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Review article

The prevalence of insomnia among health care workers amid the COVID-19 pandemic: An umbrella review of meta-analyses

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ABSTRACT

Background: Health care workers (HCWs) during the COVID-19 pandemic experience numerous psychological problems, including stress and anxiety. These entities can affect their sleep quality and predispose them to insomnia. The aim of the present study was to investigate the prevalence of insomnia among HCWs during the COVID-19 crisis via an umbrella review.

Methods: The PRISMA guideline was used to conduct this review. By searching relevant keywords in databases of Scopus, PubMed, Web of Science, and Google Scholar, studies that reported the prevalence of insomnia among HCWs during the COVID-19 pandemic (January 2020 to the end of January 2021) and had been published in English were identified and evaluated. The random effects model was used for meta-analysis, and the I^2 index was used to assess heterogeneity. The Egger test was used to determine publication bias. Based on the results of the primary search, 96 studies were identified, and ultimately 10 eligible studies entered the meta-analysis phase.

Results: The results of the umbrella review of meta-analyses showed that the prevalence of insomnia among HCWs during the COVID-19 pandemic was 36.36% (95% CI: 33.36–39.36, $I^2 = 59.6\%$, $p = 0.006$).

Conclusions: The results of this umbrella review of meta-analyses showed a relatively high prevalence of insomnia among HCWs during the COVID-19 pandemic. As insomnia can be associated with other psychological problems, policymakers and health managers should regularly screen HCWs for psychological disorders as well as a possible tendency for suicide. Furthermore, by treating insomnia, one can reduce the incidence of these psychological disorders.

1. Introduction

In December of 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in Wuhan, China and rapidly spread worldwide, causing the World Health Organization (WHO) declared a pandemic a few months later [1,2]. This pandemic has been associated with an increased prevalence of psychological health issues, in addition to the more obvious physical health consequences [3,4]. The disease affects different aspects of people's lives and different communities in the society, including health care workers (HCWs) [5,6]. HCWs, due to frequent contact with COVID-19 patients, are at high risk of infection transmission. In addition, they have grappled with higher workloads, frustration, discrimination, fatigue, isolation from their families, and shortages of personal protective equipment (PPE) within a high pressure, high stress work environment. Despite their resilience, a significant number of HCWs have experienced various physical and psychological problems [5,7]. It has been noted that due to high stress, HCWs engaged in caring for COVID-19 patients are at an increased risk of depression, anxiety, insomnia [8,9], burnout, and post-traumatic stress disorder (PTSD) [10]. Stress has been shown to be one of the main factors contributing to HCW insomnia. The change in normal daily routine, economic uncertainty, and concerns about contracting the COVID-19 have all contributed to increased HCW insomnia [11,12]. According to studies during the COVID-19 pandemic, HCWs serving on the front-line experience more sleep disorders and poorer sleep quality as compared with non-HCWs [13]. The results of a study in Turkey showed that the

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prevalence of depression, anxiety, and insomnia among HCWs were 77.6%, 60.2, and 50.4%, respectively [14]. The results of another study in China revealed that about one-third of HCWs experienced insomnia during the COVID-19 pandemic. Education level, isolated environment, occupational concerns, and worries about the consequences of COVID-19 have been associated with an increased risk of insomnia among HCWs [15]. As HCWs have been on the frontline of caring for patients affected by COVID-19 since its emergence, they seem to be vulnerable to different psychological consequences. Numerous systematic reviews and meta-analyses have been conducted on the mental health outcomes, especially insomnia, among HCWs during this pandemic, but no single study has combined these results to identify overarching trends or conclusions. Therefore, the present umbrella review of meta-analyses aims to serve as the first and most comprehensive study in this regard. This umbrella review assesses all meta-analyses conducted on the prevalence of insomnia among HCWs around the world to estimate the prevalence of insomnia in this population. The results of this study can serve as a resource for policy-makers or health managers to implement appropriate plans to improve the mental health of HCWs around the world.

2. Materials and methods

In order to conduct this review, we used the Preferred Reporting Items for Systematic Reviews and Meta-analyzes (PRISMA) guidelines [16]. The review protocol was registered and is accessible at the PROSPERO database under the code of CRD42021238985.

2.1. Search strategy in databases

In this study, the search was performed in Scopus, PubMed, Web of Science, and Google Scholar databases using relevant keywords including:

"Insomnia", "Primary Insomnia", "Transient Insomnia", "Secondary Insomnia", "Sleep Initiation Dysfunction", Sleeplessness,"Insomnia Disorder", "Chronic Insomnia", "Psychophysiological Insomnia", "Mental Health Disorder", "Psychiatric Disorder", "2019 Novel Coronavirus Disease" COVID19, "COVID-19 Pandemic", "SARS-CoV-2 Infection", "COVID-19 virus disease", "2019 Novel Coronavirus Infection", "2019-nCoV Infection", "Coronavirus Disease 2019", "2019-nCoV Disease", "COVID-19 Virus Infection", "Health Personnel", "Health Care Provider," "Health worker," "Healthcare Provider," "Healthcare Worker," "Health Care Professional," "Medical Staff," "Medical worker," "Systematic Review," "Meta-Analysis," "Meta-Analytic".

At first, using the keywords, search fields, and operators, a search strategy was designed for PubMed. Subsequently, according to the designed strategy, searches were also performed in the other databases. The searches were conducted to obtain studies published in English from January 2020 until the end of January 2021. The following is an example of the search strategy in PubMed. Strategies employed in other databases are noted in Appendix 1.

An example of the search strategy in PubMed:

((insomnia* OR "Primary Insomnia" OR "Transient Insomnia" OR "Secondary Insomnia" OR "Sleep Initiation Dysfunction*" OR Sleeplessness OR "Insomnia Disorder*" OR "Chronic Insomnia" OR "Psychophysiological Insomnia" OR "Mental health Disorder*" OR "Psychiatric Disorder*") AND ("2019 novel coronavirus disease" OR COVID19 OR "COVID-19 pandemic" OR "SARS-CoV-2 infection" OR "COVID-19 virus disease" OR "2019 novel coronavirus infection" OR "2019-nCoV infection" OR "Coronavirus disease 2019" OR "2019-nCoV disease" OR "COVID-19 virus infection") AND ("Health Personnel" OR "Health Care Provider*" OR "Health worker*" OR "Healthcare Provider*" OR "Healthcare Worker*" OR "Health care professional*" OR "medical staff" OR "Medical worker*") AND ("Systematic review") AND ("meta-analysis" OR "meta-analytic"))

2.2. Eligibility criteria

All meta-analyses reporting the prevalence of insomnia among HCWs during the COVID-19 pandemic were included. The studies addressing the prevalence of sleep disorders in people other than HCWs or those focusing on sleep disorders other than insomnia were excluded.

2.3. Study selection

Initially, all 96 studies found in the primary search were inserted into EndNote X7 software. After excluding duplicate articles, 71 studies were screened. The full texts of 16 possibly related studies were independently reviewed by two of the researchers (AS, MG). Ultimately, 10 studies were selected for quality assessment. Fig. 1 demonstrates the steps of study selection.

2.4. Quality assessment and data extraction

Qualitative evaluation of the selected studies' methodology was independently performed by two researchers using the Assessment of Multiple Systematic Reviews, version 2 (AMSTAR-2) [17]. In order to extract the data, the two researchers independently extracted the required data (the first author's name, the location, the number of subjects, the degree of heterogeneity, and publication) using a checklist designed in Microsoft Word 2016.

2.5. Statistical analysis

The random effects model was used to conduct the meta-analysis of selected studies. The I^2 index was used to evaluate the heterogeneity among the studies. The indices of $<25\%$, 25–50%, 50–75%, and $>75\%$ indicate no, moderate, high, and very high heterogeneity, respectively [18]. Publication bias was assessed by the Egger's test, and the data was analyzed using STATA (version 14) software.

3. Results

Overall, 187,506 HCWs were analyzed in this umbrella review. Table 1 shows the specifications and data related to each study.

The prevalence of insomnia among HCWs during the COVID-19 pandemic was 36.36% (95% CI: 33.36–39.36, $I^2 = 59.6\%$, $p = 0.006$, Fig. 2). The I^2 index showed a high heterogeneity between the studies. Based on the results of the Egger's test ($p = 0.571$), publication bias was insignificant (Fig. 3).

4. Discussion

Based on the findings of this umbrella review, the prevalence of insomnia among HCWs during the COVID-19 pandemic was 36.36% (95% CI: 33.36–39.36). A review by Jahrami et al. [19] showed that the prevalence of sleep disorders was higher in HCWs as compared with the general population (36%vs. 32.3%). The results of a study by Zhou et al. [20] showed that frontline HCWs suffered more from mental disorders than the general population during the COVID-19 pandemic. These findings are consistent with the results of this umbrella review, indicating that the COVID-19 pandemic has been a source of significant psychological stress for HCWs as compared with the general population. In cases of traumatic stress, acute stress suppresses rapid eye movement (REM) sleep and increases the duration of non-REM sleep, which is followed by restorative sleep compensation, increased sleep time and increased REM sleep. However, persistent or repeated chronic stress exposure like COVID-19 may have a more negative impact on sleep, resulting in the presentation of sleep disorders, insomnia and other problems. In the presence of an active the hypothalamic-pituitary-adrenal (HPA) axis, individuals may experience a lighter sleep, increasing awakenings and sleep fragmentation [21].Glucocorticoids

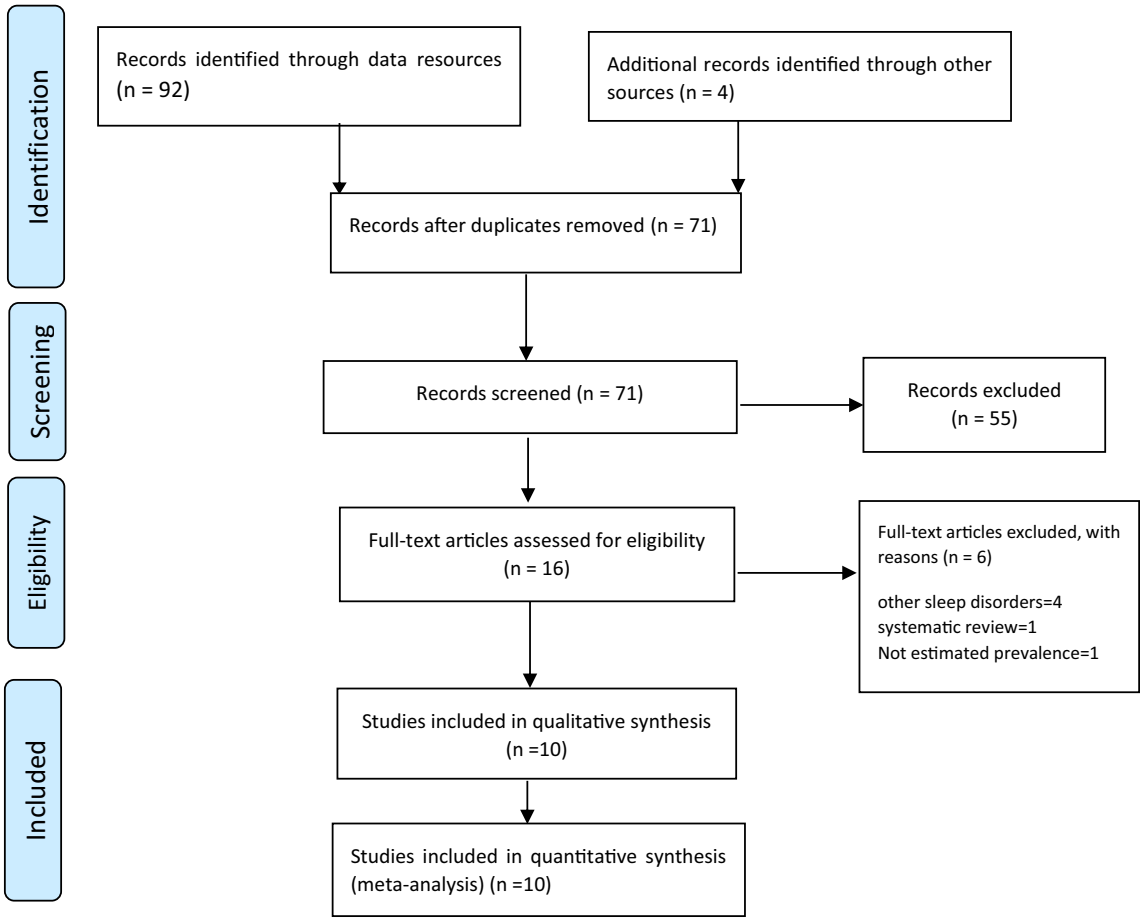

Fig. 1. Flowchart of the selection of studies based on PRISM.

Table 1
The Specifications of Studies Included in the Umbrella Review.

First author	Country	Sample Size (HCWs)	Prevalence of insomnia	Heterogeneity% I2	Publication bias	Survey Instrument	Group study
Batra [29]	USA	18,546	27.8% (21.4–35.3)	98.1%	Egger ($P = 0.01$) Begg ($P = 0.03$)	ISI, AIS, PSQI	Doctors and Nurses
Krishnamoorthy [30]	India	NA	37% (32–42)	92.6%	NA	ISI, AIS	HCWs
Pappa [31]	United Kingdom	33,062	34·32% (27·45–41·54)	98%)	NA	ISI, AIS	Physicians, nurses Other HCWs
de Pablo [32]	United Kingdom	60,458	44.5% (38.2–50.9)	93.179	NA	Not reported	Nurses, physicians, medical students, social workers
Cénat [33]	Canada	7379	36.52 (32.99–40.20)	89.45	funnel plot (No asymmetric)	ISI.AIS, PSQI	HCWs
Luo [34]	China	NA	32% (25–39)	NA	NA	ISI, PSQI, AIS	HCWs
Wu [35]	China	13,375	47.3 (38.8–55.8)	98.7	Egger ($p = 0.223$)	PSQI, ISI	Nurses and physicians
Wu [35]	China	1380	31.8 (27.2–36.5)	37.5	Egger (p = 0.223)	PSQI, ISI	Other medical staff
Dutta [36]	India	34,021	35.8% (28.3–48.1)	99.2%	NA	ISI, PSQI	Doctors and Nurses, other HCWs
Mahmud [37]	Bangladesh	19,285	40.52%. (31.19–49.86)	99.47%	Egger $P = 0.38$	ISI, AIS, PSQI, PHQ-9	HCWs
Maqbali [38]	Oman	NA	36 (30-43)	95%	NA	ISI, AIS, PHQ-15	Nurses

NA = Not Applicable, NR = Not reported, HCWs = Healthcare workers, ISI: Insomnia Severity Index, AIS: Athens insomnia scale, PSQI: Pittsburgh sleep quality index, PHQ: Patient Health Questionnaire.

are the end-hormones of the HPA axis. Their secretion is regulated by the brain and reflects the overall activity of the stress system which includes the HPA axis, and the arousal and autonomic nervous systems. Activation of the stress system is associated with a repertoire of functions that collectively constitute the "stress syndrome". Fragmented sleep can subsequently excite the sympathetic catecholamine system and elevate cortisol levels, which eventually results in persistent insomnia [21,22].

This may account for the higher prevalence of sleep disorders among HCWs. These results argue for the urgent implementation of support systems to prevent the psychological distress among HCWs and increase their resilience during this time. Supportive measures that are useful and necessary to reduce job stress include: creating a suitable environment

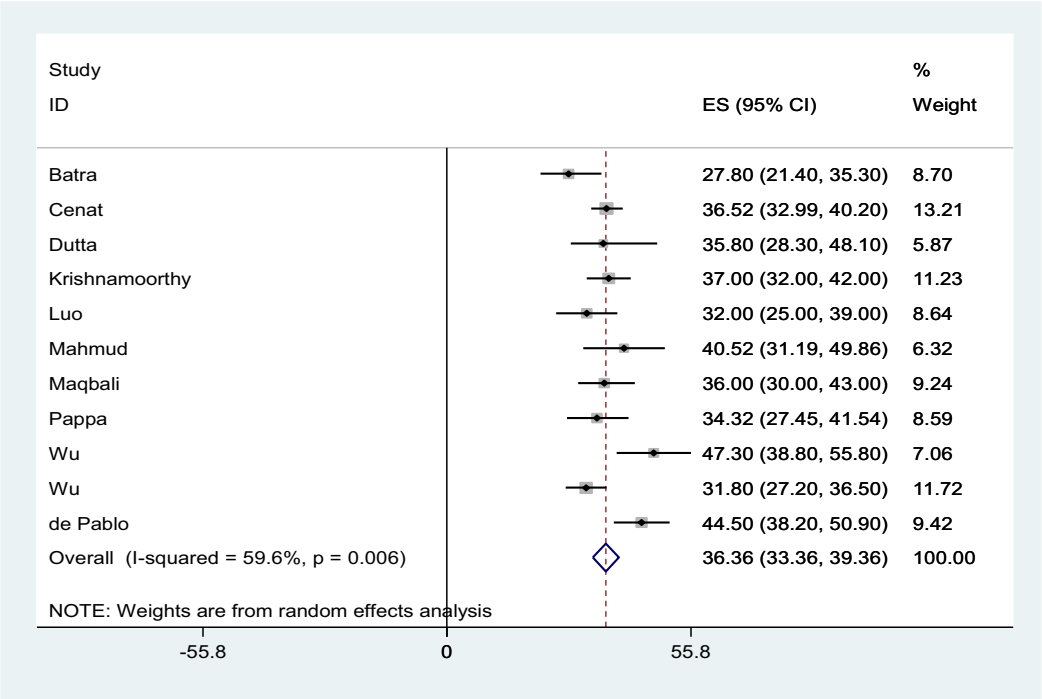

Fig. 2. The forest plot of overall and individual prevalence of insomnia in the Included studies with 95% confidence interval.

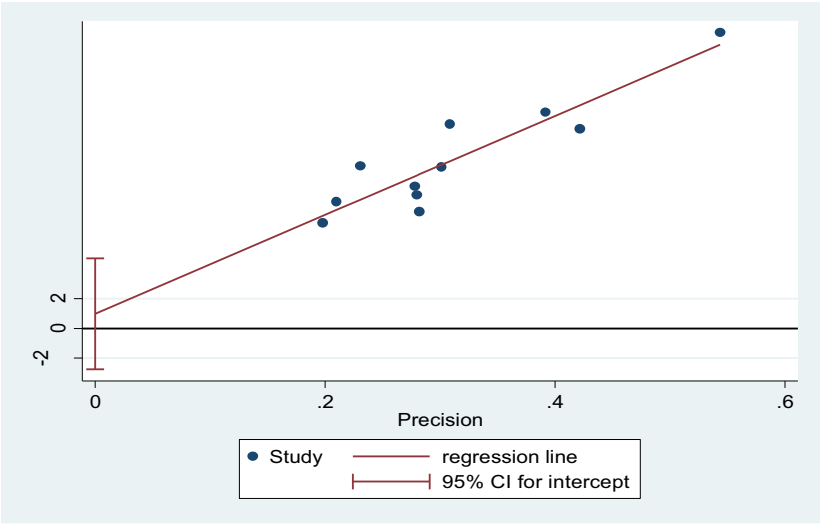

Fig. 3. Publication bias based on Egger Test.

for effective communication, reducing the hours of work shifts and workload, hiring new staff, providing adequate personal protective equipment (PPE) for staff, using mental health professionals for counseling, and setting up counseling lines for easy access to a psychiatrist. Health care workers are encouraged to express their feelings by talking, drawing, singing, exercising, and communicating with colleagues with similar experiences or feelings. They can understand each other better and help out dealing with the problem [23,24]. Previous research has demonstrated a direct correlation between COVID-19-related anxiety, insomnia severity, and suicidality. The likelihood of suicidal ideation has been directly linked to the severity of insomnia [25]. In addition to their association with anxiety and depression, sleep disorders are risk factors for suicidal ideation, attempt, and completion. Accordingly, addressing sleep disorders is vital to reducing suicide and psychiatric disorders among HCWs [26]. The results of an umbrella review by Sahebi et al. [24] showed that the prevalence of anxiety and depression among HCWs were 24.92% and 21.41%, respectively. The results of other studies further support the assertion that the HCWs engaged in caring for COVID-19 patients are more prone to psychiatric disorders such as anxiety, depression, insomnia, and stress compared with other occupational groups. HCWs should be screened for insomnia and other psychological problems and regularly followed up to reduce the risk of suicide. This research demonstrates that mental health resources should be prioritized for HCWs during this pandemic [27,28].

4.1. Limitations

The most important limitation of this study was the high

heterogeneity among the selected studies. This was because various studies used different tools and cut-off points. Another limitation of the present study was the lack of reporting the number of participants by some studies. Finally, because the prevalence of insomnia was not separately reported in men and women by most of the studies, it was not possible for us to report the prevalence of insomnia by gender.

5. Conclusion

The results of the present study showed relatively high prevalence of insomnia among HCWs. As insomnia can be associated with other psychological disorders, policymakers and administrators should consider regularly screening for insomnia, as well as other psychological disorders and suicidal ideation, among HCWs. By implementing appropriate supportive measures and timely treatment, it is possible to reduce the incidence of more serious psychological disorders and decrease the incidence of suicide within this population.

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None.

Authors contributions

AS, SM, MT, and MG designed the review, developed the inclusion criteria, screened titles and abstracts, appraised the quality of included papers, and drafted the manuscript. AS, SM, KA, MT, and MG reviewed the study protocol and inclusion criteria and provided substantial input to the manuscript. AS, MG, KA, SM, and MS reviewed the study protocol. AS and MG read and screened articles for inclusion. All authors critically reviewed drafts and approved the final manuscript.

Conflicts of interest statement

The authors declare that they have no competing interests.

Ethical considerations

Not applicable.

Acknowledgments

None.

Appendix 1. Appendix

Table A1
Using database-appropriate syntax, with parentheses, Boolean operators, and field codes.

pubmed	((insomnia* OR "Primary Insomnia" OR "Transient Insomnia" OR "Secondary Insomnia" OR "Sleep Initiation Dysfunction*" OR Sleeplessness OR "Insomnia Disorder*" OR "Chronic Insomnia" OR "Psychophysiological Insomnia" OR "Mental health Disorder*" OR "Psychiatric Disorder*") AND ("2019 novel coronavirus disease" OR COVID19 OR "COVID-19 pandemic" OR "SARS-CoV-2 infection" OR "COVID-19 virus disease" OR "2019 novel coronavirus infection" OR "2019-nCoV infection" OR "Coronavirus disease 2019" OR "2019-nCoV disease" OR "COVID-19 virus infection") AND ("Health Personnel" OR "Health Care Provider*" OR "Health worker*" OR "Healthcare Provider*" OR "Healthcare Worker*" OR "Health care professional*" OR "medical staff" OR "Medical worker*") AND ("Systematic review") AND ("meta-analysis"[tiab] OR "meta-analytic"))	12
Scopus	((ALL(insomnia*) OR ALL("Primary Insomnia") OR ALL("Transient Insomnia") OR ALL("Secondary Insomnia") OR ALL("Sleep Initiation Dysfunction*") OR ALL(Sleeplessness) OR ALL("Insomnia Disorder*") OR ALL("Chronic Insomnia") OR ALL("Psychophysiological Insomnia") OR ALL("Mental health Disorder*") OR ALL("Psychiatric Disorder*")) AND (ALL("2019 novel coronavirus disease") OR ALL(COVID19) OR ALL("COVID-19 pandemic") OR ALL ("SARS-CoV-2 infection") OR ALL("COVID-19 virus disease") OR ALL("2019 novel coronavirus infection") OR ALL("2019-nCoV infection") OR ALL ("Coronavirus disease 2019") OR ALL("2019-nCoV disease") OR ALL("COVID-19 virus infection")) AND (ALL("Health Personnel") OR ALL("Health Care Provider*") OR ALL("Health worker*") OR ALL("Healthcare Provider*") OR ALL("Healthcare Worker*") OR ALL("Health care professional*") OR ALL ("medical staff") OR ALL("Medical worker*")) AND (ALL("Systematic review")) AND (TITLE-ABS("meta-analysis") OR ALL("meta-analytic")))	77
Web of science	((TS = (insomnia*) OR TS = ("Primary Insomnia") OR TS = ("Transient Insomnia") OR TS = ("Secondary Insomnia") OR TS = ("Sleep Initiation Dysfunction*") OR TS = (Sleeplessness) OR TS = ("Insomnia Disorder*") OR TS = ("Chronic Insomnia") OR TS = ("Psychophysiological Insomnia") OR TS = ("Mental health Disorder*") OR TS = ("Psychiatric Disorder*")) AND (TS = ("2019 novel coronavirus disease") OR TS = (COVID19) OR TS = ("COVID-19 pandemic") OR TS = ("SARS-CoV-2 infection") OR TS = ("COVID-19 virus disease") OR TS = ("2019 novel coronavirus infection") OR TS = ("2019-nCoV infection") OR TS = ("Coronavirus disease 2019") OR TS = ("2019-nCoV disease") OR TS = ("COVID-19 virus infection")) AND (TS = ("Health Personnel") OR TS = ("Health Care Provider*") OR TS = ("Health worker*") OR TS = ("Healthcare Provider*") OR TS = ("Healthcare Worker*") OR TS = ("Health care professional*") OR TS = ("medical staff") OR TS = ("Medical worker*")) AND (TS = ("Systematic review")) AND (Ti = ("meta-analysis") OR TS = ("meta-analytic")))	3

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