The Effect of Sleep Disorders on Anxiety and Depression in Health Workers: A Meta-Analysis

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ABSTRACT

Background: Sleep disorders are a clinical condition when a person frequently experiences problems or decreased sleep quality that can lead to anxiety and depression. The purpose of this meta-analysis is to estimate and analyze the magnitude of the influence of sleep disorders on anxiety and depression in health workers based on the results of previous similar primary studies.

Subjects and Method: Meta-analysis was performed on a primary study with a cross sectional design. The research with the PICO format is as follows. Q: Health workers. I: Sleep disturbances < 8 hours per day; C: No sleep disturbances (Enough sleep > 8 hours per day). O: Anxiety and depresssion. The meta-analysis study was conducted by searching for articles from databases in electronic form using Google schoolar and Pubmed. This study was conducted by researchers in November 2023 by searching and selecting research data online conducted by previous primary data researchers in Pubmed and google scholar with a research period of 2016-2023. The keywords used in the primary data search were "Mental health" OR "Anxiety" OR "Depression" AND "Sleep disturbance" AND "Health worker" OR "Healthcare". The inclusion criteria for this study are complete articles using Cross-sectional research, published years from 2013-2023. The analysis of the articles in this study uses RevMan 5.3 software.

Results: The meta-analysis in this study included 7 cross-sectional studies from Hong Kong, China, Bangladesh, Saudi Arabia, the United States, and Turkey. The total sample size is 5,267 samples. The risk of anxiety caused by sleep disturbances in health workers was 1.6 times compared to health workers who did not experience sleep disturbances (aOR=1.67; CI 95%=1.05 to 2.45; p= 0.030). the risk of depression caused by sleep disturbances in health workers was 1.32 times compared to health workers who did not experience sleep disturbances (aOR=1.32; CI 95%=0.81 to 2.15; p= 0.270).

Conclusion: Sleep disorders increase the risk of anxiety and depression in health workers.

Keywords: sleep disorder, anxiety, depression, health workers.

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BACKGROUND

Sleep disorders are a group of conditions that interfere with normal sleep patterns. Not getting enough or not recovering sleep can interfere with normal physical, mental, social, and emotional functioning. Sleep

disorders can affect health, safety, and overall quality of life (Karna et al., 2024). Sleep disturbances occur in 10% to 15% of the general population (Kaur et al., 2023).

The results of a study by McArdle et al. (2020) reported that in Australia 836 people revealed that 41% of women and 42% of men had sleep problems. Another study in Turkey with 5,021 subjects found that more than half (53%) of individuals had sleep disorders. Sleep disturbances among health-care workers in China range from 21% to 65.5% (Liu et al., 2019). Anxiety is one of the things that can affect the quality of health services and open up opportunities for health service errors. Generalized anxiety disorder is characterized by persistent, excessive, and unrealistic worries about everyday things. Excessive worry is the main characteristic of generalized anxiety disorder (Munir, 2022).

A health worker needs excellent physical and psychological condition in duty. Depression is one of the causes of disruption of physical and psychological conditions that have the opportunity to reduce the quality of health services. Depression is a mood disorder that causes feelings of sadness and constant loss of interest (Chand and Arif, 2023).

Based on the existing literature, statistical summaries are needed to calculate the estimated effect of sleep disorders on anxiety and depression as a form of optimization of health workers' performance in health services. The purpose of this meta-analysis was to estimate and analyze the magnitude of the influence of sleep disorders on anxiety and depression in health workers based on the results of previous similar primary studies.

SUBJECTS AND METHOD

1. Study Design

The meta-analysis was carried out with a PRISMA flowchart using Google Scholar and PubMed databases for the 2016-2023 research period. The keywords used in the primary data search were "Mental health" OR "anxiety" OR "Depression" AND "sleep disturbance" AND "health worker" OR "Healthcare". There were 7 studies with cross-sectional research designs that met the inclusion criteria. The analysis was carried out with RevMan 5.3 software.

2. Steps of Meta-Analysis

1) Create research questions using the PICO model, which involves defining the Population, Intervention, Comparison, and Outcome.
2) Search for primary study articles from electronic databases such as Google Scholar, PubMed, and Science Direct
3) Screening articles with Critical Appraisal assessment of primary research.
4) Extract data and enter impact estimates from each primary study into RevMan 5.3.
5) Conducting interpretation and conclusion of study results.

3. Inclusion Criteria

This research article is a full-text paper with a cross-sectional study design that analyzes the effect of sleep disorders on anxiety and depression in health workers. The analysis uses multivariate adjusted Odds Ratio (aOR) and publication of English-language articles.

4. Exclusion Criteria

Articles were published before 2013 with randomized control trial, case control and cohort designs.

5. Operational Definition of Variables

Sleep disorders: The state of not meeting the needs of sleep according to normal needs, which is >8 hours a day.

Anxiety: A feeling that arises in a person's personality due to a situation or condition that threatens/fears/worries.

Depression: psychological problems that negatively impact thoughts, actions, feelings, and health so that a person feels hopeless, helpless, full of rejection, or feels worthless.
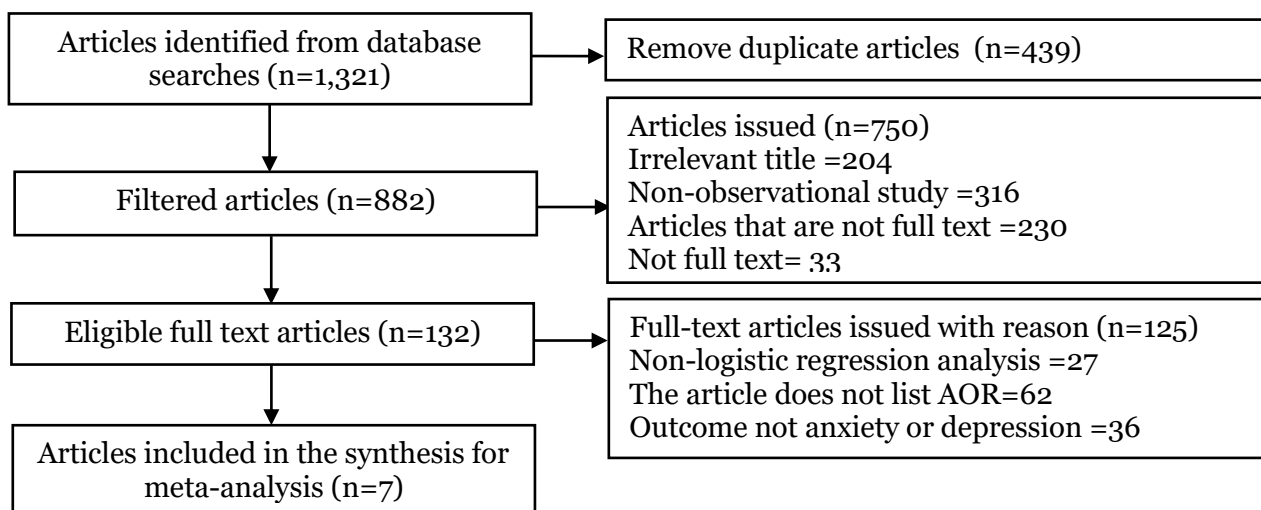
6. Study Instruments

Critical Appraisal criteria for a control case study for meta-analysis research (Muna-waroh and Murti, 2023). With 13 questions with the total minimum number of article points to be included in the research is 22 and the maximum is 26.

7. Data Analysis

The articles in this study were collected using PRISMA diagrams and analyzed using the Review Manager 5.3 application (Rev-Man 5.3). The results are presented in the form of forest plots and funnel plots.

Articles identified from database searches (n=1,321) → Remove duplicate articles (n=439)

Filtered articles (n=882) → Articles issued (n=750)
Irrelevant title =204
Non-observational study =316
Articles that are not full text =230
Not full text= 33

Eligible full text articles (n=132) → Full-text articles issued with reason (n=125)
Non-logistic regression analysis =27
The article does not list AOR=62
Outcome not anxiety or depression =36

Articles included in the synthesis for meta-analysis (n=7)

Figure 1. PRISMA flowchart

1 studies in America

6 studies in Asia

Figure 2. Map of the distribution of articles included in the meta-analysis

RESULTS

The process of searching for articles is carried out through several journal databases which include Google Scholar and PubMed. The article review process can be seen in the PRISMA flow diagram in Figure 1. A total of 7 cross-sectional studies can be seen in Figure 2. that research articles originating from Hong Kong, China, Bangladesh, Saudi Arabia, the United States and Turkey were selected for systematic review and meta-analysis.

Table 1. The Critical Appraisal of Articles with a Cross-Sectional Study

Authors (Year)	Criteria													Total
	1a	1b	1c	1d	2a	2b	3a	3b	4	5	6a	6b	7	
Gong et al. (2014)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Repon et al. (2021)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Cheung et al, (2015)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Al Mutairi et al. (2017)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Yousef et al. (2020)	2	2	2	2	2	2	1	2	2	2	2	2	2	25
Tu et al. (2020)	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Norful et al. (2023)	2	2	2	2	2	2	2	2	2	2	2	2	2	26

Description of question criteria:

1a. Is the population in the primary study the same as the population in the PICO meta-analysis?

1b. Is the operational definition of the intervention, i.e. exposed status in the primary study the same as the definition intended in the meta-analysis?

1c. Is the comparison, i.e. unexposed status used by the primary study the same as the definition intended in the meta-analysis?

1d. Are the outcome variables studied in the primary study the same as the definitions intended in the meta-analysis?

2a. In analytical cross-sectional studies, did researchers randomly select samples from the population (random sampling)?

2b. Alternatively, if in an analytically cross-sectional study, the sample was not randomly selected, did researchers select the sample based on outcome status or based on intervention status?

3a. Were both exposure and outcome variables measured with the same instruments in all primary studies?

3b. If variables were measured on a categorical scale, were the cutoffs or categories used the same across primary studies?

4. If the sample was not randomly selected, had the researcher made efforts to prevent bias in choosing the study subject? For example, selecting subjects based on outcome status was not affected by exposure status (intervention), or in selecting subjects based on exposure status (intervention) was not affected by outcome status.

5. Whether the primary study researcher has made efforts to control for the influence of confusion (e.g., performing a multivariate analysis to control for the influence of several confounding factors)

6a. Did the researchers analyze the data in this primary study with multivariate analysis models (e.g., multiple linear regression analysis, multiple logistic regression analysis)

6b. Whether the primary study reports effect size or the association of the results of the multivariate analysis

(e.g., adjusted OR, adjusted regression coefficient)

7. Is there no possibility of a conflict of interest with the research sponsor, which causes bias in concluding research results?

Description of Scoring:

Yes=2; Hesitate=1; No=0

Table 2. Description of primary study articles included in the meta-analysis study (N= 5,267)

Author (year)	Country	Sample	P	I	C	O
Gong et al. (2014)	China	2,646	Health workers	Having trouble sleeping	No sleep disturbance	Anxiety and depression
Repon et al. (2021)	Bangladesh	355	Health professionals	Having trouble sleeping	No sleep disturbance	Anxiety and depression
Cheung et al. (2015)	Hongkong	850	Nurses	Having trouble sleeping	No sleep disturbance	Anxiety and depression
Al Mutairi et al. (2017)	Saudi Arabia	240	Paramedics	Having trouble sleeping	No sleep disturbance	Anxiety and depression
Yousef et al. (2020)	Turki	540	Health care professionals	Having trouble sleeping	No sleep disturbance	Anxiety and depression
Tu et al. (2020)	China	100	Nurses	Having trouble sleeping	No sleep disturbance	Anxiety
Norful et al. (2023)	United States	536	Nurses	Having trouble sleeping	No sleep disturbance	Anxiety and depression

Table 3. Data adjusted Odds Ratio (aOR) on the effect of sleep disorders on anxiety in the workforce

Author (Year)	aOR	CI 95%	
		Lower Limit	Upper Limit
Gong et al. (2014)	2.70	1.51	4.83
Repon et al. (2021)	2.00	0.63	6.41
Cheung et al. (2015)	1.695	1.18	2.44
Al Mutairi et al. (2017)	0.54	0.28	0.98
Yousef et al. (2020)	1.73	1.01	2.95
Norful et al. (2023)	2.81	1.42	5.57
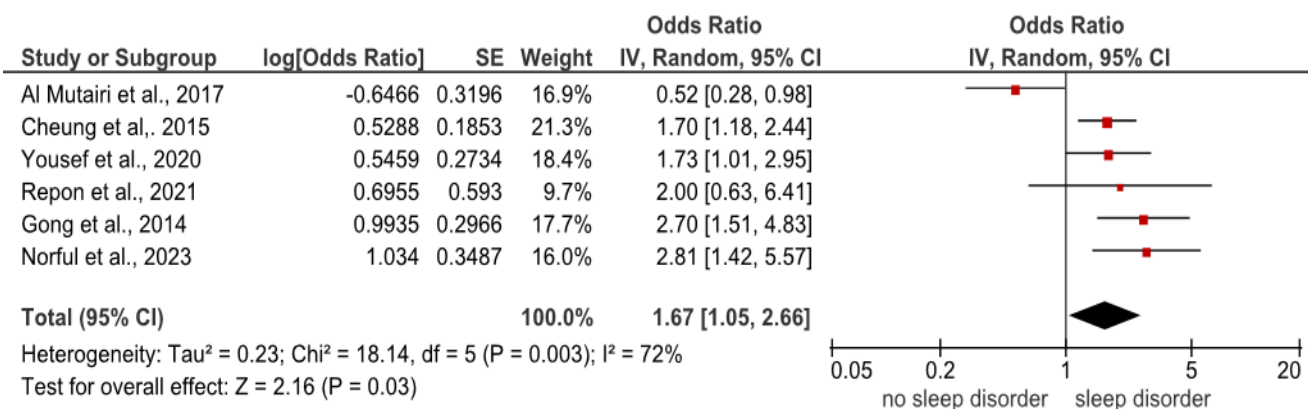
Figure 3. Forest Plot of the effect of sleep disorders on anxiety in health workers

The forest plot in Table 3 shows that the risk of anxiety caused by sleep disturbances in health workers is 1.6 times compared to health workers who do not experience sleep disturbances (aOR =1.67; CI 95%= 1.05 to 2.66; = p=0.030).

The forest plot in Figure 3 shows a very large heterogeneity of effect estimates between studies (I^2= 72%; p< 0.030). Thus, the calculation of the average effect estimate is carried out using a random effect model approach.
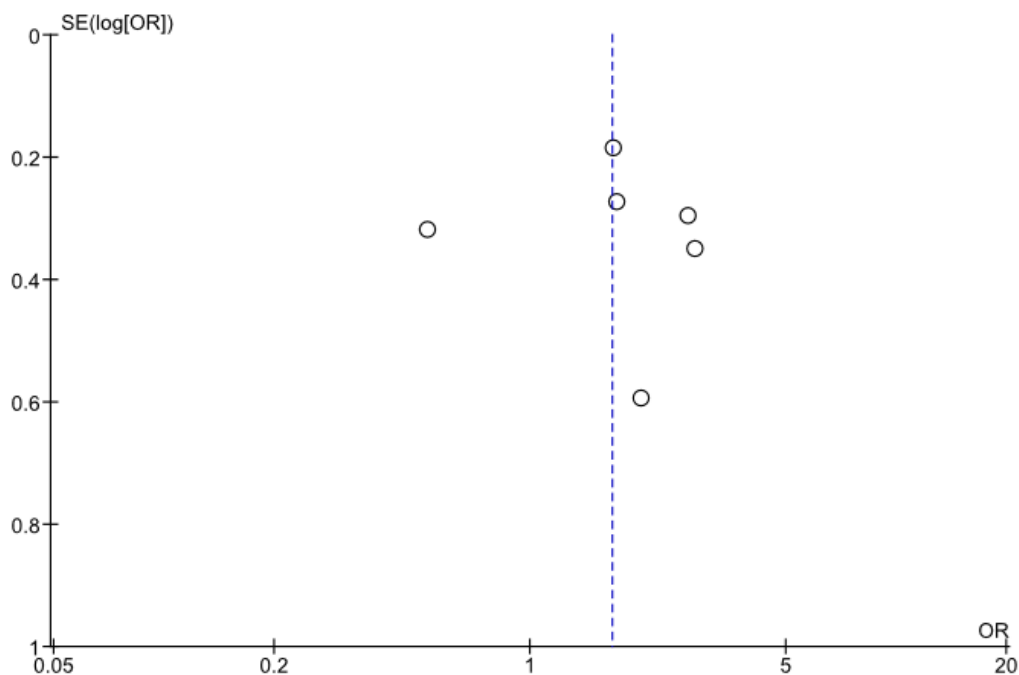
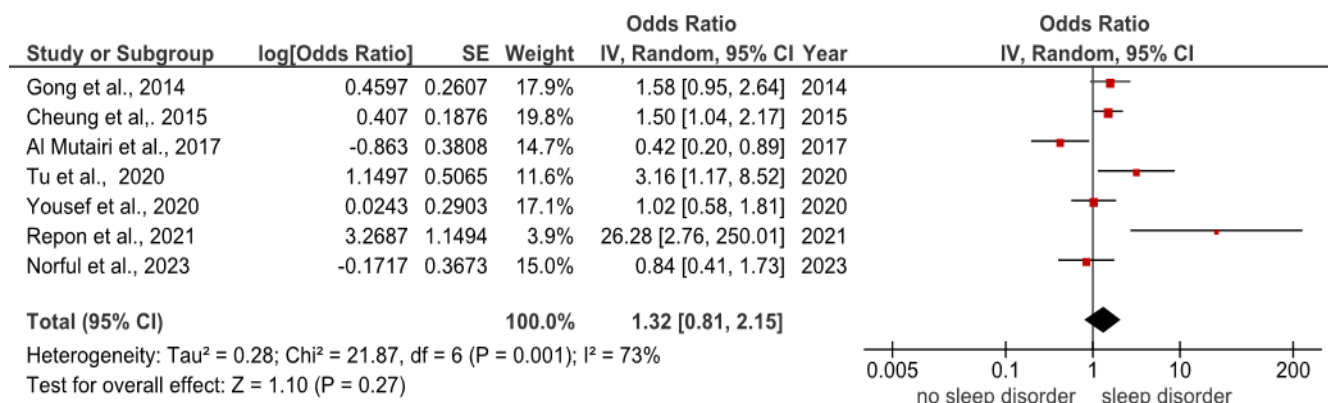**Figure 4. Funnel plot of the effect of sleep disorders on anxiety in health workers**

The Funnel plot of sleep disorders on anxiety in the workforce in Figure 4 shows a sympathetic distribution that can be interpreted as the absence of publication bias.

Table 4. Data adjusted Odds Ratio (aOR) on the effect of sleep disorders on depression in the workforce

Author (Years)	aOR	95% CI	
		Lower Limit	Upper Limit
Gong et al. (2014)	1.58	0.95	2.64
Repon et al. (2021)	23.81	2.76	250.00
Cheung et al. (2015)	1.50	1.04	2.17
Al Mutairi et al. (2017)	0.42	0.20	0.89
Yousef (2020)	1.03	0.58	1.81
Tu et al. (2020)	3.16	1.17	8.52
Norful et al. (2023)	0.75	0.41	1.73

Study or Subgroup	log[Odds Ratio]	SE	Weight	Odds Ratio IV, Random, 95% CI	Year
Gong et al., 2014	0.4597	0.2607	17.9%	1.58 [0.95, 2.64]	2014
Cheung et al,. 2015	0.407	0.1876	19.8%	1.50 [1.04, 2.17]	2015
Al Mutairi et al., 2017	-0.863	0.3808	14.7%	0.42 [0.20, 0.89]	2017
Tu et al., 2020	1.1497	0.5065	11.6%	3.16 [1.17, 8.52]	2020
Yousef et al., 2020	0.0243	0.2903	17.1%	1.02 [0.58, 1.81]	2020
Repon et al., 2021	3.2687	1.1494	3.9%	26.28 [2.76, 250.01]	2021
Norful et al., 2023	-0.1717	0.3673	15.0%	0.84 [0.41, 1.73]	2023
Total (95% CI)			100.0%	1.32 [0.81, 2.15]	

Heterogeneity: Tau² = 0.28; Chi² = 21.87, df = 6 (P = 0.001); I² = 73%
Test for overall effect: Z = 1.10 (P = 0.27)

Figure 5. Forest Plot of the effect of sleep disturbance on depression in health workers

The forest plot in Figure 5 shows that the risk of depression caused by sleep disturbances in health workers is 1.32 times compared to health workers who do not experience sleep disturbances (aOR=1.32; CI 95%=0.81 to 2.15; p=0.270). The forest plot in Figure 5 shows a very large heterogeneity of effect estimates between studies (I^2=73%; p< 0.001). Thus, the calculation of the average effect estimate is carried out using a random effect model approach.

The Funnel plot of sleep disorders on anxiety in the workforce in Figure 6 shows a sympathetic distribution that can be interpreted with no publication bias.
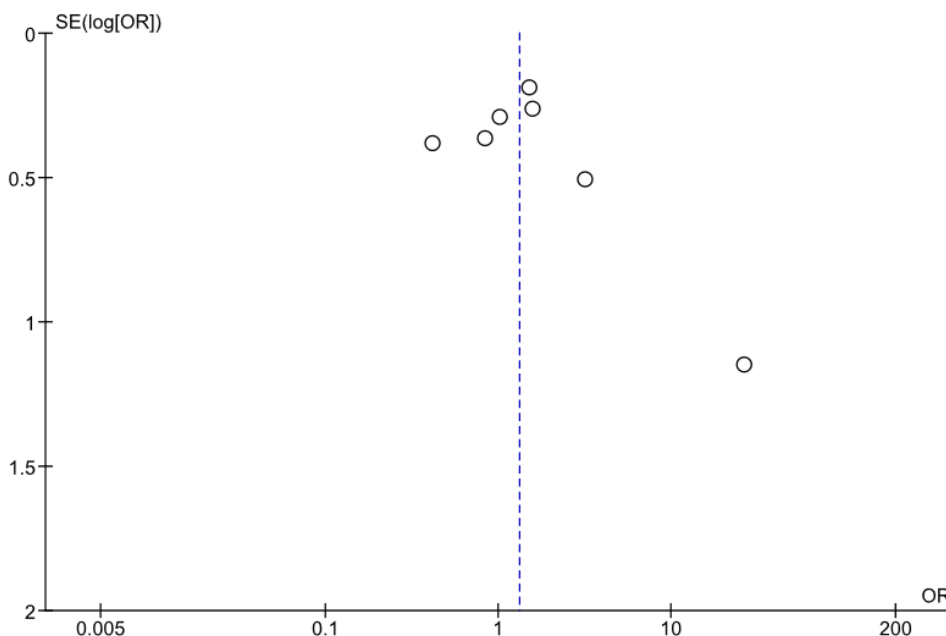
Figure 6. Funnel plot of the effect of Sleep Disorders on Depression in Health Workers

There were 7 primary studies of cross sectional research design as a source of meta-analysis from Hong Kong, China, Bangladesh, Saudi Arabia, the United States and Turkey. Sleep disorders are a group of conditions that interfere with normal sleep patterns. Sleep disorders are one of the clinical problems that interfere with normal physical, mental, social, and emotional functioning. Sleep disorders can affect health, safety, and overall quality of life (Karna et al, 2024).

1. The effect of sleep disorders on anxiety in health workers

In this study, there were 6 primary cross-sectional studies as a source of meta-analysis on sleep disorders on anxiety in health workers. The results of the meta-analysis showed that the risk of anxiety caused by sleep disturbances in health workers was 1.67 times compared to health workers who didn't experience sleep disturbances (aOR= 1.67; CI 95%=1.05 to 2.66; p=0.030). The effect of sleep disorders on anxiety in health workers showed a very large heterogeneity of effect estimates between studies (I^2 = 72%; p< 0.030) and no publication bias was found.

Health workers are prone to sleep disturbances due to shift working hours. Night shifts affect the quality of a person's sleep. The things that also affect work shifts, such as the type of work, the rotation pattern of work shifts, the number of night shifts, as well as rest time and holidays. A person with adequate sleep time and optimal quality will affect the person's activity. People who lack sleep will be less focused during activities, easily feel tired, and have a bad mood (Sarasputri and Kusuma, 2022). In general, night shift workers have less sleep time and lower concentration levels than non-shift workers. Where things such as lack of sleep and low concentration of workers are things

that must be considered so as not to cause accidents (Ramadhani et al., 2022).

One of the consequences of sleep disturbances in health workers is caused by regular morning, noon, and night shift hours. Reduced sleep quality and duration, and insomnia symptoms are common in shift workers (Moreno et al., 2019), especially those who work at night, early in the morning, and rotating shifts (Akerstedt and Wright, 2009). Non-standard and often irregular work times force sudden changes in bedtime and wake-up times that lead to misalignments between circadian systems. Circadian rhythm disturbances can significantly disrupt the gut-brain communication pathway, which can lead to an increase in cortisol levels (Mulianda et al., 2023). High cortisol levels trigger an increased prevalence of depression and anxiety (Brown et al., 2020).

This is in line with Kalmbach et al. (2019) which examined the assessment of the effect of sleep disorders and sleep duration disorders on the risk of anxiety due to stress which found that intership doctors who experienced sleep disorders had a risk of experiencing anxiety by 2.08 times (aOR= 2.08, 95% CI = 1.26,3.45).

2. Effect of sleep deprivation on depression in health workers

The results of meta-analysis on 7 primary studies of cross-sectional research design as a source of meta-analysis from 2 Asian continents (2 China, 1 Bangladesh, 1 Turkey, 1 Hong Kong, 1 Saudi Arabia) and the United States showed that the Forest plot of the effect of sleep deprivation on depression in health workers showed that the risk of depression caused by sleep disturbances in health workers was 1.32 times compared to health workers who did not experience sleep disturbances sleep (aOR=1.32; CI 95%=0.81 to 2.15; p= 0.270).

The forest plot of the effect of sleep on depression in health workers showed a very large heterogeneity of estimated effects between studies (I^2=73%; p<0.001). Thus, the calculation of the average effect estimate is carried out using a random effect model approach. The funnel plot of the effect of sleep on depression in health workers shows that there is no publication bias. Working hours for health workers who experience shifts will affect irregular sleep patterns. The sleep disorder will cause damage to the circadian rhythm so that it increases the level of the hormone cortisol (Hirotsu et al, 2015). Elevated cortisol levels lead to psychological disorders such as depression and anxiety (Nandham et al, 2020).

The results of this study are in line with Robert and Duong (2015), which stated that the relationship between sleep deprivation and depression in adolescents, giving the result that sleeping 6 hours or less at night and every night (including weekends) increased the risk of depressive symptoms at the follow-up period, finding an increased risk of 25% to 38% (aOR=1.95; CI95%=0.94 to 4.04).

CONFLICT OF INTEREST
There is no conflict of interest in this study.

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