International Journal of Research in Human Resource Management

E-ISSN: 2663-3361
P-ISSN: 2663-3213
IJRHRM 2025; 7(1): 147-153
www.humanresourcejournal.com
Received: 09-12-2024
Accepted: 12-01-2025

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Shift work and its association with mental health outcomes: A Systematic Review

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DOI: https://www.doi.org/10.33545/26633213.2025.v7.i1b.266

Abstract
While prior research has demonstrated that long hours and shift work are associated with higher hazards to one's physical health, their effects on one's mental health have received less attention. Through an analysis of the available data, this review seeks to close this gap. A systematic review was carried out with an emphasis on articles that had the terms "shift work" and "mental health" in their abstracts/titles. 24 publications were found in the first searches; six articles-all published between, 2010-2021, remained after screening. The results show a strong correlation between poor mental health outcomes and shift employment. This demonstrates the necessity of improved workplace policies and support to protect workers' well-being. Further research across various sectors and demographics is essential to fully understand the impact of shift work on mental health beyond anxiety, depression, and insomnia. As shift workers constitute a vulnerable group, prioritizing their mental health is crucial.

Keywords: Shift work, mental health, work schedules, literature review

Introduction
Previously published literature has demonstrated that shift work or working long hours are associated with an increased risk for chronic conditions [1]. What is missing in the data, however, is the relationship specifically with mental health conditions. A better understanding of the consequences that shift work has on mental health outcomes can help provide data to aid in developing policy recommendations for future workers.
For this review, shift work is defined as work that takes place outside of the normal 7:00 AM to 6:00 PM hours, including evening work, night work, and combinations of those and day work [2, 11]. It is also important to distinguish that within shift work is night work, which covers at least 3 hours of work between 11:00 PM and 6:00 AM [3]. Evening work is defined as work that takes place from 3:00 PM to 11:00 PM[4]. According to Rivera, *et al*., in the United States and European Union, a fifth of the workforce are employees who work shift work. These employees work in a variety of industries such as, health care, public safety, manufacturing, and mining/resource extraction [1]. Since the industrial revolution, production is able take place 24 hours a day, maximizing economic gains. This is a driver for businesses to maintain workers around the clock.
Previous research and published reviews examined the relationship between health outcomes and shift work, specifically in the areas related to increased risk for disease and in sleep changes due to altering the circadian rhythm patterns. Many of the articles that have been published [5-7] also focus only on rotating shift schedules (i.e. 5 day shifts one week followed by 5 night shifts the next). Additionally, there is a significant lack of reviews on mental health outcomes from shift work, specifically regarding night work. This review revisits the epidemiolocal data that exists regarding shift work and its association with mental health outcomes.

Methods
To conduct this systematic review of shift work and its association with mental health outcomes, the researchers conducted a systematic and comprehensive literature search in PubMed and Web of Science. This review is important because currently, no review exist discussing mental health outcomes in a consolidated format with data. Migration from rural to urban areas, industrialization, rapid loss of natural habitats and changes in lifestyle.

To grow and additionally, the study evaluated the risk of bias of each article using the tool developed by Cochrane Collaboration [8]. The study included 6 peer-reviewed, quantitative epidemiological studies covering shift work and mental health.

The objective was to answer the follow *study question*: "Does shift work affect mental health outcomes?" The researchers developed a participants', exposure, comparator, and outcomes (PECO) statement as follows [9]: (P) the participants in the reviews were all humans, (E) the primary exposure was occupational exposure to shift work schedules, (C) the comparator was humans exposed to non-shift work schedules, lastly, (O) the outcome was any mental health diagnosis.

Search Strategy

The researchers searched two electronic databases from the University of Montana Mansfield Library including PubMed and Web of Science. They initially did the search term "mental health" and "shift work" and included the years 2011 to 2023. To narrow the search, they then combined exposure and outcome search terms and used the language "shift work effects on mental health." The searches for literature lasted between February 16th and 26th, 2022 and the date with the final search results was February 26th, 2022. To capture additional literature, the researchers utilized citations that were identified through being cited in articles that had strong association with the search terms. Of the additional literature records, 7 sources came up.

Study Eligibility

As noted in the PRISMA diagram below (Figure 1), after removing the duplicates from an excel sheet that cross-referenced all the PubMed and Web of Science searches, 466 records remained. To get to the 24 records that were screened, the researchers eliminated any articles that were missing the terms 'shift work' and/or 'mental health' directly in the title or abstract. Other reasons for article exclusion include: 1. the article focusing on the workers spouse or child rather than they themselves; 2. the article not mentioning mental health outcomes at all; 3. the article being a review; and 4. the article being a qualitative study.

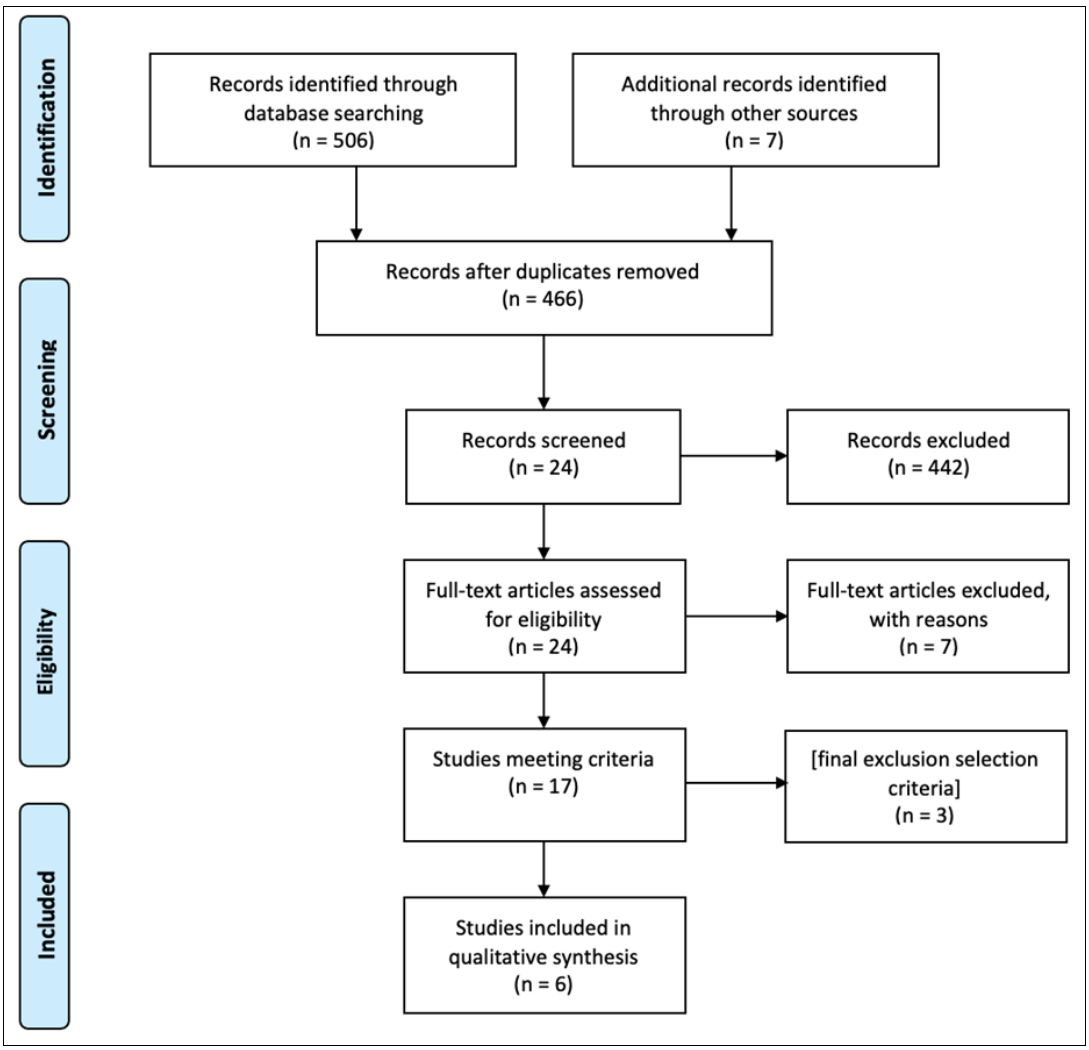

Fig 1: Prisma Diagram

After these exclusions, 17 articles remained. For the final exclusion criteria, the researchers eliminated articles that: were gender specific (i.e. only had a female study sample), articles that focused on burnout rather than shift work, and articles that only looked at rotating 8-hour shifts (rather than our broader definition of shift work). This left 6 remaining articles. The population studied was working individuals and the exposure was shift work schedules. It is also important to note that all articles consisted only of studies dealing with humans and that were all in the English language.

Study Selection

The author performed the data extraction and search screening independently. There were no conflicts of interest, and no computer-assisted techniques were used. The article collection was done manually through reading printed articles and sorting according to study exclusion criteria.

Study Quality

The researchers assessed the risk of bias in each study using "Risk of Bias" tool via Cochrane Collaboration [8]. They analyzed the following Agency for Healthcare Research and Quality's (AHRQ) domains: Source population representation, blinding, outcome assessment, potential confounding, incomplete outcome data, selective outcome reporting, conflict of interest and other. Based on each of those domains, the researchers scored each risk as not applicable, low, probably low, probably high, or high risk of bias utilizing the human studies instructions for making risk of bias determinations. The author independently recorded the risk of bias determinations for each study as well as the strengths and limitations presented within each article.

After assessing the risk of bias, limitations, and strengths of each article, the researchers also looked at possible knowledge gaps. By comparing the six articles across one another, they were able to gain a more holistic picture of where data is lacking. Additionally, they assessed the study attributes from each article to evaluate the study features, populations, exposure assessment (including the variations in types of shift work), and outcomes within mental health. Based on these domains, the researchers evaluated the quality of evidence presented across all studied.

In terms of measuring the strength of the evidence across all studies, the researchers looked at the quality of the evidence, the reliability of the study, and the levels of bias that may affect precision and validity. They used these considerations to assign a strength rating.

Results

Table 1: Summary of Studies

Study	Study Design	Study Population & Location	Sample Size	Exposure (Shift Work Schedules) Assessment	Outcome (Mental Health) Assessment
Berthelsen *et al*., 2015 [10]	Cross-Sectional	Employees from 5 companies in Norway between 2010-2011	1,471 participants completed the survey	Shift schedules were recorded via a hierarchy of questions in the survey. Participants were requested to specific their working hour arrangements.	The hospital anxiety and depression scale (HADS) were utilized to measure outcomes. For psychological and social work factors, the General Questionnaire for Psychological and Social factors at work (QPS) was used. Lastly, neuroticism was measured by the Eysenck Personality Questionnaire (EPQ).
Behrens *et al*., 2021 [11]	Cohort Study	Random sample of men and women ages 45-74 residing in the Ruhr area in Germany between 2000-2003.	The baseline sample size was 4,814. After study exclusions were applied, 1,500 participants were included in the sample size.	Shift-work information was collected in a survey using 2 questions, and then again in the five-year follow-up survey using the 1st question again. In the 10-year follow up, a detailed shift work interview was conducted. The extended shift work assessment used information from detailed shift work histories.	The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess various aspects of depressive symptoms in this study including depressed mood, feelings of worthlessness, self-doubt, and restless sleep. Further, to assess symptoms of major clinical depression during the last two weeks of the 10-year follow up, the Patient Health Questionnaire (PHQ) was used, aligning with DSM-IV criteria.
Nabe-Nielsen *et al*., 2010 [2]	Cohort Study	This study came from a prospective cohort study "The Danish Health Care Worker Cohort Class of 2004." These participants are social and health care workers who finished their education during 2004.	The study population consisted of 6,347 students from 27 out of 28 of the Danish schools. On average, participants had 11.4 months of work experience after finishing their education.	Shift work was assessed within the category of work-time influence. This was measured by survey questions. Ultimately, the survey asked at which time of day the participants worked and then categorized them into evening work, night work, day work, and combinations of the above.	The researchers used four scales as outcome measures. *Vitality* consisted of four questions. *Mental health* consisted of five questions. *Somatic Stress* had four questions. These three categories all had scales that were derived from the Copenhagen Psychosocial Questionnaire. *Disturbed Sleep* had four questions and was derived from the Karolinska Sleep Questionnaire.
Jorgensen *et al*., 2021 [4]	Cohort Study	This study used the Danish Nurse Cohort which consisted of 28,731 Danish female nurses who were less than 44 years old at recruitment in 1993 or in 1999. All participants were members of the Danish Nurses Organization, comprising over 95% of nurses in Denmark.	The study population consisted of 19,964 nurses who were working and provided information on their current shift work schedule at the time of recruitment into the cohort wave in 1993 or 1999.	Shift work schedules were asked in the survey to identify their shift, which included the following options, day, evening, night, and rotating. Rotating could be any combination of the two. Since no information was gathered on the duration of shifts, the researched gathered a subset of 5,102 nurses who provided information on the shift schedules. Nurses were classified as persistent shift workers if they reported the same shift in 1993 and 1999 (assuming it had been for 6 years).	The researchers focused on mood disorders and neurotic disorders. Using unique personal ID numbers, the nurses were linked to the Danish Psychiatric Central Research Register and National Patient Register, which has information on all psychiatric hospital contacts since 1969. The researchers looked at the first-ever hospital contact or date of first redeemed prescription for mood or neurotic disorder.
Kang *et al*., 2017 [12]	Cross-sectional	This study gathered participants from workers of an electronic manufacturer in South Korea between April 9 and May 21, 2015.	The survey was administered to 21, 969 workers. After receiving survey numbers back and study exclusions, 14,114 responses were analyzed.	Respondents were divided into two groups, shift work and daytime work. This information was a part of a larger project in which the researchers had collected considerable information on respondents including shift schedules.	Three areas of mental health were measured within the survey including sleep disturbance, depression, and suicide ideation. Sleep disturbance was evaluated using the Insomnia Severity Index (ISI) and through asking 7 questions. Depression was screened using the Center for Epidemiologic Studies Depression Scale (CES-D) and through asking 4

					questions using a Likert scale. Lastly, suicide ideation was assess using one dichotomous question.
Sweeney et. al., 2021	Cohort Study	This study utilized participants from the longitudinal Atlantic PATH (Partnership for Tomorrow's Health) study. Participants were ages 35-69 and resided in one of the four Atlantic Canadian provinces. Data was collected between 2009 and 2015.	The final sample had 12,413 participants. This included 4,155 shift workers and 8,258 non-shift workers.	Participants work schedules were assessed based on their responses to the survey regarding their work schedule in their current job. Shift workers were categorized if participants reported working an irregular schedule. These were then further categorized into daytime shift workers, evening/ occasional night shift workers, and regular night shift workers.	To evaluate depression, the researchers utilize the nine-item Patient Health Questionnaire (PHQ-9). For measuring anxiety, the Seven-item Generalized Anxiety Disorder (GAD-&) scale was utilized. This is a self-reported anxiety module.

The findings of the Berthelsen *et al*. 2015 study did not detect significant differences in mental distress between types of shift schedules (p. 286). Neuroticism was found to attenuate the associations between work factors and mental distress (p. 287). Additionally, incomplete outcome data were reported, with 237 cases (almost 19 percent) having one or more missing values. The researchers addressed this limitation by performing imputations to account for error variance.

The study by Behrens *et al*. (2021) observed increased risks for major depressive symptoms among female nightshift workers [11]. Additionally, the study highlighted that the number of days off after the last shift is a significant factor for workplaces to consider when addressing the association between shift work and depressive symptoms. The results underscore the need for increased health and safety measures to alleviate job strain for shift workers.

Nabe-Nielsen *et al*. (2010) found that shift workers are particularly vulnerable to the negative effects of moderate or low worktime influence [2]. The combination of shift work and moderate work-time influence was associated with substantially worse mental health outcomes [2]. However, shift work was associated with better psychological well-being when combined with high work-time influence. These findings emphasize the importance of including shift workers in the planning of their work schedules to mitigate adverse mental health effects.

Jorgensen *et al*. (2021) analyzed the Danish Nurse Cohort study to examine shift work and its association with psychiatric disorders like depression or mood disorders [4]. The study concluded that night shift work is associated with a higher risk for major psychiatric disorders. The findings were supported by strong prospective data, the researchers looked at repeated assessments of shift work and detailed tracking of shift work schedules that was available because of the Cohort study [4].

Kang *et al*. (2017) investigated the relationship between shift work and mental health among electronic workers in South Korea [12]. The study focused on insomnia, depression, and suicidal ideation. The researchers found that shift work is associated with workers having an increased risk of mental health issues; and that sleep disturbances play a central role in those mental health issues. This information is helpful for employers and managers because it demonstrates the need for them to prioritize addressing workers' sleep problems and implementing interventions that mitigate mental illness and safety concerns for shift workers. At the very least, it can also show the need for further supports for those employees [12].

Sweeney *et al*. (2021) used the Atlantic PATH study to look at the association between mental health and shift work [13]. This study found that workers who follow shift schedules are more likely to experience higher rates of anxiety and depression. This research draws from a general working population rather than being focused on one occupation or gender. This makes the research valuable because it is more broadly representative [13].

Please reference to Table 2 for understanding the individual judgments on each evaluation section for each individual article

Table 2: Risk of Bias Summary

Author	Source Population Representation	Blinding	Outcome Assessment	Potential Confounding	Incomplete Outcome Data	Selective Outcome Reporting	Conflict of Interest	Exposure
Berthelsen *et al*., 2015 [10]								
Behrens *et al*., 2021 [11]								
Nabe-Nielsen *et al*., 2010 [2]								
Jorgensen *et al*., 2021 [4]								
Kang *et al*., 2017 [12]								
Sweeney *et al*., 2021 [13]								

Low Risk	
Probably Low Risk	
Probably High Risk	
High Risk	

Synthesis Summary

Overall, considering the six reviewed studies, the researchers found that there is sufficient evidence that shift work influences mental health outcomes. This rating was determined by looking at the associations of shift work and mental health within each article and reviewing whether the researchers determined if evidence exists. Table 3 and Table 4 below break down the strength of evidence analyses.

Table 3: Strength of Evidence

Study	Evidence of an Effect on Mental Health Outcomes	Evidence of no Effect on Mental Health Outcomes
Berthelsen *et al*., 2015 [10]		x
Behrens *et al*., 2021 [11]	x	
Nabe-Nielsen *et al*., 2010 [2]	x	
Jorgensen *et al*., 2021 [4]	x	
Kang *et al*., 2017 [12]	x	
Sweeney *et al*., 2021 [13]	x	

Table 4: Strength of Evidence Definitions

Sufficient Evidence	4+ articles influence mental health outcomes
Limited Evidence	2 or 3 articles influence mental health outcomes
Inadequate Evidence	1 article influences mental health outcomes
Evidence is Lacking	0 articles influence mental health outcome

Discussion

Two previous reviews came up when researching shift work and mental health outcomes. One was on the prevalence of shift work disorder [1], and one was on shift work and its association with chronic health conditions [3]. Within these reviews, depression was the only item mentioned regarding mental health.

Throughout the six reviewed articles, the researchers were able to gather sufficient evidence on the following: Work factors, age and gender differences, psychiatric disorders, sleep, and their impacts on mental health outcomes. Work factors play a crucial role in mental health outcomes for shift workers. According to Berthelsen *et al*. (2015), revolving shift workers reported having lower job control which means they are more at risk for mental distress[10]. Further, job control, role clarity, and fair and empowering leadership are protective factors for mental distress. Lastly, having work-time influence for shift workers is instrumental in having better vitality, mental health, and somatic stress levels [2].

In the Berthelsen *et al*. 2015 article, a notable limitation was the lack of precise measurements of time schedules, which made it difficult to fully evaluate the impact of shift schedules on mental distress [10]. The issue of incomplete data, with 237 cases (almost 19 percent) having one or more missing values, was mitigated to some extent through imputations, though this remains a methodological consideration. Lastly, a potential conflict of interest was noted, as the study received funding from the Optimal Management of Petroleum Resources, part of the Petromaks Program in Norway, which may have influenced the study's design or interpretation.

Further, the schedule of shifts also plays a role on psychological distress. The shift system (whether one works rotating or regular shifts) can increase risk of distress or poor mental health as well for individuals that are working rotating or irregular work hours[11]. Contrarily, there was no association found with rotating shift work and mental health outcomes within the Danish Nurse Cohort Study, though there was an association between night shift work [4].

Demographic factors like age and gender also seem to play a role in the effect on mental health from shift work. Behrens *et al*. (2021) indicated positive associations between shift work and psychosocial distress, especially within women under the age of 60 working night shifts [11]. Kang *et al*. (2017) further substantiated this with their findings that female respondents working shift schedules had much greater odds of depression and suicidal ideation [12].

Jorgensen *et al*. (2021) found strong associations between night shift work and several major psychiatric disorders including depression, anxiety, and substance abuse[4]. The use of repeated assessments of shift work schedules and comprehensive data collection methods strengthens the reliability of these findings. This was further substantiated by Kang *et al*. (2017) and Sweeney *et al*. (2021), who found that shift work increases risk of mental health problems [4, 13]. As expected, depression and suicidal ideation increased substantially when subjects had insomnia. Numerous studies have demonstrated the importance of sleep and a healthy circadian rhythm for workers' health and safety [4, 13].

The Sweeney *et al*. 2021 study provides evidence that shift work is associated with higher rates of anxiety and depression in the general working population [13]. This emphasizes the need for workplace interventions to address mental health inequities, as mentioned previously. The inclusion of diverse workers across occupations and genders strengthens the applicability of the findings to a wider range of workplace settings. This also highlights an urgent call for employers to create supportive strategies that help mitigate the mental health risks that come along with shift work.

Kang *et al*. (2017) found that insomnia was significantly more prevalent in workers on shift schedules than among daytime workers [12]. By focusing on multiple mental health outcomes, including insomnia, depression, and suicidal ideation, the researchers provided a widespread view of the impact of shift work on mental health [12]. On the contrary, Nabe-Nielson *et al*. (2010) did not find any effect of working hours or shifts on disturbing sleep [2]. These results highlight the critical role of workplace support and flexibility in protecting the well-being of shift workers.

Despite the Jorgensen *et al*. study's strengths, some limitations were identified. The self-reporting used in assessing shift work schedules contributed to a "probably low" risk of bias for exposure assessment [4]. This was further impacted by a lack of information regarding the intensity of night work, which may have led to exposure misclassification. Although the researchers acknowledged this limitation and attempted to address it, it remains a potential source of error in interpreting the results [4].

Additionally, for the Kang *et al*. study, there were several limitations that may affect the generalizability and reliability of the findings [12]. The source population representation received a "probably low" risk of bias rating due to the use of a convenient sample from a single company, which limits the study's applicability to other populations. Outcome assessment was rated as "probably high" risk of bias, as the tools used for screening relied on self-reports from

participants, potentially introducing subjectivity and inaccuracies. The researchers also expressed concern about whether the sample adequately represented the broader working population or primarily reflected a "healthy part of the working population" [12].

In the Sweeney *et al*. article, there was limitations of incomplete outcome data and outcome assessment [13]. Missing responses in the matched study sample led to a loss of data, limiting the robustness of the analysis. For the outcome assessment, the reliance on self-reported mental health data, even when using validated tools such as the PHQ-9 for depression and the GAD-7 for anxiety, introduced a "probably high" risk of bias. Additionally, the use of a self-rated health variable for overall mental health further underscored this limitation [13].

The limitations in the Nabe-Nielson *et al*. article were around self-reporting data[2]. Participants filled in their baseline questionnaires during final exams, potentially increasing their distress levels and skewing the data. Self-reported exposure and outcome measures further contributed to methods bias, affecting the reliability of the exposure classifications and outcome assessment. Incomplete outcome data due to participant dropout was another limitation, as only 37.7 percent of baseline participants were included and eligible for analysis.

Limitations of the review

The present systematic review targeted the inclusion of many different sectors of work, including healthcare, manufacturing, and resource extraction. The study selection was conducted in line with the PRISMA guidelines. The PRISMA format helps outline for replication and demonstrate the quality of the review.

As the researchers performed this review, it was discovered later in the study that more thorough initial searches could have taken place. This would have broadened the review and opened the possibility for more articles to be available using different language. Some recommendations for future searches include the terms “night work”, “swing schedule”, or “evening shifts.” Another limitation is that some articles presented limited study information, such as only focusing on depression. Additionally, there is a lot of work to be done to examine the impact of shift work on mental health outcomes outside the areas of anxiety, depression, and insomnia.

Conclusion

The findings overall suggest with sufficient evidence from six peer-reviewed articles that working shift schedules, especially ones with rotating or irregular patterns have a negative effect on mental health outcomes. It is important for further research to take place in other sectors and with more widespread demographics to help demonstrate the need for stronger workplace supports and policy recommendations to protect employee mental health. Shift workers are a vulnerable group of employees who need to have safeguards in place for their well-being. Protective factors like work-time influence, role clarity, and job control should be examined by managers and employers to help ensure safe and healthy workplaces.

Acknowledgement

The authors would like to acknowledge Dr. Curtis Noonan for his invaluable guidance and support during the writing of this paper. His insights and expertise significantly contributed to the development and refinement of this work. The authors also wish to thank Mr. Rod Charlie Delos Reyes for his assistance with the submission process and for providing additional support throughout the writing journey. Their contributions were instrumental in the successful completion of this research.

Declarations

Conflict of Interest: The author has no conflict of interest.

Funding: The review is not funded by any agency or organization

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