



Psychological effects of the COVID 19 pandemic on healthcare workers globally: A systematic review

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ABSTRACT

In this systematic review, we compared the incidences of psychological issues during the COVID-19 pandemic, such as anxiety, depression, occupational stress, PTSD and insomnia, in healthcare workers (HCW) and non-healthcare workers (NHCW). PubMed, Ovid, Google Scholar and PsycInfo were systematically searched for related published articles. In all electronic databases, the following search strategy was implemented, and these key words were used: “COVID 19” OR “SARS-CoV-2” AND “psychological” OR “stress” OR “depression” AND “healthcare\$”. We identified 6 studies, out of the final 15 selected, which reported numerical estimates for incidences of psychological effects. Meta-analysis was conducted, comparing both combined and individual effect sizes of all psychological manifestations. Qualitative evidence was reported from the remaining 9 cross-sectional studies. The summary effects of the combined quantitative meta-analysis conducted on 6 studies did indicate near significant differences between HCW and NHCW. Summary effects of individual manifestations indicated significantly higher incidence of insomnia among HCW, when compared to NHCW. Qualitative evidence from remaining cross-sectional studies provided additional information into the nature of the psychological issues. We conclude that even though reasons for psychological distress among HCW and NHCW may be different, both suffered in equal measures excepting for insomnia.

1. Background

The COVID-19 pandemic has emerged as a very real threat to global health, economic stability, and how different societies and governments function. COVID-19 first emerged in December of 2019 with a report of severe flu-like illness in Wuhan, Hubei Province, China (Shah et al., 2020, H. Li et al., 2020). In January 2020, the causative pathogen was identified as a novel coronavirus, subsequently named SARS-CoV-2. In February 2020, the World Health Organization (WHO) coined the term “COVID-19” in reference to Coronavirus Disease 2019 (WHO director-general). As of May 22nd, 2020, over 5.1 million laboratory-confirmed cases of COVID-19 have been reported in 195 countries out of which 1.5 million are in the US. Worldwide COVID-19 has resulted in over 333 thousand deaths out of which 94,000 have been in the US (COVID-19 Map). The higher incidences of coronavirus infection and mortality in HCW is well documented and continues to be monitored (Rothan and

Byrareddy, 2020). Simultaneously, interventions to reduce transmission of the virus from patients by proper usage of adequate personal protective equipment (PPE) have been hampered by shortages of the same. Individual caretaker workloads have been increased either due to high-risk exposure or developing symptoms/testing positive and the resulting quarantine (Neto et al., 2020). These factors may result in significant stress in HCW. However, psychological ramifications of the pandemic in the otherwise physically healthy HCW has not yet been well studied. This integrative review examines all cross-sectional studies measuring the mental illness burden of HCW in comparison to the general public whose mobility has been severely restricted.

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2. Methods

2.1. Search strategy

This systematic review assessed the clinical evidence using a pre-specified protocol and an explicit, reproducible plan for a literature search and synthesis according to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Hutton et al., 2015). The review protocol was not registered. Ovid, PubMed, Google Scholar and Psych Info from November 01, 2019 to May 02, 2020 were systematically searched for related published articles. In both electronic databases, the following search strategy was implemented and these key words (in the title/abstract) were used: “COVID 19” OR “SARS-CoV-2” AND “psychological” OR “stress” OR “depression” AND “Healthcare\$”. To ensure literature saturation, the authors scanned the reference lists of the included studies or relevant reviews identified through the search.

2.2. Selection criteria

Authors (MS, ND) participated through each phase of the review independently (screening, eligibility, and inclusion). As per protocol, only articles written in English which were limited to the current COVID pandemic and described observational studies measuring psychological outcomes with HCW as subjects were included. The authors independently screened the titles and abstracts yielded by the search against the inclusion criteria. They obtained full reports for all titles that appeared to meet the inclusion criteria or where there was any uncertainty. Authors screened the full text reports and decided whether these met the inclusion criteria. They resolved any disagreement through discussions among all authors. Neither of the authors were blinded to the journal titles or to the study authors or institutions. Studies found suitable for selection were all cross-sectional studies.

2.3. Data collection

The following data were extracted from the included studies: study authors, country, study design, participants and outcome measures. The primary and secondary outcome measures were combined and individual incidences of anxiety, depression, occupational stress, PTSD and insomnia in HCWs and NHCWs during the COVID19 pandemic. The methodological quality of the included studies was assessed by the authors using the Cochrane risk of Bias tool (Sterne et al., 2019). Comparable control group data from studies were used when a control group was not reported in any individual study.

2.4. Statistical analysis

The meta-analysis specifically included studies comparing psychological symptoms of anxiety, depression, occupational stress, and insomnia in HCW vs. that in NHCW. Meta-analysis was performed first for the combination of all mental health outcomes using the mean of all outcomes without assuming independence. Subsequently meta-analyses were performed for individual outcomes utilizing only the studies in which the outcome examined was reported. In all cases random-effects meta-analyses were performed using the Mantel-Haenszel method for dichotomous data to estimate pooled odds ratios (OR). Statistical heterogeneity was assessed using I^2 statistics. The meta-analysis was conducted with Comprehensive Meta-analysis software (CMA).

3. Results

3.1. Study selection

The search identified 239 articles (Fig. 1), which were culled to 121 potentially eligible studies after removing duplicates. No articles were

added from a manual search of references or through gray literature sources like conference proceedings or clinical trials registry. In all 90 studies were excluded after review of their titles and abstracts mainly due to lack of specificity with regards to the current COVID-19 pandemic. Full text assessments of the remaining 31 articles were carried out. A total 17 were excluded because they were commentaries and did not contain patient data. Out of the remaining 14 all were cross-sectional studies and a systematic review which were used in the qualitative synthesis (E.supplement). Only 6 of the studies reported binary data regarding whether HCW and NHCW suffered from psychological outcomes. The remaining 9 studies either reported survey narratives or scored answers on psychological outcome specific scales. Eventually, they reported differences in means and standard deviations of scale scores between HCW and NHCW. The difficulty in developing a summary effect from these studies was that separate scales were used to measure the same outcome in different studies. Therefore, the resulting scores for an outcome were not comparable. One of the excluded studies was a systematic review, which summarized effects from studies pertaining to the SARS and MERS epidemics (De Brier et al., 2020). Of the remaining 6, the Naser et al. study from Jordan reported outcomes on a nominal scale (mild, moderate, moderately severe and severe) (Naser et al., 2020). This made it impossible to extract dichotomous outcomes for which it was excluded. Finally, 5 studies; 4 from China and 1 from Singapore, were used for meta-analysis. Lai et al. and Wu et al. studies did not have the control group (Lai et al., 2020, Wu et al., 2020). However, the Huang & Zhao and Lu et al. studies consists of contemporary data (Huang and Zhao, 2020, Lu et al., 2020). Therefore, we utilized comparable control group data from these studies.

These studies, with sample sizes ranging from 174 to 4986, either had a “high risk of bias” (3) or “some concerns” (2) on the Cochrane risk of bias tool.

3.2. Outcomes

The outcomes reported in all five studies were not consistent. Huang and Zhao reported anxiety, depression, and insomnia while Lai et al. additionally reported stress incidence (Lai et al., 2020, Huang and Zhao, 2020). Lu et al. reported anxiety, depression, and stress while Tan et al. additionally reported about PTSD (Lu et al., 2020, Tan et al., 2020). Wu et al. only reported incidence of anxiety and stress (Wu et al., 2020).

3.3. Meta-analysis

A total 5 studies, all of which were cross sectional observational studies, were included in the combined outcomes random effects meta-analysis. The pooled study population had 6035 HCW and 5417 NHCW. It was deficient in homogeneity of demographics and specificity in the types of healthcare occupations. The primary outcome was incidence of combined psychological ailments which included anxiety, depression, occupational stress, PTSD and insomnia. There was no significant difference between the two groups (OR=1.39, 95% CI 0.99 to 1.96, $p = 0.06$, Fig. 2) with relatively high heterogeneity ($I^2=88.75\%$, Table). Of the secondary outcomes, resulting from comparisons of incidence of each separate psychological effect, only insomnia was found to be significantly higher in the HCW group compared to NHCW group (OR=2.19, 95% CI 1.33 to 3.61, $p<0.01$, Fig. 3) with relatively high heterogeneity ($I^2=96.5\%$, Table). However, only two of the studies could be used for obtaining summary effects for insomnia.

3.4. Publication bias

Visual inspection of the standard error and precision funnel plots (Fig. 4A and 4B) suggest asymmetry consistent with an under-representation of studies with moderate precision and small effect sizes. Classic fail-safe N analysis computed taking alpha at 0.01 put the

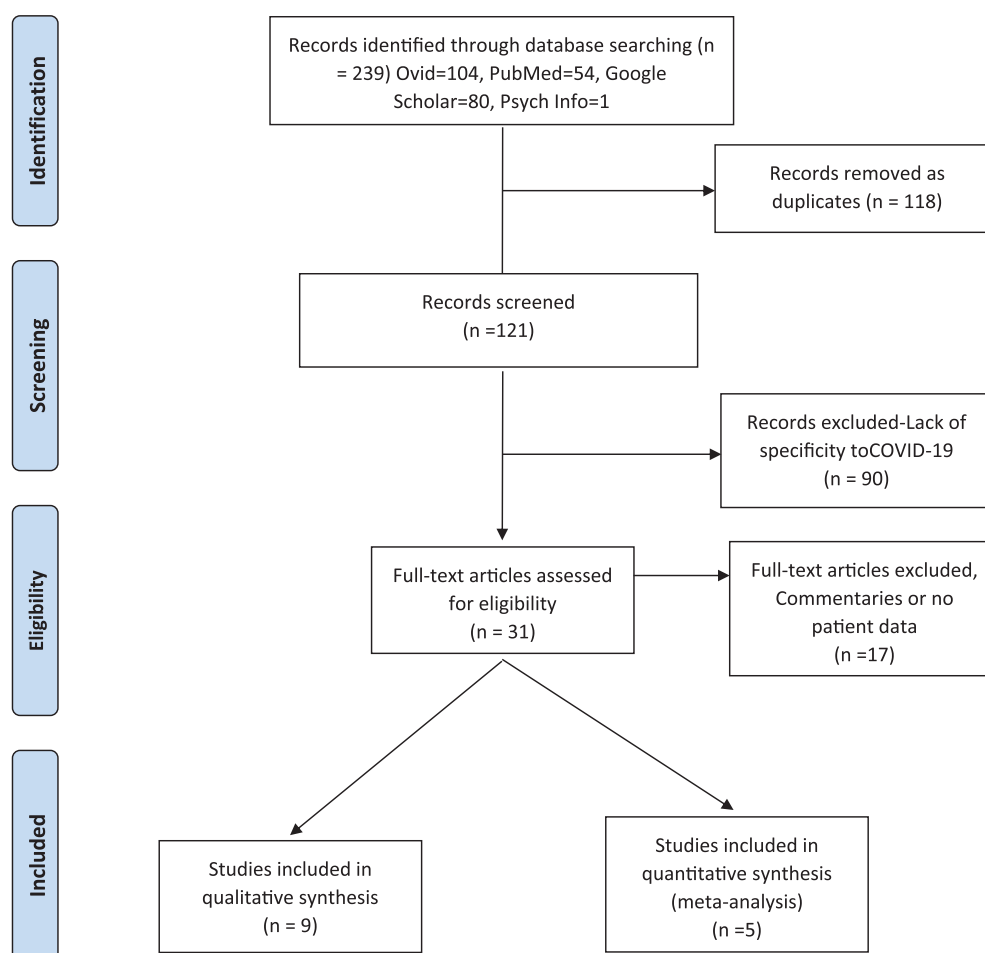


Fig. 1. PRISMA 2009 flow diagram.

number of missing studies at 47. In Egger's regression test the null hypothesis of no small study effects was not rejected at $P < 0.05$ (estimated bias coefficient = -3.52 ± 2.28 SE). Overall, we estimate a good risk of publication bias.

3.5. Qualitative synthesis

All publications that were not used to extract quantitative data were used for qualitative synthesis. They provide an insight into unique types

of HCW that suffered from specific kinds of psychological distress and root causes of these problems. Ahmed et al. surveyed 650 dentists from 30 different countries from all continents except the Americas. They assessed their fears and anxiety associated with the current pandemic. A majority of them were concerned about acquiring the COVID-19 virus during patient care and inadvertently transmitting it to their families. They were afraid of quarantine after getting infected, and of higher mortality associated with the disease. They experienced anxiety while treating or talking to coughing or suspected COVID-19 infected patients

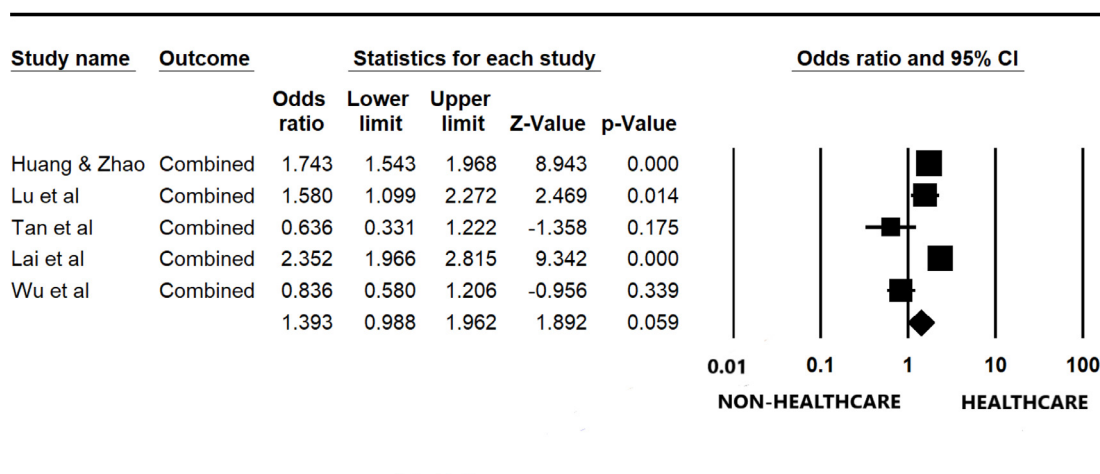


Fig. 2. Forest plot for combined outcomes.

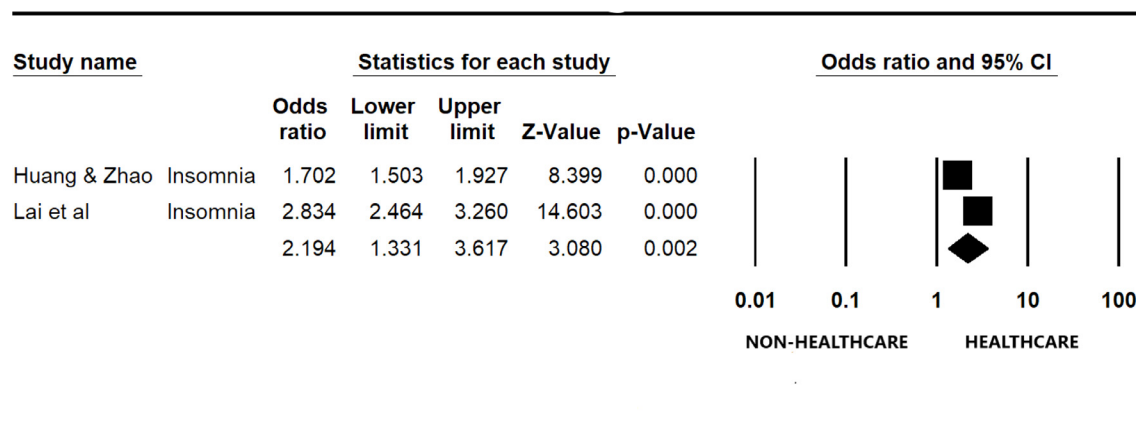


Fig. 3. Forest plot for insomnia.

without adequate PPE, and contemplating costs of treatment should they get infected. Although most had sound knowledge of the universal precautions and some practiced them diligently, about 2/3rd favored closing their practices till the number of new infections started declining (Ahmed et al., 2020)

Chew et al. surveyed 906 HCW from 5 hospitals in Singapore and India using Depression Anxiety Stress Scales (DASS-21) and the Impact of Events Scale-Revised (IES-R) instruments. They found an association between higher scores on these instruments and the risk of developing physical symptoms such as headache, lethargy, and insomnia. They advised offering psychological diagnostic and support services for all HCW with physical symptoms (like PPE associated headaches or fatigue) after excluding COVID19 infection (Chew et al., 2020). De Briers et al. conducted a systematic review of 28 observational studies, primarily from prior coronavirus epidemics, to identify risk and protective factors affecting the mental health outcomes in HCW. The review suggested that the presence of good mental health support in a safe working environment afforded a greater sense of control and agency to HCWs and helped improve their resilience during the pandemic (De Brier et al., 2020).

Huang and Zhao used a web-based survey with 7236 volunteers consisting of both HCW and NHCW members of the community without COVID and scored them on the Generalized Anxiety Disorder-7 (GAD-7), Center for Epidemiology Scale for Depression (CES-D), and Pittsburgh Sleep Quality Index (PSQI) scales. They found that younger people, those who spent more than 3 h/day thinking about the pandemic and HCW suffered the worst outcomes. In HCW, they found significantly worse scores on the PQSI compared to NHCW. This echoes our findings from the quantitative meta-analysis that HCW suffered much more from insomnia than NHCW during the pandemic (Huang and Zhao, 2020). Naser et al. from Jordan surveyed 4126 participants consisting of both HCW and NHCW using the Patient Health Questionnaire (PHQ-9) and GAD-7 instruments. They found anxiety to be higher amongst university students than in HCW. Amongst HCWs females, divorcees and those with physical co-morbidities had higher risk for depression and anxiety (Naser et al., 2020).

Kang et al. did the first study on mental health of HCW consisting of 994 physicians and nurses out of Wuhan, China using a web-based survey between Jan 29th to Feb 4th, 2020. The survey included the PHQ-9, the GAD-7, the Insomnia Severity Index (ISI) and the IES-R instruments to assess psychological outcomes. Notably, while about 63.1% had mental health concerns, only 17.5% had either received or availed themselves of counseling or psychotherapy services. They concluded that mental health services for frontline HCW should be an essential component in any infectious disease fight (Kang et al., 2020).

Li et al. analyzed responses from 214 volunteer members of the general public and 526 nurses both frontline and non-frontline obtained

through a mobile app questionnaire to generate vicarious traumatization scores. They found that while vicarious traumatization scores for the general public were not significantly different than that for non-frontline nurses, both these groups had significantly higher scores than frontline nurses. Evidence of vicarious traumatization included physiological responses, emotional responses, behavioral responses, cognitive responses and life beliefs. Thus, the study underscored the importance of extending mental health services to both non-frontline and frontline HCW (Z. Li et al., 2020).

Mo et al. studied Stress overload scale and Self-rating anxiety scale responses from 180 anti-epidemic nurses at Wuhan, China. They found a significant correlation of nurse's stress, with anxiety, being an only child and long work hours. They called for nurse leaders to improve stress in nurses by increasing education about the virus, providing a safe work environment, social support and financial rewards such as hazard pay and disability support in cases of disease resulting from occupational exposure to the virus (Mo et al.).

Sacham et al. surveyed a combined 338 dentists and dental hygienists in Israel about psychological distress using Kessler's K6 scale, subjective overload using Demand's scale and self-efficacy using General self-efficacy scale (GSES) along with other health related questions. They found psychological distress was elevated in 11.5% of subjects. The risk was more in those who had underlying comorbidities, a fear of contracting the virus from patients and higher scores on the Demand's scale. Psychological distress was found to be lower in subjects who were in a committed relationship and had higher GSES scores (Shacham et al., 2020).

Simione & Gnagnarella surveyed 353 subjects (167 HCW and 186 NHCW) using the Perceived stress scale, State-trait anxiety inventory, Existential concerns questionnaire, and Marlowe & Crowne social desirability scales. These, assessed stress, anxiety, death anxiety and the tendency of answering in a socially desirable manner, respectively. They found HCW to be at higher risk for worry and stress than NHCW. Location, pre-existing psychological factors and gender were also found to be important determinants of psychological distress (Simione and Gnagnarella, 2020).

Xiao et al. conducted a cross sectional study of 180 HCW in China. They measured anxiety by employing the Self-Rating Anxiety Scale (SAS), self-efficacy by the GSES, stress by the Stanford Acute Stress Reaction (SASR) questionnaire, sleep quality by the PSQI, and social support by the Social Support Rate Scale (SSRS). They found significant correlation between measures of sleep quality and stress and between measures of anxiety and stress. Social support, by reducing stress and anxiety and improving self-efficacy, indirectly helped in improving sleep quality (Xiao et al., 2020).

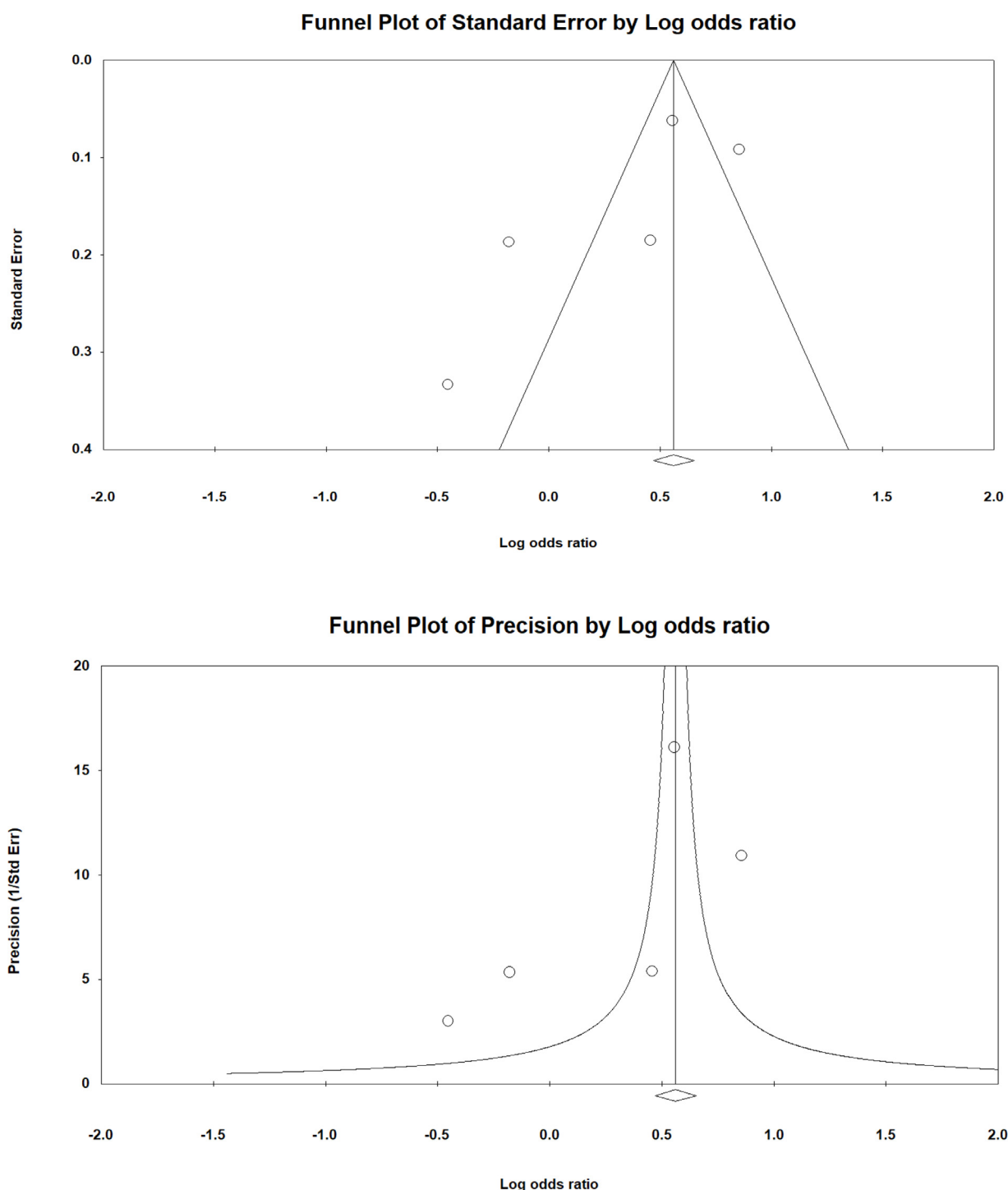


Fig. 4. Publication Bias A) Funnel plot of SE B) Precision Plot.

4. Discussion

This systematic review did not find statistically significant difference between combination effect of anxiety, depression, PTSD and occupational stress of HCW when compared with NHCW at this stage of the current pandemic. The causes for psychological stressors however were different among these two groups. While the fear of working with infected people in the absence of proper PPE and subsequent spread to their families were strongly associated with anxiety in HCW, uncertainties regarding spread of the virus may be a major contributor for stress in NHCW. Global observational studies might be able to shed

more light on this topic. (Walkey et al., 2020)

Sub-groups amongst HCW such as frontline and non-frontline workers also had differences noted in the incidence of stress. Perhaps counterintuitively, frontline workers scored less on these scales than that of the non-frontline health care workers and NHCW. While there is a potential for dedicated training in frontline/emergency workers contributing to this, it could be the result of type of instruments used or the study methodology and should be a focus in future studies.

Psychosomatic manifestations were commonly reported as predictive of worse outcomes. Several interventions including improved access to mental health interventions targeting prevention and early

therapeutic intervention, strict implementation of staff safety guidelines, and balancing workload are thought to be useful.

The incidence of insomnia was found to be higher in HCW across the board in all studies and is important to address in all health care workers regardless of staffing location. Good social support, practices decreasing anxiety and work stress such as mindfulness training, strict adherence to physical activity, daily routines and good sleep hygiene are important to improving sleep.

This study is one of the earliest systematic reviews restricting itself exclusively to studies examining effects the COVID-19 outbreak on mental health of HCW. Another advantage of this review is that it includes studies from across continents thus improving its external validity. Specifically, conducting both qualitative and quantitative analyses strengthens the levels of evidence gathered when one supports conclusions from the other.

We would like to point out to the reader limitations of this study. Internal validity of the review is questionable because of poor reporting of sources. Most of the studies included are cross sectional studies and thus do not provide inference for causation. Given the ongoing quarantine, most of the studies utilized online surveys which introduce the element of selection bias. Though health anxiety has been a major cause of stress amongst HCW we did not include 'anxiety' explicitly in our search strategy. The risk of publication bias is also high as demonstrated by the funnel and precision plots for the meta-analysis. Most of the studies that could not be utilized for meta-analysis used different survey instruments to determine mental health outcome. Scales are subjective measurements of stress and are less reliable than more objective measurements. Also, even though occasionally we came across studies that used a similar methodology, their total numbers did produce a good summary effect. Our meta-analysis demonstrating higher incidence of insomnia used only 2 studies thus limiting the summary effect. Nonetheless, this is an early study within the evolution of this pandemic and provides evidence which may assist health care workers and help in the development of future studies.

In a contemporary systemic review of psychological issues during the COVID-19 pandemic among healthcare workers, we conclude that reasons for psychological distress among HCW and NHCW may be different, but both groups suffer in equal measure. Given the inverse relationship of insomnia and sleep disturbance with care giver well-being and performance, interventions should be directed at prevention and treatment of insomnia in HCW during the pandemic. Our review underlines the need for further research with longitudinal study designs to effectively delineate causation of mental health outcomes in HCW.

Contributions

MS conducted data curation, formal analysis and wrote the original draft. ND conducted data curation and wrote the original draft. TD conducted validation, review, and editing. SS was responsible for project conceptualization, review, and editing of the draft. DH contributed with project supervision, review, and editing of the draft. RK contributed with project conceptualization, review, and editing of the draft. The final manuscript draft was approved by all the authors.

Declaration of Competing Interests

None of the authors have any competing interests to declare.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.psychres.2020.113360](https://doi.org/10.1016/j.psychres.2020.113360).

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