.** In: *Occupational and Environmental Safety and*
 484 *Health III.* edn. Edited by Arezes PM, Baptista JS, Carneiro P, Castelo Branco J, Costa N, Duarte
 485 J, Guedes JC, Melo RB, Miguel AS, Perestrelo G. Cham: Springer International Publishing; 2022:
 486 661-669.
- 487 18. **Sleep-RSPH, Availbel at: <https://www.rsph.org.uk/our-work/policy/wellbeing/sleep.html>**
- 488 19. Colten HR, Altevogt BM: **Extent and health consequences of chronic sleep loss and sleep**
 489 **disorders.** *Sleep disorders and sleep deprivation: an unmet public health problem* 2006:55-135.

- 1
2
3 490 20. Ohayon M, Wickwire EM, Hirshkowitz M, Albert SM, Avidan A, Daly FJ, Dauvilliers Y, Ferri R,
4 491 Fung C, Gozal D: **National Sleep Foundation's sleep quality recommendations: first report.**
5 492 *Sleep health* 2017, **3**(1):6-19.
- 6 493 21. Organization WH: **WHO technical meeting on sleep and health: Bonn Germany, 22–24**
7 494 **January 2004.** In.: World Health Organization. Regional Office for Europe; 2004.
- 8 495 22. Mullington JM, Haack M, Toth M, Serrador JM, Meier-Ewert HK: **Cardiovascular,**
9 496 **inflammatory, and metabolic consequences of sleep deprivation.** *Progress in cardiovascular*
10 497 *diseases* 2009, **51**(4):294-302.
- 11 498 23. Yoo H, Franke WD: **Sleep habits, mental health, and the metabolic syndrome in law**
12 499 **enforcement officers.** *Journal of occupational and environmental medicine* 2013, **55**(1):99-103.
- 13 500 24. Slagter SN, van Vliet-Ostaptchouk JV, van Beek AP, Keers JC, Lutgers HL, van der Klauw MM,
14 501 Wolffebuttel BH: **Health-related quality of life in relation to obesity grade, type 2 diabetes,**
15 502 **metabolic syndrome and inflammation.** *PloS one* 2015, **10**(10):e0140599.
- 16 503 25. Hung H-C, Yang Y-C, Ou H-Y, Wu J-S, Lu F-H, Chang C-J: **The association between self-**
17 504 **reported sleep quality and metabolic syndrome.** *PloS one* 2013, **8**(1):e54304.
- 18 505 26. Rosekind MR, Gregory KB, Mallis MM, Brandt SL, Seal B, Lerner D: **The cost of poor sleep:**
19 506 **workplace productivity loss and associated costs.** *Journal of Occupational and Environmental*
20 507 *Medicine* 2010, **52**(1):91-98.
- 21 508 27. Dumith SC, Meneghini KFD, Demenech LM: **Who are the individuals with the worst perceived**
22 509 **quality of sleep? A population-based survey in southern Brazil.** *Preventive Medicine Reports*
23 510 2021, **21**:101288.
- 24 511 28. Adams R, Appleton S, Taylor A, McEvoy D, Antic N: **Report to the sleep Health Foundation**
25 512 **2016 sleep health survey of Australian adults.** *Adelaide: The Adelaide Institute for Sleep Health*
26 513 *& The University of Adelaide* 2016.
- 27 514 29. Watson N, Badr M, Belenky G, Bliwise D, Buxton O, Buysse D, Dinges D, Gangwisch J, Grandner
28 515 M, Kushida C: **Consensus Conference Panel Non-Participating Observers American Academy**
29 516 **of Sleep Medicine Staff (2015) Recommended amount of sleep for a healthy adult: a joint**
30 517 **consensus statement of the American Academy of Sleep Medicine and Sleep Research Society.**
31 518 *J Clin Sleep Med*, **11**:591-592.
- 32 519 30. Roth T: **Insomnia: definition, prevalence, etiology, and consequences.** *J Clin Sleep Med* 2007,
33 520 **3**(5 Suppl):S7-10.
- 34 521 31. Baker FC, Wolfson AR, Lee KA: **Association of sociodemographic, lifestyle, and health factors**
35 522 **with sleep quality and daytime sleepiness in women: findings from the 2007 National Sleep**
36 523 **Foundation “Sleep in America Poll”.** *Journal of women's health* 2009, **18**(6):841-849.
- 37 524 32. Gellis LA, Lichstein KL, Scarinci IC, Durrence HH, Taylor DJ, Bush AJ, Riedel BW: **Socioeconomic**
38 525 **status and insomnia.** *Journal of abnormal psychology* 2005, **114**(1):111.
- 39 526 33. Ding D, Gebel K, Phongsavan P, Bauman AE, Merom D: **Driving: a road to unhealthy lifestyles**
40 527 **and poor health outcomes.** *PloS one* 2014, **9**(6):e94602.
- 41 528 34. Kabrita CS, Hajjar-Muça TA, Duffy JF: **Predictors of poor sleep quality among Lebanese**
42 529 **university students: association between evening typology, lifestyle behaviors, and sleep**
43 530 **habits.** *Nature and science of sleep* 2014, **6**:11.
- 44 531 35. Shochat T: **Impact of lifestyle and technology developments on sleep.** *Nature and science of*
45 532 *sleep* 2012, **4**:19.
- 46 533 36. Alonzo R, Hussain J, Stranges S, Anderson KK: **Interplay between social media use, sleep**
47 534 **quality, and mental health in youth: A systematic review.** *Sleep Medicine Reviews* 2021,
48 535 **56**:101414.
- 49 536 37. Amschler DH, McKenzie JF: **Perceived sleepiness, sleep habits and sleep concerns of public**
50 537 **school teachers, administrators and other personnel.** *American Journal of Health Education*
51 538 2010, **41**(2):102-109.

- 1
2
3 539 38. Alemayehu M, Nega A, Tegegne E, Mule Y: **Prevalence of self reported computer vision syndrome and associated factors among secretaries and data processors who are working in University of Gondar, Ethiopia.** *Journal of Biology, Agriculture and Healthcare* 2014, **4**(15).
4 540
5 541
6 542 39. Kabito GG, Wami SD, Chercos DH, Mekonnen TH: **Work-related Stress and Associated Factors among Academic Staffs at the University of Gondar, Northwest Ethiopia: An Institutionbased Cross-sectional Study.** *Ethiopian journal of health sciences* 2020, **30**(2).
7 543
8 544
9 545 40. Daniel WW, Cross CL: **Biostatistics: a foundation for analysis in the health sciences:** Wiley; 2018.
10 546
11 547 41. Martínez-Mesa J, González-Chica DA, Bastos JL, Bonamigo RR, Duquia RP: **Sample size: how many participants do I need in my research?** *Anais brasileiros de dermatologia* 2014, **89**:609-615.
12 548
13 549
14 550 42. Patil A, Bhavya SC, Srivastava S: **Eyeing computer vision syndrome: Awareness, knowledge, and its impact on sleep quality among medical students.** *Industrial psychiatry journal* 2019, **28**(1):68.
15 551
16 552
17 553 43. Salahuddin M, Maru TT, Kumalo A, Pandi-Perumal SR, Bahammam AS, Manzar MD: **Validation of the Pittsburgh sleep quality index in community dwelling Ethiopian adults.** *Health and quality of life outcomes* 2017, **15**(1):1-7.
18 554
19 555
20 556 44. Seidell JC, Flegal KM: **Assessing obesity: classification and epidemiology.** *British medical bulletin* 1997, **53**(2):238-252.
21 557
22 558 45. Nakata A, Ikeda T, Takahashi M, Haratani T, Hojou M, Swanson NG, Fujioka Y, Araki S: **The prevalence and correlates of occupational injuries in small-scale manufacturing enterprises.** *Journal of occupational health* 2006, **48**(5):366-376.
23 559
24 560
25 561 46. Jemere T, Mossie A, Berhanu H, Yeshaw Y: **Poor sleep quality and its predictors among type 2 diabetes mellitus patients attending Jimma University Medical Center, Jimma, Ethiopia.** *BMC research notes* 2019, **12**(1):1-6.
26 562
27 563
28 564 47. Berhanu H, Mossie A, Tadesse S, Geleta D: **Prevalence and associated factors of sleep quality among adults in Jimma Town, Southwest Ethiopia: a community-based cross-sectional study.** *Sleep disorders* 2018, **2018**.
29 565
30 566
31 567 48. Rolander B, Bellner A-L: **Experience of musculo-skeletal disorders, intensity of pain, and general conditions in work--the case of employees in non-private dental clinics in a county in southern Sweden.** *Work* 2001, **17**(1):65-73.
32 568
33 569
34 570 49. Negussie BB, Emeria MS, Reta EY, Shiferaw BZ: **Sleep deprivation and associated factors among students of the Institute of Health in Jimma University, Southwest Ethiopia.** *Frontiers of Nursing*, **8**(3):303-311.
35 571
36 572
37 573 50. Abdu Z, Hajure M: **Prevalence and Associated Factors of Poor Quality of Sleep among Prisoners in Mettu Town Prison, Oromia, South West Ethiopia, 2019.** *The Open Public Health Journal* 2020, **13**(1).
38 574
39 575
40 576 51. Azene ZN, Merid MW, Muluneh AG, Geberu DM, Kassa GM, Yenit MK, Tilahun SY, Gelaye KA, Mekonnen HS, Azagew AW: **Adherence towards COVID-19 mitigation measures and its associated factors among Gondar City residents: A community-based cross-sectional study in Northwest Ethiopia.** *PloS one* 2020, **15**(12):e0244265.
41 577
42 578
43 579
44 580 52. Macdonald S, MacIntyre P: **The generic job satisfaction scale: Scale development and its correlates.** *Employee Assistance Quarterly* 1997, **13**(2):1-16.
45 581
46 582 53. The Marlin Company NH, CT, and the American Institute of Stress, Yonkers, NY.: **The Workplace Stress Scale™** Available at: <https://teorionline.files.wordpress.com/2011/04/unit-3-the-workplace-stress-scale.pdf>. Accessed on 10 June 2019.
47 583
48 584
49 585 54. Cohen S, Kamarck T, Mermelstein R: **Perceived stress scale.** *Measuring stress: A guide for health and social scientists* 1994, **10**(2):1-2.
50 586
51 587 55. Birhanu TT, Salih MH, Abate HK: **Sleep Quality and Associated Factors Among Diabetes Mellitus Patients in a Follow-Up Clinic at the University of Gondar Comprehensive**
52 588
53
54
55
56
57
58
59
60

- 1
2
3 589 **Specialized Hospital in Gondar, Northwest Ethiopia: A Cross-Sectional Study.** *Diabetes, metabolic syndrome and obesity: targets and therapy* 2020, **13**:4859.
- 4 590
- 5 591 56. Wondie T, Molla A, Mulat H, Damene W, Bekele M, Madoro D, Yohannes K: **Magnitude and**
- 6 592 **correlates of sleep quality among undergraduate medical students in Ethiopia: cross-**
- 7 593 **sectional study.** *Sleep Science and Practice* 2021, **5**(1):1-8.
- 8 594 57. James BO, Omoaregba JO, Igberase OO: **Prevalence and correlates of poor sleep quality among**
- 9 595 **medical students at a Nigerian university.** *Ann Nigerian Med* 2011, **5**(1):1-5.
- 10 596 58. Deressa W, Worku A, Abebe W, Gizaw M, Amogne W: **Risk perceptions and preventive**
- 11 597 **practices of COVID-19 among healthcare professionals in public hospitals in Addis Ababa,**
- 12 598 **Ethiopia.** *PloS one* 2021, **16**(6):e0242471.
- 13 599 59. Mekonnen TH, Abere G, Olkeba SW: **Risk Factors Associated with Upper Extremity**
- 14 600 **Musculoskeletal Disorders among Barbers in Gondar Town, Northwest Ethiopia, 2018: A**
- 15 601 **Cross-Sectional Study.** *Pain Research and Management* 2019, **2019**(2019):1-9.
- 16 602 60. Mekonnen TH, Yenealem DG: **Factors affecting healthcare utilization for low back pain among**
- 17 603 **nurses in Gondar town, northwest Ethiopia, 2018: a cross-sectional study.** *BMC Res Notes*
- 18 604 **2019, 12**(185):1-6.
- 19 605 61. Meaza H, Temesgen MH, Redae G, Hailemariam TT, Alamer A: **Prevalence of Musculoskeletal**
- 20 606 **Pain Among Academic Staff of Mekelle University, Ethiopia.** *Clinical Medicine Insights:*
- 21 607 *Arthritis and Musculoskeletal Disorders* 2020, **13**:1179544120974671.
- 22 608 62. Etana G, Ayele M, Abdissa D, Gerbi A: **Prevalence of Work Related Musculoskeletal Disorders**
- 23 609 **and Associated Factors Among Bank Staff in Jimma City, Southwest Ethiopia, 2019: An**
- 24 610 **Institution-Based Cross-Sectional Study.** *Journal of Pain Research* 2021, **14**:2071.
- 25 611 63. Hosmer DW, Hjort NL: **Goodness-of-fit processes for logistic regression: simulation results.**
- 26 612 *Statistics in medicine* 2002, **21**(18):2723-2738.
- 27 613 64. de Sousa AR, Santos RB, da Silva RM, Santos CCT, Lopes VC, Mussi FC: **Occupational stress**
- 28 614 **and sleep quality in professors of the health area.** *Rev Rene* 2018(19):60.
- 29 615 65. Farah NM, Saw Yee T, Mohd Rasdi HF: **Self-reported sleep quality using the Malay version of**
- 30 616 **the Pittsburgh sleep quality index (PSQI-M) in Malaysian adults.** *International journal of*
- 31 617 *environmental research and public health* 2019, **16**(23):4750.
- 32 618 66. Vandewalle G, Archer SN, Wuillaume C, Balteau E, Degueldre C, Luxen A, Dijk D-J, Maquet P: **Effects of light on cognitive brain responses depend on circadian phase and sleep homeostasis.**
- 33 619 *Journal of biological rhythms* 2011, **26**(3):249-259.
- 34 620 67. Virtanen M, Ferrie JE, Gimeno D, Vahtera J, Elovainio M, Singh-Manoux A, Marmot MG, Kivimäki M: **Long working hours and sleep disturbances: the Whitehall II prospective cohort study.** *Sleep* 2009, **32**(6):737-745.
- 35 621 68. Jansen N, Kant I, van Amelsvoort L, Nijhuis F, van den Brandt P: **Need for recovery from work: evaluating short-term effects of working hours, patterns and schedules.** *Ergonomics* 2003, **46**(7):664-680.
- 36 622 69. Bannai A, Ukawa S, Tamakoshi A: **Long working hours and sleep problems among public junior high school teachers in Japan.** *Journal of occupational health* 2015:15-0053-OA.
- 37 623 70. Ferrie J, Gimeno D, Vahtera J, Elovainio M, Singh-Manoux A, Marmot M, Kivimäki M: **Long working hours and sleep disturbances: the Whitehall II prospective cohort study.** *Virtanen M. SLEEP MEDICINE*:129.
- 38 624 71. Salehi SG, Hassani H, Mortezaipoor A, Sadeghniaat-Haghighi K: **Assessing of Sleepiness, Insomnia and Sleep Quality among University Students: Association between Computer Use and Sleep Quality.** *Annals of Military & Health Sciences Research*• Vol 2015, **13**(4).
- 39 625 72. O'Callaghan F, Muurlink O, Reid N: **Effects of caffeine on sleep quality and daytime functioning.** *Risk management and healthcare policy* 2018, **11**:263.
- 40 626 73. Byrd E: **The Effect of the Use of An Electronic Device Before Bed on Sleep Quality.** 2019.
- 41 627
- 42 628
- 43 629
- 44 630
- 45 631
- 46 632
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3 638 74. Walsh NA, Rodriguez N, Repa LM, King E, Garland SN: **Associations between device use before**
4 639 **bed, mood disturbance, and insomnia symptoms in young adults.** *Sleep Health* 2020, **6(6):822-**
5 640 **827.**
- 6 641 75. Fossum IN, Nordnes LT, Storemark SS, Bjorvatn B, Pallesen S: **The association between use of**
7 642 **electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness,**
8 643 **morningness, and chronotype.** *Behavioral sleep medicine* 2014, **12(5):343-357.**
- 9 644 76. Salfi F, Amicucci G, Corigliano D, D'Atri A, Viselli L, Tempesta D, Ferrara M: **Changes of**
10 645 **evening exposure to electronic devices during the COVID-19 lockdown affect the time course**
11 646 **of sleep disturbances.** *Sleep* 2021, **44(9):zsab080.**
- 12 647 77. Shechter A, Kim EW, St-Onge M-P, Westwood AJ: **Blocking nocturnal blue light for insomnia:**
13 648 **A randomized controlled trial.** *J Psychiatr Res* 2018, **96:196-202.**
- 14 649 78. Sobaih AEE, Hasanein AM, Abu Elnasr AE: **Responses to COVID-19 in Higher Education:**
15 650 **Social Media Usage for Sustaining Formal Academic Communication in Developing**
16 651 **Countries.** *Sustainability* 2020, **12(16):6520.**
- 17 652 79. Lin S-Y, Chung KKH: **Risk Perception, Perception of Collective Efficacy and Sleep Quality in**
18 653 **Chinese Adults during COVID-19 Pandemic in Hong Kong: A Cross-Sectional Study.**
19 654 *International journal of environmental research and public health* 2021, **18(21):11533.**
- 20 655 80. Yan J, Kim S, Zhang SX, Foo M-D, Alvarez-Risco A, Del-Aguila-Arcentales S, Yáñez JA:
21 656 **Hospitality workers' COVID-19 risk perception and depression: A contingent model based**
22 657 **on transactional theory of stress model.** *International Journal of Hospitality Management* 2021,
23 658 **95:102935.**
- 24 659 81. Iorga M, Iurcov R, Pop L-M: **The Relationship between Fear of Infection and Insomnia among**
25 660 **Dentists from Oradea Metropolitan Area during the Outbreak of Sars-CoV-2 Pandemic.**
26 661 *Journal of Clinical Medicine* 2021, **10(11):2494.**
- 27 662 82. Kesintha A, Rampal L, Sherina M, Kalaiselvam T: **Prevalence and predictors of poor sleep**
28 663 **quality among secondary school students in Gombak District, Selangor.** *Med J Malaysia* 2018,
29 664 **73(1):32-40.**
- 30 665 83. Herawati K, Gayatri D: **The correlation between sleep quality and levels of stress among**
31 666 **students in Universitas Indonesia.** *Enfermeria clinica* 2019, **29:357-361.**
- 32 667 84. Hirotsu C, Tufik S, Andersen ML: **Interactions between sleep, stress, and metabolism: From**
33 668 **physiological to pathological conditions.** *Sleep Science* 2015, **8(3):143-152.**
- 34 669 85. Han KS, Kim L, Shim I: **Stress and sleep disorder.** *Experimental neurobiology* 2012, **21(4):141.**

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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.

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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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3 **1 Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19**
4 **2 Pandemic in Ethiopia: an institution-based cross-sectional study**

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7 3 Amensisa Hailu Tesfaye^{1*}

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24 Abstract

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

27 **Design:** An institution-based cross-sectional study was conducted from March to April 2021. A
28 validated self-administered, standardized Pittsburgh Sleep Quality Index was used to quantify the
29 amount of self-reported poor sleep quality. The collected data were entered into EpiData version
30 4.6 and analyzed using STATA version 14 software. Binary logistic regressions were computed to
31 determine the association between variables. The association was determined using an adjusted
32 Odds ratio (AOR) with a 95% confidence interval (CI) at a p-value of < 0.05.

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

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

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

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

44 **Conclusion:** The study revealed that the prevalence of poor sleep quality was high during the
45 COVID-19 pandemic. The finding highlights the importance of optimizing the working hours per
46 day, minimizing electronic device use before bedtime, promoting risk perception toward COVID-
47 19 infection, and developing workplace coping strategies for stress, which play a substantial role
48 in minimizing poor sleep quality.

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

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52 **Strengths and limitations of this study**

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

63 **Background**

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

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

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3 81 now and in the future [14]. Likewise, the World Health Organization (WHO) has classified poor
4 82 sleep quality as a public health issue that exacerbates the risk of disease and death [15]. Poor SQ
5 83 also has significant economic consequences. In the USA, for example, the annual costs of poor
6 84 sleep have been estimated to be as high as US\$16 billion in healthcare costs and US\$50 billion in
7 85 lost productivity [16]. In Australia, the costs were estimated to be approximately US\$1.8 billion
8 86 for the health system and US\$66.3 billion for financial loss and decreased well-being [17-19].

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10 87 During the COVID-19 period, the prevalence of sleep quality was found to be at a poor level [20].
11 88 A couple of studies from Brazilian [12, 21], documented that 61.3% and 44.2% of university
12 89 academic staff reported poor sleep quality. Scientific investigation showed that four out of ten
13 90 people do not get enough sleep, and one in five sleep poorly most nights, making poor sleep the
14 91 second most common health complaint after pain [22, 23]. According to a study done in Iran [24],
15 92 79.6% (n=133) of university staff reported having poor sleep quality. A similar finding was also
16 93 found in a study conducted in Thailand [25], where 78.3% of respondents experienced poor sleep
17 94 quality. So far, epidemiological data from Turkey indicated that 55.1% of adults had poor sleep
18 95 quality [20]. In Ethiopia, the pooled prevalence of poor sleep quality was 53% among general
19 96 populations and university students, with incidences ranging from 26% to 66.2% [26]. However,
20 97 studies on sleep quality, particularly among university academic staff, are lacking.

21 98 Recent research shows that during the COVID-19 pandemic, sleep quality was impaired and the
22 99 prevalence of poor sleep increased in both the working and general population [27-29].
23 100 Furthermore, the global COVID-19 pandemic has compelled higher education institutions,
24 101 including Ethiopian universities, the shift from face-to-face to online instruction, which has an
25 102 impact on sleep quality [30-32]. Prolonged use of uses of computers, coupled with the brightness
26 103 of the light that they project onto the retina, are factors that are thought to trigger changes in sleep
27 104 patterns [33]. The light emitted from computers is in close proximity to the retina [34]. This emitted
28 105 optical radiation at short wavelengths is close to the peak sensitivity of melatonin suppression [33].
29 106 Since, the utilization of computers is fast during the COVID-19 pandemic among academic staff
30 107 can be a source of computer light exposure, which can lead to poor sleep quality [35]. Moreover,
31 108 poor sleep quality has been correlated to old age, low economic status, substance use, obesity, use
32 109 of an electronic device before bedtime, higher risks of contracting COVID-19 at work, workload
33 110 and job stress [36-44].

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3 111 Given the widespread and harmful consequences of poor sleep quality, it needs to be a top priority
4 112 for public and occupational health. As previously stated, a thorough review of the literature
5 113 revealed that even less is known about the prevalence and factors of poor sleep quality among
6 114 academic staff and other university personnel in developing countries including Ethiopia [45].The
7 115 number of universities in Ethiopia is increasing, which is accompanied by an increase in academic
8 116 staff workforces. However, the lack of reliable and up-to-date data on mental health, especially on
9 117 sleep quality, makes it difficult for officials to plan for prevention and control measures. Therefore,
10 118 in the current study, we aimed to assess the prevalence and associated factors of poor sleep quality
11 119 among academic staff at the University of Gondar, Northwest Ethiopia.

120 **Methods and materials**

121 **Study design, Period, and Setting**

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

129 **Study participants**

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

135 **Sample size determination and sampling procedure**

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

138 Confidence level (CI) of 95%

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

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3 140 Margin of error of 5%

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5 141 Using the following single proportion formula:

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8 142 $n = (Z\alpha/2)^2 \frac{[p(1-p)]}{d^2}$ where:

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10 143 n = initial sample size,

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12 144 $Z = 1.96$, the corresponding Z -score for the 95% CI

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14 145 P = Proportion = 50%

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16 146 d = Margin of error = 5% = 0.05

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19 147 $n = (1.96)^2 \frac{[0.5(1-0.5)]}{0.05^2} = 384$

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22 148 The final sample size was 635 people, after taking into account a 10% non-response rate and a
23 149 design effect of 1.5 because, in the absence of prior literature, a design effect of 1.5 to 2.0 is
24 150 endorsed [49]. We employed a stratified sampling technique to select participants from the five
25 151 campuses of the University of Gondar. A proportional allocation for each stratum defined how
26 152 many sample points were needed. Thus, there were a total of 1027 academic staff members in the
27 153 College of Medicine and Health Sciences ($N_1=1027$), 630 academic staff members on Maraki
28 154 campus ($N_2=630$), 509 academic staff members on Tewdros campus ($N_3=509$), 536 academic
29 155 staff members on the Fasil campus ($N_4=536$), and 156 academic staff members on the Teda
30 156 campus ($N_5=156$). Consequently, the numbers of participants from each campus were 228, 140,
31 157 119, 113, and 35 from the College of Medicine and Health Sciences, Maraki, Fasil, Tewodros, and
32 158 Teda campuses, respectively. The requisite sample sizes were then determined using a simple
33 159 random sampling technique, and academic staff members from each stratum were randomly
34 160 assigned using the OpenEpi random software version 3.

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44 161 **Variable measurement and definition of terms**

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47 162 **Poor sleep quality:** This was measured using the Pittsburgh Sleep Quality Index (PSQI) 19-item
48 163 self-report measure of sleep quality over the past month was used to measure academicians poor
49 164 sleep quality during the COVID-19 pandemic period (**supplementary file**). The tool, which was
50 165 free to use and designed to measure the outcome variable, has a diagnostic sensitivity of 89.6%
51 166 and a specificity of 86.5% at greater than five cutoff values for identifying cases with sleep

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3 167 disorders [50]. PSQI consists of 7 component scores (ranging from 0 to 3), measuring subjective
4 168 sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping
5 169 medication, and daytime dysfunction. The 7 component scores are summed to give a global PSQI
6 170 score ranging from 0 to 21, with higher scores reflecting greater overall sleep disturbances. A
7 171 global PSQI score of greater than 5 indicates poor sleep quality [33, 51].

12 172 **Body mass index (BMI):** weight in kilograms divided by the square of the height in meters (kg/m^2)
13 173 categorized as underweight = $\text{BMI} < 18.5$, normal (health) = $\text{BMI} 18.5\text{--}24.9$, overweight = BMI
14 174 $25.0\text{--}29.9$, and obese = $\text{BMI} \geq 30.0$ [52].

18 175 **Alcohol drinker:** a scholar who drinks alcohol of any kind at least twice each week [53]

20 176 **Cigarette smoker:** a scholar with a daily consumption of at least one stick of cigarettes [54].

22 177 **Khat chewer:** a scholar who had chewed khat in the previous month [42].

24 178 **Doing physical exercise:** doing any type of physical activity at least twice a week for at least 30
25 179 minutes [55].

28 180 **Electronic device use:** if the participant utilizes/ watches at least one of the following: television,
29 181 computer, tablet, or mobile phone in bed before going to sleep [56].

32 182 **Chronic illness:** illnesses such as asthma, diabetes mellitus, stroke, kidney stone, hypertension
33 183 that can be managed, but cannot be cured and have a greater risk of developing a poor quality of
34 184 sleep, [57].

38 185 **Risk perception of COVID-19 infection:** was assessed by two psychological dimensions;
39 186 perceived susceptibility and perceived severity. The first dimension was proxied by how likely
40 187 one considered oneself (his/her family) would be infected with COVID-19 if no preventive
41 188 measures will be taken. The second dimension was proxied by how one rated the seriousness of
42 189 symptoms caused by COVID-19, their perceived chance of having COVID-19 cured and that of
43 190 survival if infected with COVID-19. By combining the two dimensions, five items with five
44 191 response options were asked to determine the respondents' levels of risk perception, with a higher
45 192 total score indicating a high perceived risk of COVID-19 infection [58].

52 193 **Job satisfaction:** the total score of at least 32 on the general job satisfaction scale [59].

54 194 **Perceived job stress:** a score of at least 21 on the workplace-stress scale [60].

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196 **Data Collection Tools and Procedures**

197 Data were collected through a validated self-administered standardized questionnaire.
198 The questionnaire was adapted after an extensive review of related literature and similar study
199 tools [12, 42, 57, 61-63]. The questionnaire embraces three sections containing different items.
200 The first section, socio-demographic characteristics, assesses information on age, sex, religion,
201 educational status, working experience, and monthly salary. The second element of the
202 questionnaire hugs information on poor sleep quality, which was assessed by using the PSQI,
203 which is a measure of sleep disturbance for the period of 1-month immediately preceding the time
204 of administration. PSQI is an effective and the most widely used instrument in diagnosis of sleep
205 disorders in different populations [9, 64]. The tool is easy to understand, patient compliant and
206 requires about 5 min to be completed. 10]. The PSQI contains 19 items and 7 clinically important
207 components in relation to sleep difficulties: subjective sleep quality, sleep latency, sleep duration,
208 sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. The total
209 PSQI score was calculated by summing up the seven component scores as cited in [50]. Scoring
210 of the answers is based on a 0 to 3 scale, whereby 3 reflects the negative extreme on the Likert
211 scale, as well a global score of between 0 and 21. Individuals scoring a global score of greater than
212 5 were deemed poor sleep quality [65]. The PSQI has been validated in many languages with
213 acceptable psychometric properties [66] and is frequently used in clinical and research settings
214 [67]. The PSQ has also been validated as reliable for use in Ethiopian community [51]. The PSQI's
215 validity was supported by a comprehensive test used to diagnose sleep disorders like
216 polysomnographic findings [68, 69]. The PSQI has a sensitivity of 89.6% and specificity of 86.5%
217 for identifying cases with sleep disorder, using a cut-off score of 5 [50]. The last part of the
218 questionnaire includes information used to assess behavioral factors and psychosocial factors like
219 cigarette smoking (yes/no), BMI (kg/m²), physical activity (yes/no), alcohol consumption
220 (yes/no), use of an electronic device before bedtime (yes/no), history of chronic illness (yes/no),
221 risk perception of COVID-19, job satisfaction, job stress, and workload.

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

225 and how likely one considered oneself (his/her family) would be infected with COVID-19 if no
226 preventive measures will be taken. Responses of the two questions were rated on a 5-point Likert
227 scale (ranging from 1 = very likely to 5 = very unlikely). The second dimension (perceived
228 severity) contains three questions; including how one rated the seriousness of symptoms caused
229 by COVID-19, their perceived chance of having COVID-19 cured, and that of survival if infected
230 with COVID-19. Responses of the three questions were rated on a 5-point Likert scale (ranging
231 from 1 = Very serious /Very low to 5 = Not serious at all/Very high). By combining the two
232 dimensions, making five questions each answered on a Likert scale of 1 to 5 giving rise to a total
233 score ranging from 5 to 25. The higher the score, the higher the risk perception of COVID-19
234 infection [70]. We used the 10-item generic job satisfaction scale questionnaire to measure
235 academicians' perceived job satisfaction [59]. The scale comprised ten questions ranging from 1
236 to 5 each item and ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied,
237 according to their occurrence respectively, in 1 month before the survey. The scale had 10 items
238 with a rating of 1 to 5, and the responses ranged from very dissatisfied, dissatisfied, neutral,
239 satisfied and very satisfied, depending on how frequently they occurred in the month before to the
240 survey and then summing up all 10 items. The scale produced a single ranking, with high scores
241 indicated higher job satisfaction vice versa. Perceived job-related stress of the participants was
242 collected using the 8-item workplace stress scale questionnaire [60]. The scale comprised eight
243 questions ranging from 1 to 5 each item and ranged from never, rarely, sometimes, often and very
244 often, according to their occurrence respectively, in 1 month before the survey. The 8- item
245 workplace stress scores are obtained by reversing scores on three positive items, e.g. 5 = 1, 4 = 2,
246 3 = 3, etc., and then summing up all 8 items. Items 6, 7 and 8 are positive items. The scale produced
247 a single ranking, with high scores indicated higher stress levels and vice versa. The instruments
248 used in the current study have been employed in previous studies conducted in the country's
249 context [71-74].

250 **Data quality control**

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

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3 256 questions, objectives of the study, confidentiality of information, the voluntary involvement
4 257 (consent) participants in the study, and on time of data collection as study participants' regular
5 258 duties should not be compromised. Both data collectors and supervisors were under the lead
6 259 investigator's supervision. The pre-test was carried out at Teda Health Sciences College in Gondar
7 260 city on 5% (31) of the sample size to ensure the validity and reliability of the questionnaire, yet
8 261 the College was not included in the final survey. Based on the results of the pretest analysis, various
9 262 modifications were made including the clarification of a few ambiguities and misinterpretations,
10 263 and an estimation of how long the data gathering process would take. Feedback was provided by
11 264 discussing any issue that arose during data collection with the primary investigator, the supervisor,
12 265 and the data collectors.

266 **Data processing and analysis**

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

286 Patient and public involvement statement

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

290 Results

291 Socio-demographic characteristics of study participants

292 A total of 635 questionnaires were distributed, giving a response rate of 95.59% (N = 607). The
293 age of the participants ranged from 21 to 70, with a mean (\pm SD) of 32.39 (\pm 6.80) years old.
294 Moreover, more than two-thirds of the participants were male (71.83%), and the majority of them,
295 362 (59.64%), indicated that they were married. Regarding educational status, 416(68.53%) of the
296 participants had master's degree. The participants' median estimated (interquartile range (IQR)
297 monthly income was 11305 (10700-13600) Ethiopian Birr (ETB) (**Table 1**).

298 **Table 1:** Socio-demographic characteristics of academic staff in University of Gondar, Ethiopia,
299 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
\geq 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

300 **Key:** ETB= Ethiopian Birr (currency)

301 Behavioral and psychosocial characteristics of study participants

302 Four hundred fourteen (68.20%) of the participants were working between 6 and 10 hours per day,
 303 and 79 (13.11%) participants were working more than 10 hours per day. Of the study participants,
 304 the number of respondents who admitted to smoking cigarettes was 108 (17.79%). While 112
 305 (18.45) said they had alcohol drinking habits, over one-third (33.28%) of respondents were
 306 performing physical exercise at least twice a week. The majority of the respondents, 434 (71.5%),
 307 had a normal (18.5-24.9 kg/m²) BMI, while 48 (7.91%) of them were underweight (>18.5 kg/m²)
 308 BMI. Out of the study participants, 188 (30.97%) of them clarified that they had a chronic illness,
 309 and almost half (51.24%) of the study participants have used an electronic device before bedtime.
 310 Regarding psychosocial characteristics, nearly one-fourth (24.38%) of the respondents had high-
 311 risk perceptions of the COVID-19 virus. Moreover, 516 (85.01%) respondents supposed they were
 312 satisfied with their jobs. Furthermore, when asked whether they felt stressed out by their work,
 313 276 respondents (45.47 %) said they did (**Table 2**).

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

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

1			
2			
3	6-10hr	414	68.20
4	>10hr	79	13.01
5			
6	Cigarette smoker		
7			
8	Yes	108	17.79
9	No	499	82.21
10			
11	Alcohol consumption habit		
12			
13	Yes	112	18.45
14	No	495	81.55
15			
16	Khat chewing behavior		
17			
18	Yes	19	3.13
19	No	588	96.87
20			
21	Physical exercise		
22			
23	Yes	202	33.28
24	No	405	66.72
25			
26	Body mass index (BMI)		
27			
28	Underweight	48	7.91
29	Normal	434	71.50
30	Overweight and obese	125	20.59
31			
32	Chronic Illness		
33			
34	Yes	188	30.97
35	No	419	69.03
36			
37	The habit of taking breaks		
38			
39	Yes	329	54.20
40	No	278	45.80
41			
42	Electronic device use		
43			
44	Yes	311	51.24
45	No	296	48.76
46			
47	Duration of electronic device use		
48			
49	≤3hrs/day	127	40.84
50	>hrs/day	184	59.16
51			
52	Risk perception towards COVID-19 virus		
53			
54	High	148	24.38
55	Low	459	75.62
56			
57	Colleagues relationship		
58			
59			
60			

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

316

317 Prevalence of poor sleep quality and its components scores

318 The mean global score of PSQI (computed using the component scores) was 6.80, 95% CI (6.55,
 319 7.04). The result of this study revealed that 60.30% (95% CI, 56.28%-64.21%) of academicians
 320 were classified as having poor sleep quality. Seven components of sleep quality in the present
 321 study were assessed and the components identified their sleep status (**supplementary file**).
 322 Accordingly, 514 (84.68%) of the academicians had fairly good to very good sleep perception.
 323 From the total study participants, 342 (56.34%) had mild difficulty in falling asleep (PSQI latency).
 324 Regarding sleeping duration, only 165 (27.18%) of the respondents had more than 7 hours of sleep
 325 per night, and 326 (53.71%) had a very high habitual sleep efficiency (>85%). Moreover, most
 326 (66.39%) of academicians reported that they had mild difficulty in the PSQI disturbance domain
 327 and only 39 (6.42%) of them used sleep medication to sleep during the past month. Furthermore,
 328 196 (32.29%) of them had mild to severe difficulty in PSQI day dysfunction due to sleepiness in
 329 the past month (**Table 3**).

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

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

1			
2			
3	Fairly bad	80	13.18
4	Very bad	13	2.14
5			
6	Sleep latency (falling asleep)		
7			
8	0 to 15minutes (0)	27	4.45
9	16 to 30 minutes (1)	342	56.34
10	31 to 60 minutes (2)	161	26.52
11	>60 minutes (3)	77	12.69
12			
13			
14	Sleep duration		
15			
16	>7hrs (0)	165	27.18
17	6h to 7hrs (1)	148	24.38
18	< 6hrs (2 & 3)	294	48.43
19			
20	Sleep efficiency		
21			
22	>85% (0)	326	53.71
23	75% to 84% (1)	143	23.56
24	65% to 74% (2)	60	9.88
25	<65% (3)	78	12.85
26			
27			
28	Sleep disturbance		
29			
30	Never (0)	116	19.11
31	1 time a week (1)	403	66.39
32	1–2 times a week (2)	84	13.84
33	≥3 times a week (3)	4	0.66
34			
35			
36	Used sleep medication		
37			
38	Never (0)	568	93.57
39	1 time a week (1)	27	4.45
40	1–2 times a week (2)	7	1.15
41	≥3 times a week (3)	5	0.82
42			
43			
44	Daytime dysfunction		
45			
46	No problem (0)	411	67.71
47	1 time a week (1)	143	23.56
48	1–2 times a week (2)	44	7.25
49	≥3 times a week (3)	9	1.48
50			
51			
52	Total score of poor sleep quality		
53			
54	≤ 5 (Good sleep quality)	241	39.70
55	> 5 (Poor sleep quality)	366	60.30
56			

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

333 **Factors associated with poor sleep quality**

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

343 The probability of developing poor sleep quality was 2.19 times greater in employees who worked
 344 more than 10 hours per day compared to those who worked for 5 hours or less per day [AOR=
 345 2.19, 95% CI (1.16, 4.27)] at a p-value of 0.019. Similarly, participants who use electronic devices
 346 before bedtime were 1.53 times more likely to experience poor sleep quality compared to who
 347 didn't use electronic devices before bedtime counterparts [AOR=1.53, 95% CI (1.04, 2.27)] at a
 348 p-value of 0.031. Moreover, the odds of having poor sleep quality were 1.60 times more likely
 349 among workers who had a high-risk perception of COVID-19 infection than among those who had
 350 a low-risk perception about it [AOR =1.60, 95% CI (1.04, 2.46)] at a p-value of 0.032. Finally, the
 351 chances of suffering from poor sleep quality among academicians who had perceived job stress
 352 were 2.15 times higher as compared to those who had no job stress [AOR = 2.15 (95% CI, (1.50,
 353 3.08)] at a p-value of ≤ 0.01 as shown in **Table 4**.

354 **Table 4:** Bivariable and multivariable logistic regression analysis of factors associated with poor
 355 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	

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

359 Discussion

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3 360 Poor sleep quality incurs substantial health, economic and societal costs. Understanding the
4 361 magnitude and various factors linked to the ailment would help researchers identify viable
5 362 therapies to improve sleep quality in vulnerable populations. The higher education work
6 363 environment is characterized by a highly competitive work nature. The University teaching staff
7 364 in addition to their normal teaching activities, handled various tasks including conducting and
8 365 preparing research for publication, providing community services, and managing administrative
9 366 positions. Furthermore, their regular teaching activities have shifted from face-to-face to online
10 367 instruction during the COVID-19 pandemic, which has an impact on their sleep quality.
11 368 Understanding the magnitude and investigating etiologies of the condition plays a paramount role
12 369 to establish effective prevention and control strategies. To our knowledge, the current study is the
13 370 first to assess the prevalence and risk factors of poor sleep quality among university academic staff
14 371 in Ethiopia. The prevalence of poor sleep quality in the last one month was found to be 60.30%
15 372 with 95% CI (56.28-64.21). Working for more than 10 hours per day, electronic device use before
16 373 bedtime, high-risk perception of COVID-19 infection, and having job stress were factors positively
17 374 associated with poor sleep quality in the current study.

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20 375 Findings of two investigations from Brazil (57.9%) [76] and (61.3%) [12] supported the current
21 376 data. This agreement could be due to the nature of tasks in the academic environments including
22 377 roles related to teaching and research activities, which usually resemble in every higher academic
23 378 institution. Participants in those nations might also be obliged to work in a substandard workplace
24 379 in an unhealthy manner for prolonged periods, and fewer individuals are aware of sleep health and
25 380 the effect of poor sleep quality. The other possible explanation might be due to study participants
26 381 having a similar age group as compared to participants in those countries.

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29 382 On the contrary, the current study had a higher magnitude of the risk of poor sleep quality
30 383 compared to the studies conducted in Turkey (38.9%) [13] and Malaysia (45%) [77]. This
31 384 difference might be due to the unstable socioeconomic status of the respondents in this study. The
32 385 respondents in this study might attempt to compensate for their low salaries by teaching different
33 386 shifts at multiple colleges and schools. This may lead to longer working hours because they start
34 387 their daily work activities much earlier in the day and conclude their working day much later. The
35 388 difference might be also due to the sample size variation; the previous studies were conducted
36 389 among a small number of study participants compared to the number of participants in this study.

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

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

403 In this study, long working hour per day (>10hrs/day) was significantly associated with poor sleep
404 quality. The finding echoes the result of previous investigations [9, 79]. A possible justification
405 for this report may be that employees with long working hours need more time to recover from
406 work-induced fatigue [80]. However, long working hours reduce the amount of private time
407 available to them, which may lead to sleep deprivation [81]. For recovery from fatigue, not only
408 sleep but also relaxation, for example, spending time with family and friends, resting, or reading
409 is needed, but long working hours may also reduce relaxation time [82]. Therefore, reduced private
410 time for workers due to long working hours may lead to sleeplessness, and cause sleep disorders.
411 In addition, due to the nature of their occupation, our study participants spend a lot of time working
412 with computers and other electronic devices. Plausible investigations also confirmed that the
413 utilization of electronic devices for a long period of time is associated with sleep disorders [33,
414 34].

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

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

426 Our current study revealed a high-risk perception of COVID-19 infections was found to be a
427 determinant factor of poor sleep quality. This finding is in concordance with other research reports
428 [44, 89]. This could be explained as those people who thought they were at a higher risk of
429 developing COVID-19 had more fear than those who thought they were at a lower risk. Fear and
430 rumination were also found to be adversely related to sleep quality, indicating that fear of infection
431 and rumination did lead to poor sleep quality during the pandemic, which contribute to poorer
432 sleep quality both directly and indirectly by increasing fear [44]. Several researchers had examined
433 the influence of the COVID-19 pandemic on mental health, concluding that persons who are
434 fearful of becoming infected are more likely to develop sleeping disturbances [90].

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

442 **Conclusion**

443 This study revealed that two-thirds of the participants had poor sleep quality during the COVID-
444 19 pandemic, indicating a considerable prevalence of the condition. The finding highlights the
445 importance of optimizing the working hours per day, minimizing electronic device use before
446 bedtime, promoting risk perception toward COVID-19 infection, and developing workplace
447 coping strategies for stress, which play a substantial role in minimizing poor sleep quality. We
448 recommend future studies to account for different sectors such as telecommunication, healthcare,

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3 449 transportation, etc. with interventional study design and objectively measuring sleep quality
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5 450 parameters.
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9 452 **Data availability statement**

11 453 All the data generated in this study are included in this manuscript. The data sets used and analyzed
12 454 to produce the current manuscript can be obtained from the corresponding author upon request via
13 455 e-mail address of amensisahailu@gmail.com.
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17 456 **Ethics statements**

18 457 **Patient consent for publication**

19 458 Consent obtained directly from patient (s).
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21 459 **Ethics approval and consent to participate**

22 460 Ethical approval was secured from the Institutional Ethical Review Board (IRB) of the University
23 461 of Gondar, College of Medicine and Health Sciences, Institute of Public Health (**Reference #:**
24 462 **IPH/1425/2021**). The study followed the tenets of the Declaration of Helsinki and also complied
25 463 with the ethical requirements set by the University of Gondar. Written informed consent was
26 464 obtained from each respondent before commencing data collection after an explanation of the
27 465 nature and possible consequences of the study. The information sheet that clearly shows the
28 466 research topic, the objectives of the study, confidentiality of the participant's responses, the study
29 467 benefits, and associated risks was prepared and presented. We removed any personal identifiers to
30 468 assure confidentiality of the participants and only anonymous data were used for interpretations.
31 469 Furthermore, since the data were collected during the COVID-19 pandemic, we implemented
32 470 infection prevention protocols including social distancing and wearing of facemasks.
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45 471 **Abbreviations**

46 472 AOR=Adjusted Odds Ratio; CI= Confidence Interval; COVID-19= Corona virus disease 19;
47 473 COR= Crude Odds Ratio; ETB= Ethiopia Birr; OR= Odds Ratio; PSQI= Pittsburgh Sleep Quality
48 474 Index, SD= Standard Deviation; SQ= Sleep Quality; STATA= Statistical software for data science
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53 475 **Conflicting interests**

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479 collection tools and data collectors' fee was covered by the principal investigator, i.e., AHT.

480 **Author's contribution**

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

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488 **References**

- 489 1. Landry GJ, Best JR, Liu-Ambrose T: **Measuring sleep quality in older adults: a comparison**
490 **using subjective and objective methods.** *Frontiers in aging neuroscience* 2015, **7**:166.
- 491 2. Yang Y, Li W, Ma T-J, Zhang L, Hall BJ, Ungvari GS, Xiang Y-T: **Prevalence of poor sleep**
492 **quality in perinatal and postnatal women: a comprehensive meta-analysis of observational**
493 **studies.** *Frontiers in psychiatry* 2020, **11**:161.
- 494 3. Madrid-Valero JJ, Martínez-Selva JM, Couto BRd, Sánchez-Romera JF, Ordoñana JR: **Age and**
495 **gender effects on the prevalence of poor sleep quality in the adult population.** *Gaceta sanitaria*
496 2017, **31**:18-22.
- 497 4. Sateia MJ: **International classification of sleep disorders.** *Chest* 2014, **146**(5):1387-1394.
- 498 5. Buysse DJ, Angst J, Gamma A, Ajdacic V, Eich D, Rössler W: **Prevalence, course, and**
499 **comorbidity of insomnia and depression in young adults.** *Sleep* 2008, **31**(4):473-480.
- 500 6. Paunio T, Korhonen T, Hublin C, Partinen M, Kivimäki M, Koskenvuo M, Kaprio J: **Longitudinal**
501 **study on poor sleep and life dissatisfaction in a nationwide cohort of twins.** *American Journal*
502 *of Epidemiology* 2009, **169**(2):206-213.
- 503 7. Aw SB, Teh BT, Ling GHT, Leng PC, Chan WH, Ahmad MH: **The covid-19 pandemic situation**
504 **in malaysia: Lessons learned from the perspective of population density.** *International journal*
505 *of environmental research and public health* 2021, **18**(12):6566.
- 506 8. Pinto J, van Zeller M, Amorim P, Pimentel A, Dantas P, Eusébio E, Neves A, Pipa J, Santa Clara
507 E, Santiago T: **Sleep quality in times of Covid-19 pandemic.** *Sleep medicine* 2020, **74**:81-85.
- 508 9. Musa NA, Moy FM, Wong LP: **Prevalence and factors associated with poor sleep quality**
509 **among secondary school teachers in a developing country.** *Industrial health* 2018.
- 510 10. Souza JcD, Sousa IcD, Belísio AS, Azevedo CvMd: **Sleep habits, daytime sleepiness and sleep**
511 **quality of high school teachers.** *Psychology & Neuroscience* 2012, **5**:257-263.
- 512 11. Kottwitz MU, Gerhardt C, Pereira D, Iseli L, Elfering A: **Teacher's sleep quality: linked to social**
513 **job characteristics?** *Industrial health* 2017.

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2
3 514 12. Freitas AMC, Araújo TMD, Pinho PdS, Sousa CC, Oliveira PCS, Souza FdO: **Sleep quality and associated factors among professors.** *Revista Brasileira de Saúde Ocupacional* 2021, **46**.
- 4 515
5 516 13. Teker AG, Luleci NE: **Sleep quality and anxiety level in employees.** *Northern clinics of Istanbul* 2018, **5(1):31**.
- 6 517
7 518 14. Burdorf A, Porru F, Rugulies R: **The COVID-19 (Coronavirus) pandemic: consequences for occupational health.** *Scandinavian Journal of Work, Environment & Health* 2020, **46(3):229-230**.
- 8 519
9 520 15. Stranges S, Tigbe W, Gómez-Olivé FX, Thorogood M, Kandala N-B: **Sleep problems: an emerging global epidemic? Findings from the INDEPTH WHO-SAGE study among more than 40,000 older adults from 8 countries across Africa and Asia.** *Sleep* 2012, **35(8):1173-1181**.
- 10 521
11 522 16. Dumith SC, Meneghini KFD, Demenech LM: **Who are the individuals with the worst perceived quality of sleep? A population-based survey in southern Brazil.** *Preventive Medicine Reports* 2021, **21:101288**.
- 12 523
13 524
14 525
15 526 17. Adams R, Appleton S, Taylor A, McEvoy D, Antic N: **Report to the sleep Health Foundation 2016 sleep health survey of Australian adults.** *Adelaide: The Adelaide Institute for Sleep Health & The University of Adelaide* 2016.
- 16 527
17 528
18 529 18. Watson N, Badr M, Belenky G, Bliwise D, Buxton O, Buysse D, Dinges D, Gangwisch J, Grandner M, Kushida C: **Consensus Conference Panel Non-Participating Observers American Academy of Sleep Medicine Staff (2015) Recommended amount of sleep for a healthy adult: a joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society.** *J Clin Sleep Med*, **11:591-592**.
- 19 530
20 531
21 532
22 533
23 534 19. Organization WH: **WHO technical meeting on sleep and health: Bonn Germany, 22–24 January 2004.** In.: World Health Organization. Regional Office for Europe; 2004.
- 24 535
25 536 20. Duran S, Erkin Ö: **Psychologic distress and sleep quality among adults in Turkey during the COVID-19 pandemic.** *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 2021, **107:110254**.
- 26 537
27 538
28 539 21. Crepaldi T, Carvalhais J, Cotrim T: **Sleep Quality and Quality of Working Life Among Brazilian University Professors in Telework.** In: *Occupational and Environmental Safety and Health III*. edn. Edited by Arezes PM, Baptista JS, Carneiro P, Castelo Branco J, Costa N, Duarte J, Guedes JC, Melo RB, Miguel AS, Perestrelo G. Cham: Springer International Publishing; 2022: 661-669.
- 29 540
30 541
31 542
32 543
33 544 22. **Sleep-RSPH, availbel at <https://www.rsph.org.uk/our-work/policy/wellbeing/sleep.html>**
- 34
35 545
36
37 546 23. Colten HR, Altevogt BM: **Extent and health consequences of chronic sleep loss and sleep disorders.** *Sleep disorders and sleep deprivation: an unmet public health problem* 2006:55-135.
- 38 547
39 548 24. Roodbandi ASJ, Feyzi V, KHANJANI N, MOGHADAM SR, BAFGHI MS, MOGHADASI M, NOROUZI Z: **Sleep quality and sleepiness: a comparison between nurses with and without shift work, and university employees.** *International Journal of Occupational Hygiene* 2016, **8(4):230-236**.
- 40 549
41 550
42 551
43 552 25. Chatlaong T, Pitanupong J, Wiwattanaworaset P: **Sleep quality and burnout syndrome among residents in training at the faculty of medicine, Prince of Songkla University.** *Siriraj Medical Journal* 2020, **72(4):307-314**.
- 44 553
45 554
46 555 26. Manzar MD, Bekele BB, Noohu MM, Salahuddin M, Albougami A, Spence DW, Pandi-Perumal SR, Bahammam AS: **Prevalence of poor sleep quality in the Ethiopian population: a systematic review and meta-analysis.** *Sleep and Breathing* 2020, **24(2):709-716**.
- 47 556
48 557
49 558 27. Huang Y, Zhao N: **Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey.** *Psychiatry research* 2020, **288:112954**.
- 50 559
51 560
52 561 28. Gualano MR, Lo Moro G, Voglino G, Bert F, Siliquini R: **Effects of Covid-19 lockdown on mental health and sleep disturbances in Italy.** *International journal of environmental research and public health* 2020, **17(13):4779**.
- 53 562
54 563
55 564
56 565
57
58
59
60

- 1
2
3 564 29. Marelli S, Castelnuovo A, Somma A, Castronovo V, Mombelli S, Bottoni D, Leitner C, Fossati A,
4 565 Ferini-Strambi L: **Impact of COVID-19 lockdown on sleep quality in university students and**
5 566 **administration staff.** *Journal of Neurology* 2021, **268**(1):8-15.
- 6 567 30. Dowla SU: **Evaluating the effects of COVID-19 on mental health.** Brac University; 2021.
- 7 568 31. Rwigema P: **Impact of COVID-19 lockdowns on the education sector. The case of Rwanda.**
8 569 *The Strategic Journal of Business & Change Management* 2021, **8**(1):150-169.
- 9 570 32. Salehinejad MA, Majidinezhad M, Ghanavati E, Kouestanian S, Vicario CM, Nitsche MA, Nejati
10 571 V: **Negative impact of COVID-19 pandemic on sleep quantitative parameters, quality, and**
11 572 **circadian alignment: implications for health and psychological well-being.** *EXCLI journal*
12 573 2020, **19**:1297.
- 13 574 33. Patil A, Bhavya SC, Srivastava S: **Eyeing computer vision syndrome: Awareness, knowledge,**
14 575 **and its impact on sleep quality among medical students.** *Industrial psychiatry journal* 2019,
15 576 **28**(1):68.
- 16 577 34. Salehi SG, Hassani H, Mortezaipoor A, Sadeghniaat-Haghighi K: **Assessing of Sleepiness,**
17 578 **Insomnia and Sleep Quality among University Students: Association between Computer Use**
18 579 **and Sleep Quality.** *Annals of Military & Health Sciences Research* • Vol 2015, **13**(4).
- 19 580 35. Chisale P, Mzumara T, Afonne J: **Knowledge Attitude, perception and knowledge and practice**
20 581 **of prevention practices of computer vision syndrome among mzuzu university academic staff.**
21 582 *J Eye Vis* 2019, **2**(2):1-7.
- 22 583 36. Baker FC, Wolfson AR, Lee KA: **Association of sociodemographic, lifestyle, and health factors**
23 584 **with sleep quality and daytime sleepiness in women: findings from the 2007 National Sleep**
24 585 **Foundation “Sleep in America Poll”.** *Journal of women's health* 2009, **18**(6):841-849.
- 25 586 37. Gellis LA, Lichstein KL, Scarinci IC, Durrence HH, Taylor DJ, Bush AJ, Riedel BW:
26 587 **Socioeconomic status and insomnia.** *Journal of abnormal psychology* 2005, **114**(1):111.
- 27 588 38. Ding D, Gebel K, Phongsavan P, Bauman AE, Merom D: **Driving: a road to unhealthy lifestyles**
28 589 **and poor health outcomes.** *PloS one* 2014, **9**(6):e94602.
- 29 590 39. Kabrita CS, Hajjar-Muca TA, Duffy JF: **Predictors of poor sleep quality among Lebanese**
30 591 **university students: association between evening typology, lifestyle behaviors, and sleep**
31 592 **habits.** *Nature and science of sleep* 2014, **6**:11.
- 32 593 40. Shochat T: **Impact of lifestyle and technology developments on sleep.** *Nature and science of*
33 594 *sleep* 2012, **4**:19.
- 34 595 41. Alonzo R, Hussain J, Stranges S, Anderson KK: **Interplay between social media use, sleep**
35 596 **quality, and mental health in youth: A systematic review.** *Sleep Medicine Reviews* 2021,
36 597 **56**:101414.
- 37 598 42. Berhanu H, Mossie A, Tadesse S, Geleta D: **Prevalence and associated factors of sleep quality**
38 599 **among adults in Jimma Town, Southwest Ethiopia: a community-based cross-sectional study.**
39 600 *Sleep disorders* 2018, **2018**.
- 40 601 43. Negussie BB, Emeria MS, Reta EY, Shiferaw BZ: **Sleep deprivation and associated factors**
41 602 **among students of the Institute of Health in Jimma University, Southwest Ethiopia.** *Frontiers*
42 603 *of Nursing* 2021, **8**(3):303-311.
- 43 604 44. Lin S-Y, Chung KKH: **Risk perception, perception of collective efficacy and sleep quality in**
44 605 **Chinese adults during COVID-19 pandemic in Hong Kong: a cross-sectional study.**
45 606 *International Journal of Environmental Research and Public Health* 2021, **18**(21):11533.
- 46 607 45. Amschler DH, McKenzie JF: **Perceived sleepiness, sleep habits and sleep concerns of public**
47 608 **school teachers, administrators and other personnel.** *American Journal of Health Education*
48 609 2010, **41**(2):102-109.
- 49 610 46. Alemayehu M, Nega A, Tegegne E, Mule Y: **Prevalence of self reported computer vision**
50 611 **syndrome and associated factors among secretaries and data processors who are working in**
51 612 **University of Gondar, Ethiopia.** *Journal of Biology, Agriculture and Healthcare* 2014, **4**(15).

- 1
2
3 613 47. Kabito GG, Wami SD, Chercos DH, Mekonnen TH: **Work-related Stress and Associated Factors among Academic Staffs at the University of Gondar, Northwest Ethiopia: An Institutionbased Cross-sectional Study.** *Ethiopian journal of health sciences* 2020, **30**(2).
- 4 614
5 615
6 616 48. Daniel WW, Cross CL: **Biostatistics: a foundation for analysis in the health sciences:** Wiley; 2018.
- 7 617
8 618 49. Martínez-Mesa J, González-Chica DA, Bastos JL, Bonamigo RR, Duquia RP: **Sample size: how many participants do I need in my research?** *Anais brasileiros de dermatologia* 2014, **89**:609-615.
- 9 619
10 620
11 621 50. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ: **The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research.** *Psychiatry research* 1989, **28**(2):193-213.
- 12 622
13 623
14 624 51. Salahuddin M, Maru TT, Kumalo A, Pandi-Perumal SR, Bahammam AS, Manzar MD: **Validation of the Pittsburgh sleep quality index in community dwelling Ethiopian adults.** *Health and quality of life outcomes* 2017, **15**(1):1-7.
- 15 625
16 626
17 627 52. Seidell JC, Flegal KM: **Assessing obesity: classification and epidemiology.** *British medical bulletin* 1997, **53**(2):238-252.
- 18 628
19 629 53. Nakata A, Ikeda T, Takahashi M, Haratani T, Hojou M, Swanson NG, Fujioka Y, Araki S: **The prevalence and correlates of occupational injuries in small-scale manufacturing enterprises.** *Journal of occupational health* 2006, **48**(5):366-376.
- 20 630
21 631
22 632 54. Jemere T, Mossie A, Berhanu H, Yeshaw Y: **Poor sleep quality and its predictors among type 2 diabetes mellitus patients attending Jimma University Medical Center, Jimma, Ethiopia.** *BMC research notes* 2019, **12**(1):1-6.
- 23 633
24 634
25 635 55. Rolander B, Bellner A-L: **Experience of musculo-skeletal disorders, intensity of pain, and general conditions in work--the case of employees in non-private dental clinics in a county in southern Sweden.** *Work* 2001, **17**(1):65-73.
- 26 636
27 637
28 638 56. Negussie BB, Emeria MS, Reta EY, Shiferaw BZ: **Sleep deprivation and associated factors among students of the Institute of Health in Jimma University, Southwest Ethiopia.** *Frontiers of Nursing*, **8**(3):303-311.
- 29 639
30 640
31 641 57. Abdu Z, Hajure M: **Prevalence and Associated Factors of Poor Quality of Sleep among Prisoners in Mettu Town Prison, Oromia, South West Ethiopia, 2019.** *The Open Public Health Journal* 2020, **13**(1).
- 32 642
33 643
34 644 58. Azene ZN, Merid MW, Muluneh AG, Geberu DM, Kassa GM, Yenit MK, Tilahun SY, Gelaye KA, Mekonnen HS, Azageaw AW: **Adherence towards COVID-19 mitigation measures and its associated factors among Gondar City residents: A community-based cross-sectional study in Northwest Ethiopia.** *PloS one* 2020, **15**(12):e0244265.
- 35 645
36 646
37 647
38 648 59. Macdonald S, MacIntyre P: **The generic job satisfaction scale: Scale development and its correlates.** *Employee Assistance Quarterly* 1997, **13**(2):1-16.
- 39 649
40 650 60. The Marlin Company NH, CT, and the American Institute of Stress, Yonkers, NY,: **The Workplace Stress Scale™** Available at: <https://teorionline.files.wordpress.com/2011/04/unit-3-the-workplace-stress-scale.pdf> . Accessed on 10 June 2019.
- 41 651
42 652
43 653 61. Cohen S, Kamarck T, Mermelstein R: **Perceived stress scale.** *Measuring stress: A guide for health and social scientists* 1994, **10**(2):1-2.
- 44 654
45 655 62. Birhanu TT, Salih MH, Abate HK: **Sleep Quality and Associated Factors Among Diabetes Mellitus Patients in a Follow-Up Clinic at the University of Gondar Comprehensive Specialized Hospital in Gondar, Northwest Ethiopia: A Cross-Sectional Study.** *Diabetes, metabolic syndrome and obesity: targets and therapy* 2020, **13**:4859.
- 46 656
47 657
48 658 63. Wondie T, Molla A, Mulat H, Damene W, Bekele M, Madoro D, Yohannes K: **Magnitude and correlates of sleep quality among undergraduate medical students in Ethiopia: cross-sectional study.** *Sleep Science and Practice* 2021, **5**(1):1-8.
- 49 659
50 660
51 661 64. James BO, Omoaregba JO, Igberase OO: **Prevalence and correlates of poor sleep quality among medical students at a Nigerian university.** *Ann Nigerian Med* 2011, **5**(1):1-5.
- 52 662
53 663
54
55
56
57
58
59
60

- 1
2
3 664 65. Smyth C: **The Pittsburgh sleep quality index (PSQI)**. In., vol. 25: SLACK Incorporated
4 665 Thorofare, NJ; 1999: 10-10.
- 5 666 66. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A: **The Pittsburgh
6 667 sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical
7 668 samples: A systematic review and meta-analysis**. *Sleep medicine reviews* 2016, **25**:52-73.
- 8 669 67. Zailinawati A, Teng C, Chung Y, Teow T, Lee P, Jagmohani K: **Daytime sleepiness and sleep
9 670 quality among Malaysian medical students**. *The Medical journal of Malaysia* 2009, **64**(2):108-
10 671 110.
- 11 672 68. Backhaus J, Junghanns K, Broocks A, Riemann D, Hohagen F: **Test-retest reliability and validity
12 673 of the Pittsburgh Sleep Quality Index in primary insomnia**. *Journal of psychosomatic research*
13 674 2002, **53**(3):737-740.
- 14 675 69. Bertolazi AN, Fagundes SC, Hoff LS, Dartora EG, da Silva Miozzo IC, de Barba MEF, Barreto
15 676 SSM: **Validation of the Brazilian Portuguese version of the Pittsburgh sleep quality index**.
16 677 *Sleep medicine* 2011, **12**(1):70-75.
- 17 678 70. Kwok KO, Li KK, Chan HHH, Yi YY, Tang A, Wei WI, Wong SYS: **Community responses
18 679 during early phase of COVID-19 epidemic, Hong Kong**. *Emerging infectious diseases* 2020,
19 680 **26**(7):1575.
- 20 681 71. Mekonnen TH, Abere G, Olkeba SW: **Risk Factors Associated with Upper Extremity
21 682 Musculoskeletal Disorders among Barbers in Gondar Town, Northwest Ethiopia, 2018: A
22 683 Cross-Sectional Study**. *Pain Research and Management* 2019, **2019**(2019):1-9.
- 23 684 72. Mekonnen TH, Yenealem DG: **Factors affecting healthcare utilization for low back pain among
24 685 nurses in Gondar town, northwest Ethiopia, 2018: a cross-sectional study**. *BMC Res Notes*
25 686 2019, **12**(185):1-6.
- 26 687 73. Meaza H, Temesgen MH, Redae G, Hailemariam TT, Alamer A: **Prevalence of Musculoskeletal
27 688 Pain Among Academic Staff of Mekelle University, Ethiopia**. *Clinical Medicine Insights:
28 689 Arthritis and Musculoskeletal Disorders* 2020, **13**:1179544120974671.
- 29 690 74. Etana G, Ayele M, Abdissa D, Gerbi A: **Prevalence of Work Related Musculoskeletal Disorders
30 691 and Associated Factors Among Bank Staff in Jimma City, Southwest Ethiopia, 2019: An
31 692 Institution-Based Cross-Sectional Study**. *Journal of Pain Research* 2021, **14**:2071.
- 32 693 75. Hosmer DW, Hjort NL: **Goodness-of-fit processes for logistic regression: simulation results**.
33 694 *Statistics in medicine* 2002, **21**(18):2723-2738.
- 34 695 76. de Sousa AR, Santos RB, da Silva RM, Santos CCT, Lopes VC, Mussi FC: **Occupational stress
35 696 and sleep quality in professors of the health area**. *Rev Rene* 2018(19):60.
- 36 697 77. Farah NM, Saw Yee T, Mohd Rasdi HF: **Self-reported sleep quality using the Malay version of
37 698 the Pittsburgh sleep quality index (PSQI-M) in Malaysian adults**. *International journal of
38 699 environmental research and public health* 2019, **16**(23):4750.
- 39 700 78. Vandewalle G, Archer SN, Guillaume C, Balteau E, Degueldre C, Luxen A, Dijk D-J, Maquet P:
40 701 **Effects of light on cognitive brain responses depend on circadian phase and sleep homeostasis**.
41 702 *Journal of biological rhythms* 2011, **26**(3):249-259.
- 42 703 79. Virtanen M, Ferrie JE, Gimeno D, Vahtera J, Elovainio M, Singh-Manoux A, Marmot MG,
43 704 Kivimäki M: **Long working hours and sleep disturbances: the Whitehall II prospective cohort
44 705 study**. *Sleep* 2009, **32**(6):737-745.
- 45 706 80. Jansen N, Kant I, van Amelsvoort L, Nijhuis F, van den Brandt P: **Need for recovery from work:
46 707 evaluating short-term effects of working hours, patterns and schedules**. *Ergonomics* 2003,
47 708 **46**(7):664-680.
- 48 709 81. Bannai A, Ukawa S, Tamakoshi A: **Long working hours and sleep problems among public
49 710 junior high school teachers in Japan**. *Journal of occupational health* 2015:15-0053-OA.
- 50 711 82. Ferrie J, Gimeno D, Vahtera J, Elovainio M, Singh-Manoux A, Marmot M, Kivimäki M: **Long
51 712 working hours and sleep disturbances: the Whitehall II prospective cohort study**. *Virtanen
52 713 M. SLEEP MEDICINE*:129.
- 53 714 83. Byrd E: **The Effect of the Use of An Electronic Device Before Bed on Sleep Quality**. 2019.

- 1
2
3 715 84. Walsh NA, Rodriguez N, Repa LM, King E, Garland SN: **Associations between device use before**
4 716 **bed, mood disturbance, and insomnia symptoms in young adults.** *Sleep Health* 2020, **6(6):822-**
5 717 **827.**
- 6 718 85. Fossum IN, Nordnes LT, Storemark SS, Bjorvatn B, Pallesen S: **The association between use of**
7 719 **electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness,**
8 720 **morningness, and chronotype.** *Behavioral sleep medicine* 2014, **12(5):343-357.**
- 9 721 86. Salfi F, Amicucci G, Corigliano D, D'Atri A, Viselli L, Tempesta D, Ferrara M: **Changes of**
10 722 **evening exposure to electronic devices during the COVID-19 lockdown affect the time course**
11 723 **of sleep disturbances.** *Sleep* 2021, **44(9):zab080.**
- 12 724 87. Shechter A, Kim EW, St-Onge M-P, Westwood AJ: **Blocking nocturnal blue light for insomnia:**
13 725 **A randomized controlled trial.** *J Psychiatr Res* 2018, **96:196-202.**
- 14 726 88. Sobaih AEE, Hasanein AM, Abu Elnasr AE: **Responses to COVID-19 in Higher Education:**
15 727 **Social Media Usage for Sustaining Formal Academic Communication in Developing**
16 728 **Countries.** *Sustainability* 2020, **12(16):6520.**
- 17 729 89. Yan J, Kim S, Zhang SX, Foo M-D, Alvarez-Risco A, Del-Aguila-Arcentales S, Yáñez JA:
18 730 **Hospitality workers' COVID-19 risk perception and depression: A contingent model based**
19 731 **on transactional theory of stress model.** *International Journal of Hospitality Management* 2021,
20 732 **95:102935.**
- 21 733 90. Iorga M, Iurcov R, Pop L-M: **The Relationship between Fear of Infection and Insomnia among**
22 734 **Dentists from Oradea Metropolitan Area during the Outbreak of Sars-CoV-2 Pandemic.**
23 735 *Journal of Clinical Medicine* 2021, **10(11):2494.**
- 24 736 91. Kesintha A, Rampal L, Sherina M, Kalaiselvam T: **Prevalence and predictors of poor sleep**
25 737 **quality among secondary school students in Gombak District, Selangor.** *Med J Malaysia* 2018,
26 738 **73(1):32-40.**
- 27 739 92. Herawati K, Gayatri D: **The correlation between sleep quality and levels of stress among**
28 740 **students in Universitas Indonesia.** *Enfermeria clinica* 2019, **29:357-361.**
- 29 741 93. Hirotsu C, Tufik S, Andersen ML: **Interactions between sleep, stress, and metabolism: From**
30 742 **physiological to pathological conditions.** *Sleep Science* 2015, **8(3):143-152.**
- 31 743 94. Han KS, Kim L, Shim I: **Stress and sleep disorder.** *Experimental neurobiology* 2012, **21(4):141.**
- 32
33
34 744
35
36 745
37
38 746
39
40 747
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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, sleep duration, 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 during the 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%=1, 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	
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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

For peer review only

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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

1 2 3 4 5 6 7 8 9 10	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 (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	11
11 12 13	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
14	Discussion			
15	Key results	18	Summarise key results with reference to study objectives	14
16 17 18 19	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
20 21 22 23	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
24 25	Generalisability	21	Discuss the generalisability (external validity) of the study results	
26	Other information			
27 28 29 30	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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3 **1 Risk Factors for the Prevalence of Poor Sleep Quality in Lecturers During COVID-19**
4 **2 Pandemic in Ethiopia: an institution-based cross-sectional study**
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24 **Abstract**

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

27 **Design:** An institution-based cross-sectional study was conducted from March to April 2021. A
28 validated self-administered, standardized Pittsburgh Sleep Quality Index was used to quantify the
29 amount of self-reported poor sleep quality. The collected data were entered into EpiData version
30 4.6 and analyzed using STATA version 14 software. Binary logistic regressions were computed to
31 determine the association between variables. The association was determined using an adjusted
32 Odds ratio (AOR) with a 95% confidence interval (CI) at a p-value of < 0.05.

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

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

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

37 **Results:** Overall response rate was 95.60% (N = 607). The age of the participants ranges from 21
38 to 70 with a mean of 32.39 (SD ±6.80) years. The magnitude of poor sleep quality during the
39 COVID-19 pandemic in the last month was 60.30% [95% CI (56.28%-64.21%)]. Working > 10
40 hours per day [AOR= 2.19, 95% CI (1.16, 4.27)], electronic device use before bedtime
41 [AOR=1.53, 95% CI (1.04, 2.27)], high-risk perception of COVID-19 infections [AOR =1.60,
42 95% CI (1.04, 2.46)], and perceived job stress [AOR = 2.15 (95% CI, (1.50, 3.08))] were risk factors
43 for poor sleep quality.

44 **Conclusion:** The study revealed that the prevalence of poor sleep quality was high during the
45 COVID-19 pandemic. The finding highlights the importance of optimizing the working hours per
46 day, minimizing electronic device use before bedtime, promoting risk perception toward COVID-
47 19 infection, and developing workplace coping strategies for stress, which play a substantial role
48 in minimizing poor sleep quality.

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

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52 **Strengths and limitations of this study**

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

63 **Background**

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

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

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3 81 now and in the future [14]. Likewise, the World Health Organization (WHO) has classified poor
4 82 sleep quality as a public health issue that exacerbates the risk of disease and death [15]. Poor SQ
5 83 also has significant economic consequences. In the USA, for example, the annual costs of poor
6 84 sleep have been estimated to be as high as US\$16 billion in healthcare costs and US\$50 billion in
7 85 lost productivity [16]. In Australia, the costs were estimated to be approximately US\$1.8 billion
8 86 for the health system and US\$66.3 billion for financial loss and decreased well-being [17-19].

13
14 87 The prevalence of poor sleep quality was increased during the COVID-19 period.[20]. A couple
15 88 of studies from Brazilian [12, 21], documented that 61.3% and 44.2% of university academic staff
16 89 reported poor sleep quality. Scientific investigation showed that four out of ten people do not get
17 90 enough sleep, and one in five sleeps poorly most nights, making poor sleep the second most
18 91 common health complaint after pain [22, 23]. According to a study done in Iran [24], 79.6%
19 92 (n=133) of university staff reported having poor sleep quality. A similar finding was also found in
20 93 a study conducted in Thailand [25], where 78.3% of respondents experienced poor sleep quality.
21 94 So far, epidemiological data from Turkey indicated that 55.1% of adults had poor sleep quality
22 95 [20]. In Ethiopia, the pooled prevalence of poor sleep quality was 53% among general populations
23 96 and university students, with incidences ranging from 26% to 66.2% [26]. However, studies on
24 97 sleep quality, particularly among university academic staff, are lacking.

25
26 98 Recent research shows that during the COVID-19 pandemic, sleep quality was impaired and the
27 99 prevalence of poor sleep increased in both the working and general population [27-29].
28 100 Furthermore, the global COVID-19 pandemic has compelled higher education institutions,
29 101 including Ethiopian universities, to shift from face-to-face to online instruction, which has an
30 102 impact on sleep quality [30-32]. Prolonged use of computers, coupled with the brightness of the
31 103 light that they project onto the retina, are factors that are thought to trigger changes in sleep patterns
32 104 [33]. The light emitted from computers is in close proximity to the retina [34]. This emitted optical
33 105 radiation at short wavelengths is close to the peak sensitivity of melatonin suppression [33].
34 106 Academic staff members used computers more frequently during the COVID-19 outbreak, which
35 107 may have increased their exposure to computer light and led them to poor sleep quality, and
36 108 negatively affected their quality of sleep [35]. Moreover, poor sleep quality has been correlated to
37 109 old age, low economic status, substance use, obesity, use of an electronic device before bedtime,
38 110 higher risks of contracting COVID-19 at work, workload, and job stress [36-44].

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3 111 Given the widespread and harmful consequences of poor sleep quality, it needs to be a top priority
4 112 for public and occupational health. As previously stated, a thorough review of the literature
5 113 revealed that even less is known about the prevalence and factors of poor sleep quality among
6 114 academic staff and other university personnel in developing countries including Ethiopia [45].The
7 115 number of universities in Ethiopia is increasing, which is accompanied by an increase in academic
8 116 staff workforces. However, the lack of reliable and up-to-date data on mental health, especially on
9 117 sleep quality, makes it difficult for officials to plan for prevention and control measures. Therefore,
10 118 in the current study, we aimed to assess the prevalence and associated factors of poor sleep quality
11 119 among academic staff at the University of Gondar, Northwest Ethiopia.

120 **Methods and materials**

121 **Study design, Period, and Setting**

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

129 **Study participants**

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

135 **Sample size determination and sampling procedure**

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

138 Confidence level (CI) of 95%

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

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3 140 Margin of error of 5%

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5 141 Using the following single proportion formula:

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8 142 $n = (Z\alpha/2)^2 \frac{[p(1-p)]}{d^2}$ where:

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10
11 143 n = initial sample size,

12
13 144 $Z = 1.96$, the corresponding Z -score for the 95% CI

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15 145 P = Proportion = 50%

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17 146 d = Margin of error = 5% = 0.05

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19
20 147 $n = (1.96)^2 \frac{[0.5(1-0.5)]}{0.05^2} = 384$

21
22 148 The final sample size was 635 people, after taking into account a 10% non-response rate and a
23 149 design effect of 1.5 because, in the absence of prior literature, a design effect of 1.5 to 2.0 is
24 150 endorsed [49]. We employed a stratified sampling technique to select participants from the five
25 151 campuses of the University of Gondar. A proportional allocation for each stratum defined how
26 152 many sample points were needed. Thus, there were a total of 1027 academic staff members in the
27 153 College of Medicine and Health Sciences ($N_1=1027$), 630 academic staff members on Maraki
28 154 campus ($N_2=630$), 509 academic staff members on Tewdros campus ($N_3=509$), 536 academic
29 155 staff members on the Fasil campus ($N_4=536$), and 156 academic staff members on the Teda
30 156 campus ($N_5=156$). Consequently, the numbers of participants from each campus were 228, 140,
31 157 119, 113, and 35 from the College of Medicine and Health Sciences, Maraki, Fasil, Tewodros, and
32 158 Teda campuses, respectively. The requisite sample sizes were then determined using a simple
33 159 random sampling technique, and academic staff members from each stratum were randomly
34 160 assigned using the OpenEpi random software version 3.

35 161 **Variable measurement and definition of terms**

36 162 **Poor sleep quality:** The Pittsburgh Sleep Quality Index (PSQI), a 19-item self-assessment of sleep
37 163 quality, was used to measure academicians' poor sleep quality. The tool was free to use and
38 164 designed to measure the outcome variable in the past month. It has a diagnostic sensitivity of
39 165 89.6% and a specificity of 86.5% at greater than five cutoff values for identifying cases with sleep
40 166 disorders [50]. PSQI consists of 7 component scores (ranging from 0 to 3), measuring subjective

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3 167 sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping
4 168 medication, and daytime dysfunction. The 7 component scores are summed to give a global PSQI
5 169 score ranging from 0 to 21. A global PSQI score of greater than 5 indicates poor sleep quality [33,
6
7 170 51].
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9

10 171 **Body mass index (BMI):** weight in kilograms divided by the square of the height in meters (kg/m^2)
11 172 categorized as underweight = $\text{BMI} < 18.5$, normal (health) = $\text{BMI} 18.5\text{--}24.9$, overweight = BMI
12 173 $25.0\text{--}29.9$, and obese = $\text{BMI} \geq 30.0$ [52].
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16 174 **Alcohol drinker:** a scholar who drinks alcohol of any kind at least twice each week [53]
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18 175 **Cigarette smoker:** a scholar with a daily consumption of at least one stick of cigarettes [54].
19

20 176 **Khat chewer:** a scholar who had chewed khat in the previous month [42].
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22 177 **Doing physical exercise:** doing any type of physical activity at least twice a week for at least 30
23 178 minutes [55].
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26 179 **Electronic device use:** if the participant utilizes/ watches at least one of the following: television,
27 180 computer, tablet, or mobile phone in bed before going to sleep [56].
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30 181 **Chronic illness:** illnesses such as asthma, diabetes mellitus, stroke, kidney stone, hypertension
31 182 that can be managed, but cannot be cured and have a greater risk of developing a poor quality of
32 183 sleep, [57].
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36 184 **Risk perception of COVID-19 infection:** was assessed by two psychological dimensions;
37 185 perceived susceptibility and perceived severity. The first dimension was proxied by how likely
38 186 one considered oneself (his/her family) would be infected with COVID-19 if no preventive
39 187 measures will be taken. The second dimension was proxied by how one rated the seriousness of
40 188 symptoms caused by COVID-19, their perceived chance of having COVID-19 cured and that of
41 189 survival if infected with COVID-19. By combining the two dimensions, five items with five
42 190 response options were asked to determine the respondents' levels of risk perception, with a higher
43 191 total score indicating a high perceived risk of COVID-19 infection [58].
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50 192 **Job satisfaction:** the total score of at least 32 on the general job satisfaction scale [59].
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52 193 **Perceived job stress:** a score of at least 21 on the workplace-stress scale [60].
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55 194 **Data Collection Tools and Procedures**
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3 195 Data were collected through a validated self-administered standardized structured questionnaire.
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5 196 The questionnaire was adapted after an extensive review of related literature and similar study
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7 197 tools [12, 42, 57, 61-63]. The questionnaire embraces three sections containing different items.
8
9 198 The first section, socio-demographic characteristics, assesses information on age, sex, religion,
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11 199 educational status, working experience, and monthly salary. The second element of the
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13 200 questionnaire hugs information on poor sleep quality, which was assessed by using the PSQI,
14
15 201 which is a measure of sleep disturbance for the period of 1-month immediately preceding the time
16
17 202 of administration. PSQI is an effective and the most widely used instrument in diagnosis of sleep
18
19 203 disorders in different populations [9, 64]. The tool is easy to understand, patient compliant and
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21 204 requires about 5 min to be completed. 10]. The PSQI contains 19 items and 7 clinically important
22
23 205 components in relation to sleep difficulties: subjective sleep quality, sleep latency, sleep duration,
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25 206 sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction. The total
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27 207 PSQI score was calculated by summing up the seven component scores as cited in [50]. Scoring
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29 208 of the answers is based on a 0 to 3 scale, whereby 3 reflects the negative extreme on the Likert
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31 209 scale, as well a global score of between 0 and 21. Individuals scoring a global score of greater than
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33 210 5 were deemed poor sleep quality [65]. The PSQI has been validated in many languages with
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35 211 acceptable psychometric properties [66] and is frequently used in clinical and research settings
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37 212 [67]. The PSQ has also been validated as reliable for use in Ethiopian community [51]. The PSQI's
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39 213 validity was supported by a comprehensive test used to diagnose sleep disorders like
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41 214 polysomnographic findings [68, 69]. The PSQI has a sensitivity of 89.6% and specificity of 86.5%
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43 215 for identifying cases with sleep disorder, using a cut-off score of 5 [50]. The last part of the
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45 216 questionnaire includes information used to assess behavioral factors and psychosocial factors like
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47 217 cigarette smoking (yes/no), BMI (kg/m²), physical activity (yes/no), alcohol consumption
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49 218 (yes/no), use of an electronic device before bedtime (yes/no), history of chronic illness (yes/no),
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51 219 risk perception of COVID-19, job satisfaction, job stress, and workload.

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53 220 Risk perception regarding COVID-19 in this study was measured by using two psychological
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55 221 dimensions; perceived susceptibility and perceived severity. The first dimension (perceived
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57 222 susceptibility) contains two questions; including how likely they will be infected with COVID-19
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59 223 and how likely one considered oneself (his/her family) would be infected with COVID-19 if no
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224 preventive measures will be taken. Responses of the two questions were rated on a 5-point Likert
225 scale (ranging from 1 = very likely to 5 = very unlikely). The second dimension (perceived

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3 226 severity) contains three questions; including how one rated the seriousness of symptoms caused
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5 227 by COVID-19, their perceived chance of having COVID-19 cured, and that of survival if infected
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7 228 with COVID-19. Responses of the three questions were rated on a 5-point Likert scale (ranging
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9 229 from 1 = Very serious /Very low to 5 = Not serious at all/Very high). By combining the two
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11 230 dimensions, making five questions each answered on a Likert scale of 1 to 5 giving rise to a total
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13 231 score ranging from 5 to 25. The higher the score, the higher the risk perception of COVID-19
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15 232 infection [70]. We used the 10-item generic job satisfaction scale questionnaire to measure
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17 233 academicians' job satisfaction [59]. The scale comprised ten questions ranging from 1 to 5 each
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19 234 item and ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, according
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21 235 to their occurrence respectively, in 1 month before the survey. The scale had 10 items with a rating
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23 236 of 1 to 5, and the responses ranged from very dissatisfied, dissatisfied, neutral, satisfied and very
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25 237 satisfied, depending on how frequently they occurred in the month before to the survey and then
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27 238 summing up all 10 items. The scale produced a single ranking, with high scores indicated higher
28
29 239 job satisfaction vice versa. Perceived job-related stress of the participants was collected using the
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31 240 8-item workplace stress scale questionnaire [60]. The scale comprised eight questions ranging
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33 241 from 1 to 5 each item and ranged from never, rarely, sometimes, often and very often, according
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35 242 to their occurrence respectively, in 1 month before the survey. The 8- item workplace stress scores
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37 243 are obtained by reversing scores on three positive items, e.g. 5 = 1, 4 = 2, 3 = 3, etc., and then
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39 244 summing up all 8 items. Items 6, 7 and 8 are positive items. The scale produced a single ranking,
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41 245 with high scores indicated higher stress levels and vice versa. The instruments used in the current
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43 246 study have been employed in previous studies conducted in the country's context [71-74].

40 247 **Data quality control**

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42 248 To maintain uniformity, the questionnaire was initially created in English, translated into the local
43
44 249 tongue of Amharic, and then translated back to English. Following appropriate training and
45
46 250 orientation, three BSc nurses and MPH Environmental health specialist who were employed at the
47
48 251 comprehensive specialized hospital of the University of Gondar participated in data collection.
49
50 252 The data collectors and supervisor took the orientation on issues relating to the clarity of the
51
52 253 questions, objectives of the study, confidentiality of information, the voluntary involvement
53
54 254 (consent) participants in the study, and on time of data collection as study participants' regular
55
56 255 duties should not be compromised. Both data collectors and supervisors were under the lead
57
58 256 investigator's supervision. The pre-test was carried out at Teda Health Sciences College in Gondar

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2
3 257 city on 5% (31) of the sample size to ensure the validity and reliability of the questionnaire, yet
4
5 258 the College was not included in the final survey. Based on the results of the pretest analysis, various
6
7 259 modifications were made including the clarification of a few ambiguities and misinterpretations,
8
9 260 and an estimation of how long the data gathering process would take. Feedback was provided by
10
11 261 discussing any issue that arose during data collection with the primary investigator, the supervisor,
12
13 262 and the data collectors.

14 263 **Data processing and analysis**

15
16 264 Data were entered into Epi-data version 4.6 after being verified as complete and exported to
17
18 265 STATA version 14 for additional analysis. We used descriptive statistics, narration, tabulation,
19
20 266 and graphics to present the findings. Prior to doing bivariable and multivariable binary logistic
21
22 267 regression analyses, the variables' normality, outliers, and multicollinearity were examined. A
23
24 268 variance inflation factor (VIF) was used to test the multicollinearity assumption, and all variables
25
26 269 displayed values of less than 5. As a result, multicollinearity was not observed to exist. Also, the
27
28 270 reliability of the questionnaire was tested using Cronbach's Alpha and found a reliable Cronbach's
29
30 271 Alpha = 0.79, and therefore the questionnaire was tolerable for its consistency in repeating what
31
32 272 had previously been measured using the tool [51]. Additionally, Cronbach's Alpha was used to
33
34 273 examine the questionnaire's reliability, and the reliability Cronbach's Alpha value was 0.79. As a
35
36 274 result, the questionnaire was deemed satisfactory for its consistency in reproducing what had
37
38 275 previously been measured using the instrument. A binary logistic regression was used to compute
39
40 276 the relationship between the variables. To control the effects of potential confounders, variables
41
42 277 with p-values of 0.2 in the bivariable logistic regression analysis were exported to a multivariable
43
44 278 logistic regression. Last but not least, in the multivariable binary logistic regression model,
45
46 279 statistically significant variables were established at a p-value of 0.05, and an adjusted odds ratio
47
48 280 (AOR) with a confidence interval of 95% was provided to quantify the strength of the association.
49
50 281 The Hosmer-Lemeshow test was used to determine the final model's goodness of fit, and the results
51
52 282 revealed a good fit ($p=0.65$) [75].

53 283 **Patient and public involvement statement**

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55 284 University lecturers were participated in this investigation by contributing useful information.
56
57 285 However, they have never been involved in the study design, protocol, data collection tools, and
58
59 286 reporting and disseminating the findings.

287 Results

288 Socio-demographic characteristics of study participants

289 A total of 635 questionnaires were distributed, giving a response rate of 95.59% (N = 607). The
 290 age of the participants ranged from 21 to 70, with a mean (\pm SD) of 32.39 (\pm 6.80) years old.
 291 Moreover, more than two-thirds of the participants were male (71.83%), and the majority of them,
 292 362 (59.64%), indicated that they were married. Regarding educational status, 416(68.53%) of the
 293 participants had master's degree. The participants' median estimated (interquartile range (IQR))
 294 monthly income was 11305 (10700-13600) Ethiopian Birr (ETB) (**Table 1**).

295 **Table 1:** Socio-demographic characteristics of academic staff in University of Gondar, Ethiopia,
 296 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
\geq 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

297 **Key:** ETB= Ethiopian Birr (currency)

298 Behavioral and psychosocial characteristics of study participants

299 Four hundred fourteen (68.20%) of the participants were working between 6 and 10 hours per day,
 300 and 79 (13.11%) participants were working more than 10 hours per day. Of the study participants,
 301 the number of respondents who admitted to smoking cigarettes was 108 (17.79%). While 112
 302 (18.45) said they had alcohol drinking habits, over one-third (33.28%) of respondents were
 303 performing physical exercise at least twice a week. The majority of the respondents, 434 (71.5%),
 304 had a normal (18.5-24.9 kg/m²) BMI, while 48 (7.91%) of them were underweight (>18.5 kg/m²)
 305 BMI. Out of the study participants, 188 (30.97%) of them clarified that they had a chronic illness,
 306 and almost half (51.24%) of the study participants have used an electronic device before bedtime.
 307 Regarding psychosocial characteristics, nearly one-fourth (24.38%) of the respondents had high-
 308 risk perceptions of the COVID-19 virus. Moreover, 516 (85.01%) respondents supposed they were
 309 satisfied with their jobs. Furthermore, when asked whether they felt stressed out by their work,
 310 276 respondents (45.47 %) said they did (**Table 2**).

311 **Table 2:** Behavioral and psychosocial characteristics of academic staff in the University of
 312 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

313

314 Prevalence of poor sleep quality and its components scores

315 The mean global score of PSQI (computed using the component scores) was 6.80, 95% CI (6.55,
 316 7.04). The result of this study revealed that 60.30% (95% CI, 56.28%-64.21%) of academicians
 317 were classified as having poor sleep quality. Seven components of sleep quality in the present
 318 study were assessed and the components identified their sleep status. Accordingly, 514 (84.68%)
 319 of the academicians had fairly good to very good sleep perception. From the total study
 320 participants, 342 (56.34%) had mild difficulty in falling asleep (PSQI latency). Regarding sleeping
 321 duration, only 165 (27.18%) of the respondents had more than 7 hours of sleep per night, and 326
 322 (53.71%) had a very high habitual sleep efficiency (>85%). Moreover, most (66.39%) of
 323 academicians reported that they had mild difficulty in the PSQI disturbance domain and only 39
 324 (6.42%) of them used sleep medication to sleep during the past month. Furthermore, 196 (32.29%)
 325 of them had mild to severe difficulty in PSQI day dysfunction due to sleepiness in the past month
 326 (Table 3).

327 **Table 3:** Poor sleep quality and its components scores of academic staff in the University of
 328 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

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

330 **Factors associated with poor sleep quality**

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

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

340 The probability of developing poor sleep quality was 2.19 times greater in employees who worked
 341 more than 10 hours per day compared to those who worked for 5 hours or less per day [AOR=
 342 2.19, 95% CI (1.16, 4.27)] at a p-value of 0.019. Similarly, participants who use electronic devices
 343 before bedtime were 1.53 times more likely to experience poor sleep quality compared to who
 344 didn't use electronic devices before bedtime counterparts [AOR=1.53, 95% CI (1.04, 2.27)] at a
 345 p-value of 0.031. Moreover, the odds of having poor sleep quality were 1.60 times more likely
 346 among workers who had a high-risk perception of COVID-19 infection than among those who had
 347 a low-risk perception about it [AOR = 1.60, 95% CI (1.04, 2.46)] at a p-value of 0.032. Finally, the
 348 chances of suffering from poor sleep quality among academicians who had perceived job stress
 349 were 2.15 times higher as compared to those who had no job stress [AOR = 2.15 (95% CI, (1.50,
 350 3.08)] at a p-value of ≤ 0.01 as shown in **Table 4**.

351 **Table 4:** Bivariable and multivariable logistic regression analysis of factors associated with poor
 352 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					
≤ 5 hr	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

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3 363 positions. Furthermore, their regular teaching activities have shifted from face-to-face to online
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5 364 instruction during the COVID-19 pandemic, which has an impact on their sleep quality.
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7 365 Understanding the magnitude and investigating etiologies of the condition plays a paramount role
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9 366 to establish effective prevention and control strategies. To our knowledge, the current study is the
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11 367 first to assess the prevalence and risk factors of poor sleep quality among university academic staff
12
13 368 in Ethiopia. The prevalence of poor sleep quality in the last one month was found to be 60.30%
14
15 369 with 95% CI (56.28-64.21). Working for more than 10 hours per day, electronic device use before
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17 370 bedtime, high-risk perception of COVID-19 infection, and having job stress were factors positively
18
19 371 associated with poor sleep quality in the current study.

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21 372 Results of two investigations conducted in Brazil (57.9%) [76] and (61.3%) [12] supported the
22
23 373 current data. This agreement could be due to the nature of tasks in the academic environments
24
25 374 including roles related to teaching and research activities, which usually resemble in every higher
26
27 375 academic institution. Participants in those nations might also be obliged to work in a substandard
28
29 376 workplace in an unhealthy manner for prolonged periods, and fewer individuals are aware of sleep
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31 377 health and the effect of poor sleep quality. The other possible explanation might be due to study
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33 378 participants having a similar age group as compared to participants in those countries.

34
35 379 On the contrary, the current study had a higher magnitude of the risk of poor sleep quality
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37 380 compared to the studies conducted in Turkey (38.9%) [13] and Malaysia (45%) [77]. This
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39 381 difference might be due to the unstable socioeconomic status of the respondents in this study. The
40
41 382 respondents in this study might attempt to compensate for their low salaries by teaching different
42
43 383 shifts at multiple colleges and schools. This may lead to longer working hours because they start
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45 384 their daily work activities much earlier in the day and conclude their working day much later. The
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47 385 difference might be also due to the sample size variation; the previous studies were conducted
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49 386 among a small number of study participants compared to the number of participants in this study.
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51 387 The other possible justifications for the difference might be the variation in the educational system,
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53 388 study setting, workload, and cultural differences between Ethiopia and those countries.

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55 389 There were no study reports with a larger magnitude than the current finding. A possible reason
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57 390 for the increased magnitude of sleep problems in the current study could be due to the study period;
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59 391 we conducted the study during the early phase of the COVID-19 pandemic. Higher education
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392 institutions needed to look for alternate educational strategies to be adopted during the COVID-19

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3 393 pandemic and the e-learning strategy emerged as an alternative solution to continue education. The
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5 394 educational institutions started using different educational platforms like Google classroom,
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7 395 Zoom, and Microsoft teams. Lecturers were subjected to excessive use of digital devices without
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9 396 breaks as they were shifted to online teaching. There has also been an increased digitalization for
10
11 397 recreational purposes. Hence, it was noted as exposure to light emitted from digital devices has
12
13 398 been interfering with the circadian regulation/melatonin rhythm [33, 78], which may lead to poor
14
15 399 sleep quality.

16 400 In this study, long working hour per day (>10hrs/day) was significantly associated with poor sleep
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18 401 quality. The finding echoes the result of previous investigations [9, 79]. A possible justification
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20 402 for this report may be that employees with long working hours need more time to recover from
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22 403 work-induced fatigue [80]. However, long working hours reduce the amount of private time
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24 404 available to them, which may lead to sleep deprivation [81]. For recovery from fatigue, not only
25
26 405 sleep but also relaxation, for example, spending time with family and friends, resting, or reading
27
28 406 is needed, but long working hours may also reduce relaxation time [82]. Therefore, reduced private
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30 407 time for workers due to long working hours may lead to sleeplessness, and cause sleep disorders.
31
32 408 In addition, due to the nature of their occupation, our study participants spend a lot of time working
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34 409 with computers and other electronic devices. Plausible investigations also confirmed that the
35
36 410 utilization of electronic devices for a long period of time is associated with sleep disorders [33,
37
38 411 34].

39 412 Electronic device use before bedtime showed a significant association with poor sleep quality.
40
41 413 Similar results were reported in other studies [83-85]. This could be reasoned as sleep quantity and
42
43 414 quality are significantly reduced when people use digital devices for an extended period [86]. For
44
45 415 example, cell phones, tablets, readers, computers, and laptops emit short-wavelength enriched
46
47 416 light, which has been found to suppress or delay the normal generation of melatonin in the evening
48
49 417 and minimize feelings of sleepiness [87]. Moreover, workforces in a higher education context are
50
51 418 often confronted with demanding responsibilities requiring work overload, long working hours,
52
53 419 and stress, in addition to the COVID-19 pandemic difficulties in the world of education. Because
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55 420 of the pandemic, universities were forced to conduct all of their activities online, including in the
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57 421 current study setting, which increased the usage of electronic devices, contributing to or
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59 422 exacerbating poor sleep quality [88].

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3 423 Our current study revealed a high-risk perception of COVID-19 infections was found to be a
4 424 determinant factor of poor sleep quality. This finding is in concordance with other research reports
5 425 [44, 89]. This could be explained as those people who thought they were at a higher risk of
6 426 developing COVID-19 had more fear than those who thought they were at a lower risk. Fear and
7 427 rumination were also found to be adversely related to sleep quality, indicating that fear of infection
8 428 and rumination did lead to poor sleep quality during the pandemic, which contribute to poorer
9 429 sleep quality both directly and indirectly by increasing fear [44]. Several researchers had examined
10 430 the influence of the COVID-19 pandemic on mental health, concluding that persons who are
11 431 fearful of becoming infected are more likely to develop sleeping disturbances [90].

12 432 Participants who reported having job stress were 2.38 times more likely to have poor sleep quality
13 433 than those who did not have stress. The result is in agreement with results of the studies conducted
14 434 in Brazil [76], Malaysia [9, 91], and Indonesia [92]. The plausible reason might be due to the
15 435 linkages between sleep, stress regulation, and alteration in the hypothalamic-pituitary-adrenal axis
16 436 implication of psychopathology and sleep-wake cycle. Job stress can lead to the release of an
17 437 excessive level of glucocorticoids hormones like cortisol. A higher level of cortisol during stressful
18 438 life events primes to sleep rhythm disruption that results in sleep deprivation [93, 94].

19 439 This study is the first of its kind to examine the magnitude and factors influencing poor sleep
20 440 quality among academic staff in Ethiopia, who are more likely to suffer from sleep disturbances,
21 441 particularly during the COVID-19 pandemic. Nevertheless, there are few studies published in the
22 442 scientific literature that address the prevalence and risk factors of sleep quality problems in higher
23 443 education employees. This study would likely contribute significant evidence to literature
24 444 regarding prevalence and the factors influencing occurrences of sleep problems. As part of this
25 445 study, the following limitations should be considered while interpretation. First, the study was
26 446 based on a cross-sectional study design which hinders the temporal relationship between the
27 447 outcome of interest (poor sleep quality) and factors influencing its occurrences. Second, the study
28 448 was based on participant's self-reported data. As a result, underestimation of the condition due to
29 449 recall bias may be expected. Moreover, participants' responses may also be susceptible to social
30 450 desirability bias, which leads them to give answers that are socially acceptable. To decrease social
31 451 desirability, however, precautions were taken by making sure that only study participants were
32 452 present during data collection and that data confidentiality was upheld. Finally, the finding was
33 453 not supported by clinical diagnoses, like actigraphy and polysomnography testing that help to

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2
3 454 identify sleep disorders objectively. However, we made use of the validated Pittsburgh Sleep
4 455 Quality Index (PSQI) questionnaire, which is a standardized instrument used to measure the
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6 456 quality and patterns of sleep in adults.
7

8 9 457 **Conclusion**

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11 458 This study revealed that two-thirds of the participants had poor sleep quality during the COVID-
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13 459 19 pandemic, indicating a considerable prevalence of the condition. The finding highlights the
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15 460 importance of optimizing the working hours per day, minimizing electronic device use before
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17 461 bedtime, promoting risk perception toward COVID-19 infection, and developing workplace
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19 462 coping strategies for stress, which play a substantial role in minimizing poor sleep quality. We
20
21 463 recommend future studies to account for different sectors such as telecommunication, healthcare,
22
23 464 transportation, etc. with an interventional study design and objectively measure sleep quality
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25 465 parameters.

26 466 **Data availability statement**

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28 467 All the data generated in this study are included in this manuscript. The data sets used and analyzed
29
30 468 to produce the current manuscript can be obtained from the corresponding author upon request via
31
32 469 e-mail address of amensisahailu@gmail.com.

33 34 470 **Ethics statements**

35 36 471 **Patient consent for publication**

37
38 472 Consent obtained directly from patient (s).

39 473 **Ethics approval and consent to participate**

40
41 474 Ethical approval was secured from the Institutional Ethical Review Board (IRB) of the University
42
43 475 of Gondar, College of Medicine and Health Sciences, Institute of Public Health (**Reference #:**
44
45 476 **IPH/1425/2021**). The study followed the tenets of the Declaration of Helsinki and also complied
46
47 477 with the ethical requirements set by the University of Gondar. Written informed consent was
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49 478 obtained from each respondent before commencing data collection after an explanation of the
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51 479 nature and possible consequences of the study. The information sheet that clearly shows the
52
53 480 research topic, the objectives of the study, confidentiality of the participant's responses, the study
54
55 481 benefits, and associated risks was prepared and presented. We removed any personal identifiers to
56
57 482 assure confidentiality of the participants and only anonymous data were used for interpretations.

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

485 **Abbreviations**

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

489 **Conflicting interests**

490 None declared.

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494 **Author's contribution**

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

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506 **References**

- 507 1. Landry GJ, Best JR, Liu-Ambrose T: **Measuring sleep quality in older adults: a comparison**
508 **using subjective and objective methods.** *Frontiers in aging neuroscience* 2015, 7:166.
- 509 2. Yang Y, Li W, Ma T-J, Zhang L, Hall BJ, Ungvari GS, Xiang Y-T: **Prevalence of poor sleep**
510 **quality in perinatal and postnatal women: a comprehensive meta-analysis of observational**
511 **studies.** *Frontiers in psychiatry* 2020, 11:161.

3. Madrid-Valero JJ, Martínez-Selva JM, Couto BRd, Sánchez-Romera JF, Ordoñana JR: **Age and gender effects on the prevalence of poor sleep quality in the adult population.** *Gaceta sanitaria* 2017, **31**:18-22.
4. Sateia MJ: **International classification of sleep disorders.** *Chest* 2014, **146**(5):1387-1394.
5. Buysse DJ, Angst J, Gamma A, Ajdacic V, Eich D, Rössler W: **Prevalence, course, and comorbidity of insomnia and depression in young adults.** *Sleep* 2008, **31**(4):473-480.
6. Paunio T, Korhonen T, Hublin C, Partinen M, Kivimäki M, Koskenvuo M, Kaprio J: **Longitudinal study on poor sleep and life dissatisfaction in a nationwide cohort of twins.** *American Journal of Epidemiology* 2009, **169**(2):206-213.
7. Aw SB, Teh BT, Ling GHT, Leng PC, Chan WH, Ahmad MH: **The covid-19 pandemic situation in malaysia: Lessons learned from the perspective of population density.** *International journal of environmental research and public health* 2021, **18**(12):6566.
8. Pinto J, van Zeller M, Amorim P, Pimentel A, Dantas P, Eusébio E, Neves A, Pipa J, Santa Clara E, Santiago T: **Sleep quality in times of Covid-19 pandemic.** *Sleep medicine* 2020, **74**:81-85.
9. Musa NA, Moy FM, Wong LP: **Prevalence and factors associated with poor sleep quality among secondary school teachers in a developing country.** *Industrial health* 2018.
10. Souza JcD, Sousa ICd, Belísio AS, Azevedo CVMd: **Sleep habits, daytime sleepiness and sleep quality of high school teachers.** *Psychology & Neuroscience* 2012, **5**:257-263.
11. Kottwitz MU, Gerhardt C, Pereira D, Iseli L, Elfering A: **Teacher's sleep quality: linked to social job characteristics?** *Industrial health* 2017.
12. Freitas AMC, Araújo Tmd, Pinho Pds, Sousa CC, Oliveira PCS, Souza Fdo: **Sleep quality and associated factors among professors.** *Revista Brasileira de Saúde Ocupacional* 2021, **46**.
13. Teker AG, Luleci NE: **Sleep quality and anxiety level in employees.** *Northern clinics of Istanbul* 2018, **5**(1):31.
14. Burdorf A, Porru F, Rugulies R: **The COVID-19 (Coronavirus) pandemic: consequences for occupational health.** *Scandinavian Journal of Work, Environment & Health* 2020, **46**(3):229-230.
15. Stranges S, Tigbe W, Gómez-Olivé FX, Thorogood M, Kandala N-B: **Sleep problems: an emerging global epidemic? Findings from the INDEPTH WHO-SAGE study among more than 40,000 older adults from 8 countries across Africa and Asia.** *Sleep* 2012, **35**(8):1173-1181.
16. Dumith SC, Meneghini KFD, Demenech LM: **Who are the individuals with the worst perceived quality of sleep? A population-based survey in southern Brazil.** *Preventive Medicine Reports* 2021, **21**:101288.
17. Adams R, Appleton S, Taylor A, McEvoy D, Antic N: **Report to the sleep Health Foundation 2016 sleep health survey of Australian adults.** *Adelaide: The Adelaide Institute for Sleep Health & The University of Adelaide* 2016.
18. Watson N, Badr M, Belenky G, Bliwise D, Buxton O, Buysse D, Dinges D, Gangwisch J, Grandner M, Kushida C: **Consensus Conference Panel Non-Participating Observers American Academy of Sleep Medicine Staff (2015) Recommended amount of sleep for a healthy adult: a joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society.** *J Clin Sleep Med*, **11**:591-592.
19. Organization WH: **WHO technical meeting on sleep and health: Bonn Germany, 22–24 January 2004.** In.: World Health Organization. Regional Office for Europe; 2004.
20. Duran S, Erkin Ö: **Psychologic distress and sleep quality among adults in Turkey during the COVID-19 pandemic.** *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 2021, **107**:110254.
21. Crepaldi T, Carvalhais J, Cotrim T: **Sleep Quality and Quality of Working Life Among Brazilian University Professors in Telework.** In: *Occupational and Environmental Safety and Health III.* edn. Edited by Arezes PM, Baptista JS, Carneiro P, Castelo Branco J, Costa N, Duarte J, Guedes JC, Melo RB, Miguel AS, Perestrelo G. Cham: Springer International Publishing; 2022: 661-669.
22. **Sleep-RSPH, availbel at <https://www.rsph.org.uk/our-work/policy/wellbeing/sleep.html>**

- 1
2
3 563
4 564 23. Colten HR, Altevogt BM: **Extent and health consequences of chronic sleep loss and sleep disorders.** *Sleep disorders and sleep deprivation: an unmet public health problem* 2006:55-135.
5 565
6 566 24. Roodbandi ASJ, Feyzi V, KHANJANI N, MOGHADAM SR, BAFGHI MS, MOGHADASI M, NOROUZI Z: **Sleep quality and sleepiness: a comparison between nurses with and without shift work, and university employees.** *International Journal of Occupational Hygiene* 2016, 8(4):230-236.
7 567
8 568
9 569
10 570 25. Chatlaong T, Pitanupong J, Wiwattanaworaset P: **Sleep quality and burnout syndrome among residents in training at the faculty of medicine, Prince of Songkla University.** *Siriraj Medical Journal* 2020, 72(4):307-314.
11 571
12 572
13 573 26. Manzar MD, Bekele BB, Noohu MM, Salahuddin M, Albougami A, Spence DW, Pandi-Perumal SR, Bahammam AS: **Prevalence of poor sleep quality in the Ethiopian population: a systematic review and meta-analysis.** *Sleep and Breathing* 2020, 24(2):709-716.
14 574
15 575
16 576 27. Huang Y, Zhao N: **Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey.** *Psychiatry research* 2020, 288:112954.
17 577
18 578
19 579 28. Gualano MR, Lo Moro G, Voglino G, Bert F, Siliquini R: **Effects of Covid-19 lockdown on mental health and sleep disturbances in Italy.** *International journal of environmental research and public health* 2020, 17(13):4779.
20 580
21 581
22 582 29. Marelli S, Castelnuovo A, Somma A, Castronovo V, Mombelli S, Bottoni D, Leitner C, Fossati A, Ferini-Strambi L: **Impact of COVID-19 lockdown on sleep quality in university students and administration staff.** *Journal of Neurology* 2021, 268(1):8-15.
23 583
24 584
25 585 30. Dowla SU: **Evaluating the effects of COVID-19 on mental health.** Brac University; 2021.
26 586
27 587 31. Rwigema P: **Impact of COVID-19 lockdowns on the education sector. The case of Rwanda.** *The Strategic Journal of Business & Change Management* 2021, 8(1):150-169.
28 588
29 589 32. Salehinejad MA, Majidinezhad M, Ghanavati E, Kouestanian S, Vicario CM, Nitsche MA, Nejati V: **Negative impact of COVID-19 pandemic on sleep quantitative parameters, quality, and circadian alignment: implications for health and psychological well-being.** *EXCLI journal* 2020, 19:1297.
30 590
31 591
32 592 33. Patil A, Bhavya SC, Srivastava S: **Eyeing computer vision syndrome: Awareness, knowledge, and its impact on sleep quality among medical students.** *Industrial psychiatry journal* 2019, 28(1):68.
33 593
34 594
35 595 34. Salehi SG, Hassani H, Morteza pour A, Sadeghniaat-Haghighi K: **Assessing of Sleepiness, Insomnia and Sleep Quality among University Students: Association between Computer Use and Sleep Quality.** *Annals of Military & Health Sciences Research • Vol* 2015, 13(4).
36 596
37 597
38 598 35. Chisale P, Mzumara T, Afonne J: **Knowledge Attitude, perception and knowledge and practice of prevention practices of computer vision syndrome among mzuzu university academic staff.** *J Eye Vis* 2019, 2(2):1-7.
39 599
40 600
41 601 36. Baker FC, Wolfson AR, Lee KA: **Association of sociodemographic, lifestyle, and health factors with sleep quality and daytime sleepiness in women: findings from the 2007 National Sleep Foundation “Sleep in America Poll”.** *Journal of women's health* 2009, 18(6):841-849.
42 602
43 603
44 604 37. Gellis LA, Lichstein KL, Scarinci IC, Durrence HH, Taylor DJ, Bush AJ, Riedel BW: **Socioeconomic status and insomnia.** *Journal of abnormal psychology* 2005, 114(1):111.
45 605
46 606 38. Ding D, Gebel K, Phongsavan P, Bauman AE, Merom D: **Driving: a road to unhealthy lifestyles and poor health outcomes.** *PloS one* 2014, 9(6):e94602.
47 607
48 608 39. Kabrita CS, Hajjar-Muç a TA, Duffy JF: **Predictors of poor sleep quality among Lebanese university students: association between evening typology, lifestyle behaviors, and sleep habits.** *Nature and science of sleep* 2014, 6:11.
49 609
50 610
51 611 40. Shochat T: **Impact of lifestyle and technology developments on sleep.** *Nature and science of sleep* 2012, 4:19.
52 612
53
54
55
56
57
58
59
60

- 1
2
3 613 41. Alonzo R, Hussain J, Stranges S, Anderson KK: **Interplay between social media use, sleep**
4 614 **quality, and mental health in youth: A systematic review.** *Sleep Medicine Reviews* 2021,
5 615 **56:101414.**
- 6 616 42. Berhanu H, Mossie A, Tadesse S, Geleta D: **Prevalence and associated factors of sleep quality**
7 617 **among adults in Jimma Town, Southwest Ethiopia: a community-based cross-sectional study.**
8 618 *Sleep disorders* 2018, **2018.**
- 9 619 43. Negussie BB, Emeria MS, Reta EY, Shiferaw BZ: **Sleep deprivation and associated factors**
10 620 **among students of the Institute of Health in Jimma University, Southwest Ethiopia.** *Frontiers*
11 621 *of Nursing* 2021, **8(3):303-311.**
- 12 622 44. Lin S-Y, Chung KKH: **Risk perception, perception of collective efficacy and sleep quality in**
13 623 **Chinese adults during COVID-19 pandemic in Hong Kong: a cross-sectional study.**
14 624 *International Journal of Environmental Research and Public Health* 2021, **18(21):11533.**
- 15 625 45. Amschler DH, McKenzie JF: **Perceived sleepiness, sleep habits and sleep concerns of public**
16 626 **school teachers, administrators and other personnel.** *American Journal of Health Education*
17 627 2010, **41(2):102-109.**
- 18 628 46. Alemayehu M, Nega A, Tegegne E, Mule Y: **Prevalence of self reported computer vision**
19 629 **syndrome and associated factors among secretaries and data processors who are working in**
20 630 **University of Gondar, Ethiopia.** *Journal of Biology, Agriculture and Healthcare* 2014, **4(15).**
- 21 631 47. Kabito GG, Wami SD, Chercos DH, Mekonnen TH: **Work-related Stress and Associated Factors**
22 632 **among Academic Staffs at the University of Gondar, Northwest Ethiopia: An**
23 633 **Institutionbased Cross-sectional Study.** *Ethiopian journal of health sciences* 2020, **30(2).**
- 24 634 48. Daniel WW, Cross CL: **Biostatistics: a foundation for analysis in the health sciences:** Wiley;
25 635 2018.
- 26 636 49. Martínez-Mesa J, González-Chica DA, Bastos JL, Bonamigo RR, Duquia RP: **Sample size: how**
27 637 **many participants do I need in my research?** *Anais brasileiros de dermatologia* 2014, **89:609-**
28 638 **615.**
- 29 639 50. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ: **The Pittsburgh Sleep Quality**
30 640 **Index: a new instrument for psychiatric practice and research.** *Psychiatry research* 1989,
31 641 **28(2):193-213.**
- 32 642 51. Salahuddin M, Maru TT, Kumalo A, Pandi-Perumal SR, Bahammam AS, Manzar MD: **Validation**
33 643 **of the Pittsburgh sleep quality index in community dwelling Ethiopian adults.** *Health and*
34 644 *quality of life outcomes* 2017, **15(1):1-7.**
- 35 645 52. Seidell JC, Flegal KM: **Assessing obesity: classification and epidemiology.** *British medical*
36 646 *bulletin* 1997, **53(2):238-252.**
- 37 647 53. Nakata A, Ikeda T, Takahashi M, Haratani T, Hojou M, Swanson NG, Fujioka Y, Araki S: **The**
38 648 **prevalence and correlates of occupational injuries in small-scale manufacturing enterprises.**
39 649 *Journal of occupational health* 2006, **48(5):366-376.**
- 40 650 54. Jemere T, Mossie A, Berhanu H, Yeshaw Y: **Poor sleep quality and its predictors among type 2**
41 651 **diabetes mellitus patients attending Jimma University Medical Center, Jimma, Ethiopia.**
42 652 *BMC research notes* 2019, **12(1):1-6.**
- 43 653 55. Rolander B, Bellner A-L: **Experience of musculo-skeletal disorders, intensity of pain, and**
44 654 **general conditions in work--the case of employees in non-private dental clinics in a county in**
45 655 **southern Sweden.** *Work* 2001, **17(1):65-73.**
- 46 656 56. Negussie BB, Emeria MS, Reta EY, Shiferaw BZ: **Sleep deprivation and associated factors**
47 657 **among students of the Institute of Health in Jimma University, Southwest Ethiopia.** *Frontiers*
48 658 *of Nursing*, **8(3):303-311.**
- 49 659 57. Abdu Z, Hajure M: **Prevalence and Associated Factors of Poor Quality of Sleep among**
50 660 **Prisoners in Mettu Town Prison, Oromia, South West Ethiopia, 2019.** *The Open Public Health*
51 661 *Journal* 2020, **13(1).**
- 52 662 58. Azene ZN, Merid MW, Muluneh AG, Geberu DM, Kassa GM, Yenit MK, Tilahun SY, Gelaye
53 663 KA, Mekonnen HS, Azage AW: **Adherence towards COVID-19 mitigation measures and its**

- 664 associated factors among Gondar City residents: A community-based cross-sectional study
665 in Northwest Ethiopia. *PloS one* 2020, **15**(12):e0244265.
- 666 59. Macdonald S, MacIntyre P: **The generic job satisfaction scale: Scale development and its
667 correlates.** *Employee Assistance Quarterly* 1997, **13**(2):1-16.
- 668 60. The Marlin Company NH, CT, and the American Institute of Stress, Yonkers, NY,: **The
669 Workplace Stress Scale™** Available at: [https://teorionline.files.wordpress.com/2011/04/unit-3-
670 the-workplace-stress-scale.pdf](https://teorionline.files.wordpress.com/2011/04/unit-3-the-workplace-stress-scale.pdf) . Accessed on 10 June 2019.
- 671 61. Cohen S, Kamarck T, Mermelstein R: **Perceived stress scale.** *Measuring stress: A guide for health
672 and social scientists* 1994, **10**(2):1-2.
- 673 62. Birhanu TT, Salih MH, Abate HK: **Sleep Quality and Associated Factors Among Diabetes
674 Mellitus Patients in a Follow-Up Clinic at the University of Gondar Comprehensive
675 Specialized Hospital in Gondar, Northwest Ethiopia: A Cross-Sectional Study.** *Diabetes,
676 metabolic syndrome and obesity: targets and therapy* 2020, **13**:4859.
- 677 63. Wondie T, Molla A, Mulat H, Damene W, Bekele M, Madoro D, Yohannes K: **Magnitude and
678 correlates of sleep quality among undergraduate medical students in Ethiopia: cross-
679 sectional study.** *Sleep Science and Practice* 2021, **5**(1):1-8.
- 680 64. James BO, Omoaregba JO, Igberase OO: **Prevalence and correlates of poor sleep quality among
681 medical students at a Nigerian university.** *Ann Nigerian Med* 2011, **5**(1):1-5.
- 682 65. Smyth C: **The Pittsburgh sleep quality index (PSQI).** In., vol. 25: SLACK Incorporated
683 Thorofare, NJ; 1999: 10-10.
- 684 66. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A: **The Pittsburgh
685 sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical
686 samples: A systematic review and meta-analysis.** *Sleep medicine reviews* 2016, **25**:52-73.
- 687 67. Zailinawati A, Teng C, Chung Y, Teow T, Lee P, Jagmohani K: **Daytime sleepiness and sleep
688 quality among Malaysian medical students.** *The Medical journal of Malaysia* 2009, **64**(2):108-
689 110.
- 690 68. Backhaus J, Junghanns K, Broocks A, Riemann D, Hohagen F: **Test-retest reliability and validity
691 of the Pittsburgh Sleep Quality Index in primary insomnia.** *Journal of psychosomatic research*
692 2002, **53**(3):737-740.
- 693 69. Bertolazi AN, Fagondes SC, Hoff LS, Dartora EG, da Silva Miozzo IC, de Barba MEF, Barreto
694 SSM: **Validation of the Brazilian Portuguese version of the Pittsburgh sleep quality index.**
695 *Sleep medicine* 2011, **12**(1):70-75.
- 696 70. Kwok KO, Li KK, Chan HHH, Yi YY, Tang A, Wei WI, Wong SYS: **Community responses
697 during early phase of COVID-19 epidemic, Hong Kong.** *Emerging infectious diseases* 2020,
698 **26**(7):1575.
- 699 71. Mekonnen TH, Abere G, Olkeba SW: **Risk Factors Associated with Upper Extremity
700 Musculoskeletal Disorders among Barbers in Gondar Town, Northwest Ethiopia, 2018: A
701 Cross-Sectional Study.** *Pain Research and Management* 2019, **2019**(2019):1-9.
- 702 72. Mekonnen TH, Yenealem DG: **Factors affecting healthcare utilization for low back pain among
703 nurses in Gondar town, northwest Ethiopia, 2018: a cross-sectional study.** *BMC Res Notes*
704 2019, **12**(185):1-6.
- 705 73. Meaza H, Temesgen MH, Redae G, Hailemariam TT, Alamer A: **Prevalence of Musculoskeletal
706 Pain Among Academic Staff of Mekelle University, Ethiopia.** *Clinical Medicine Insights:
707 Arthritis and Musculoskeletal Disorders* 2020, **13**:1179544120974671.
- 708 74. Etana G, Ayele M, Abdissa D, Gerbi A: **Prevalence of Work Related Musculoskeletal Disorders
709 and Associated Factors Among Bank Staff in Jimma City, Southwest Ethiopia, 2019: An
710 Institution-Based Cross-Sectional Study.** *Journal of Pain Research* 2021, **14**:2071.
- 711 75. Hosmer DW, Hjort NL: **Goodness-of-fit processes for logistic regression: simulation results.**
712 *Statistics in medicine* 2002, **21**(18):2723-2738.
- 713 76. de Sousa AR, Santos RB, da Silva RM, Santos CCT, Lopes VC, Mussi FC: **Occupational stress
714 and sleep quality in professors of the health area.** *Rev Rene* 2018(19):60.

- 1
2
3 715 77. Farah NM, Saw Yee T, Mohd Rasdi HF: **Self-reported sleep quality using the Malay version of**
4 716 **the Pittsburgh sleep quality index (PSQI-M) in Malaysian adults.** *International journal of*
5 717 *environmental research and public health* 2019, **16**(23):4750.
- 6 718 78. Vandewalle G, Archer SN, Wuillaume C, Baiteau E, Degueldre C, Luxen A, Dijk D-J, Maquet P:
7 719 **Effects of light on cognitive brain responses depend on circadian phase and sleep homeostasis.**
8 720 *Journal of biological rhythms* 2011, **26**(3):249-259.
- 9 721 79. Virtanen M, Ferrie JE, Gimeno D, Vahtera J, Elovainio M, Singh-Manoux A, Marmot MG,
10 722 Kivimäki M: **Long working hours and sleep disturbances: the Whitehall II prospective cohort**
11 723 **study.** *Sleep* 2009, **32**(6):737-745.
- 12 724 80. Jansen N, Kant I, van Amelsvoort L, Nijhuis F, van den Brandt P: **Need for recovery from work:**
13 725 **evaluating short-term effects of working hours, patterns and schedules.** *Ergonomics* 2003,
14 726 **46**(7):664-680.
- 15 727 81. Bannai A, Ukawa S, Tamakoshi A: **Long working hours and sleep problems among public**
16 728 **junior high school teachers in Japan.** *Journal of occupational health* 2015:15-0053-OA.
- 17 729 82. Ferrie J, Gimeno D, Vahtera J, Elovainio M, Singh-Manoux A, Marmot M, Kivimäki M: **Long**
18 730 **working hours and sleep disturbances: the Whitehall II prospective cohort study.** *Virtanen*
19 731 *M. SLEEP MEDICINE*:129.
- 20 732 83. Byrd E: **The Effect of the Use of An Electronic Device Before Bed on Sleep Quality.** 2019.
- 21 733 84. Walsh NA, Rodriguez N, Repa LM, King E, Garland SN: **Associations between device use before**
22 734 **bed, mood disturbance, and insomnia symptoms in young adults.** *Sleep Health* 2020, **6**(6):822-
23 735 827.
- 24 736 85. Fossum IN, Nordnes LT, Storemark SS, Bjorvatn B, Pallesen S: **The association between use of**
25 737 **electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness,**
26 738 **morningness, and chronotype.** *Behavioral sleep medicine* 2014, **12**(5):343-357.
- 27 739 86. Salfi F, Amicucci G, Corigliano D, D'Atri A, Viselli L, Tempesta D, Ferrara M: **Changes of**
28 740 **evening exposure to electronic devices during the COVID-19 lockdown affect the time course**
29 741 **of sleep disturbances.** *Sleep* 2021, **44**(9):zsab080.
- 30 742 87. Shechter A, Kim EW, St-Onge M-P, Westwood AJ: **Blocking nocturnal blue light for insomnia:**
31 743 **A randomized controlled trial.** *J Psychiatr Res* 2018, **96**:196-202.
- 32 744 88. Sobaih AEE, Hasanein AM, Abu Elnasr AE: **Responses to COVID-19 in Higher Education:**
33 745 **Social Media Usage for Sustaining Formal Academic Communication in Developing**
34 746 **Countries.** *Sustainability* 2020, **12**(16):6520.
- 35 747 89. Yan J, Kim S, Zhang SX, Foo M-D, Alvarez-Risco A, Del-Aguila-Arcentales S, Yáñez JA:
36 748 **Hospitality workers' COVID-19 risk perception and depression: A contingent model based**
37 749 **on transactional theory of stress model.** *International Journal of Hospitality Management* 2021,
38 750 **95**:102935.
- 39 751 90. Iorga M, Iurcov R, Pop L-M: **The Relationship between Fear of Infection and Insomnia among**
40 752 **Dentists from Oradea Metropolitan Area during the Outbreak of Sars-CoV-2 Pandemic.**
41 753 *Journal of Clinical Medicine* 2021, **10**(11):2494.
- 42 754 91. Kesintha A, Rampal L, Sherina M, Kalaiselvam T: **Prevalence and predictors of poor sleep**
43 755 **quality among secondary school students in Gombak District, Selangor.** *Med J Malaysia* 2018,
44 756 **73**(1):32-40.
- 45 757 92. Herawati K, Gayatri D: **The correlation between sleep quality and levels of stress among**
46 758 **students in Universitas Indonesia.** *Enfermeria clinica* 2019, **29**:357-361.
- 47 759 93. Hirotsu C, Tufik S, Andersen ML: **Interactions between sleep, stress, and metabolism: From**
48 760 **physiological to pathological conditions.** *Sleep Science* 2015, **8**(3):143-152.
- 49 761 94. Han KS, Kim L, Shim I: **Stress and sleep disorder.** *Experimental neurobiology* 2012, **21**(4):141.
- 50
51
52
53 762
54
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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

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2	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
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6			(b) Report category boundaries when continuous variables were categorized
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8			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
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11	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
12			
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14	Discussion		
15	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
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20	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
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24	Generalisability	21	Discuss the generalisability (external validity) of the study results
25			
26	Other information		
27	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
28			
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*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.