

Depression in the context of shift work schedule: a systematic review

A depressão no contexto da jornada de trabalho em turnos: uma revisão sistemática

Depresión en el contexto de la jornada de trabajo: una revisión sistemática

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Abstract

The circadian rhythm deregulation can result in an alteration in the sleep-wake cycle, causing sleep disturbances and promoting mental and mood disorders development. Conditions that can disrupt this rhythm, such as shift work schedule (SWS) can unbalance neural functioning and favors those professional classes may have a greater tendency to develop depression. In this context, this study aims to carry out a systematic review to understand the relationship between SWS and the risk of depression, so 1,001 articles were selected for eligibility analysis for the study. After an evaluation sequence starting from the title, abstract and complete work, 31 works that responded to the proposed theme were included. Depression was found to be higher in JTT workers such as nurses, company employees, physicians, residents, and firefighters compared to other professionals. The main explanations involve decreased melatonin production, stressful conditions linked to professional activity and lifestyle habits. Thus, it is important to delineate new therapeutic forms, control, prevention, and health promotion for these workers, since the SWS is strongly associated with depression.

Keywords: Shift work schedule; Circadian rhythm; Depression; Health teaching.

Resumo

A desregulação do ritmo circadiano pode resultar na alteração do ciclo sono-vigília, causando distúrbios do sono e promovendo o desenvolvimento de transtornos mentais e de humor. Condições que possam desregular esse ritmo como a jornada de trabalho em turnos (JTT) podem desequilibrar o funcionamento neural e favorecer que classes de profissionais possam ter uma maior tendência ao desenvolvimento de depressão. Nesse contexto, o presente estudo tem como objetivo realizar uma revisão sistemática para entender a relação entre a jornada de trabalho em turnos (JTT) com o risco de apresentar depressão, assim foram selecionados 1.001 artigos para análise da elegibilidade. Após uma sequência de avaliação partindo do título, resumo e trabalho completo, foram incluídos 31 trabalhos que respondiam ao tema proposto. Foi encontrado que a depressão está mais elevada em trabalhadores em JTT como enfermeiros, funcionários de empresas, médicos, residentes e bombeiros comparados a outros profissionais. As principais explicações envolvem diminuição da produção de melatonina, condições estressantes ligadas à atividade profissional e aos hábitos de vida. Assim, é importante delinear novas formas terapêuticas, controle, prevenção e promoção de saúde para esses trabalhadores, já que a JTT está fortemente associada com a depressão.

Palavras-chave: Jornada de trabalho em turnos; Ritmo circadiano; Depressão; Ensino de saúde.

Resumen

La desregulación del ritmo circadiano puede resultar en una alteración del ciclo sueño-vigilia, provocando alteraciones del sueño y favoreciendo el desarrollo de trastornos mentales y anímicos. Condiciones que pueden interrumpir este ritmo, como el trabajo por turnos, pueden desequilibrar el funcionamiento neuronal y favorecer que las clases profesionales puedan tener una mayor tendencia a desarrollar depresión. En este contexto, el presente estudio tiene como objetivo realizar una revisión sistemática para comprender la relación entre el trabajo por turnos y el riesgo de depresión, por lo que se seleccionaron 1.001 artículos para el análisis de elegibilidad para el estudio. Luego de una secuencia de evaluación a partir del título, resumen y trabajo completo, se incluyeron 31 trabajos que respondieron a la temática propuesta. Se encontró que la depresión era mayor en los trabajadores por turnos, como enfermeras, empleados de la empresa, médicos, residentes y bomberos en comparación con otros profesionales. Las principales explicaciones son la disminución de la producción de melatonina, las condiciones estresantes vinculadas a la actividad profesional y los hábitos de vida. Así, es importante delinear nuevas formas terapéuticas, de control, prevención y promoción de la salud para estos trabajadores, ya que el trabajo por turnos está fuertemente asociado a la depresión.

Palabras clave: Horario de trabajo por turnos; Ritmo circadiano; Depresión; Educación en la salud.

1. Introduction

Life has evolved in a 24-hour rhythm, where environmental factors such as temperature and light fluctuate with a predictable daily sequence (Jagannath *et al.*, 2017). Consequently, most organisms have evolved circadian clocks that anticipate these regular environmental changes and establish endogenous 24-hour rhythms to achieve the best physiological response in the appropriate time window. This endogenous rhythm regulates a processes variety, from our metabolism to neural activity and cell cycle (Jagannath *et al.*, 2017; Oliveira *et al.*, 2018). Thus, the sleep-wake cycle disruption and circadian rhythm resulting from social, work, or endogenous factors contribute to many disorders' development (Jagannath *et al.*, 2017).

Regarding working hours, an increasing set of evidence suggests that nighttime, rotating, or irregular shift work is more detrimental to mental health than the daytime working condition (Nakata, 2017). It is known that Shift Work (JTT) is associated with increased physical and mental health problems risk in workers. Knowing this, different studies relate the association between JTT and mental illness risk (Kalmbach *et al.*, 2017; Lee *et al.*, 2017; Moon *et al.*, 2015). One of the possible mechanisms of association between TKA and mental disorders is circadian rhythm dysfunction. This disturbance can affect the cortisol and melatonin levels balance, consequently affecting the neural network's homeostasis and favoring a mental disorder establishment (Angerer *et al.*, 2017; Lee *et al.*, 2017). In this context, depression is one of the most common and costly disorders in modern society, contributing to decreased work and reduced productivity, affecting many people who work night shifts and rotate (Nakata, 2017; Da Silva; Neto, 2021).

Given this, the present work aims to seek information about the association between depression and the TTJ. Knowing that there is a relationship between circadian rhythm dysfunction and depression, it is important to understand if workers who are exposed to these dysfunctions tend to have a greater susceptibility to depression and which are the adjacent

pathophysiological mechanisms. Thus, such information can support protective and control measures, such as psychological monitoring and reduced hours of service.

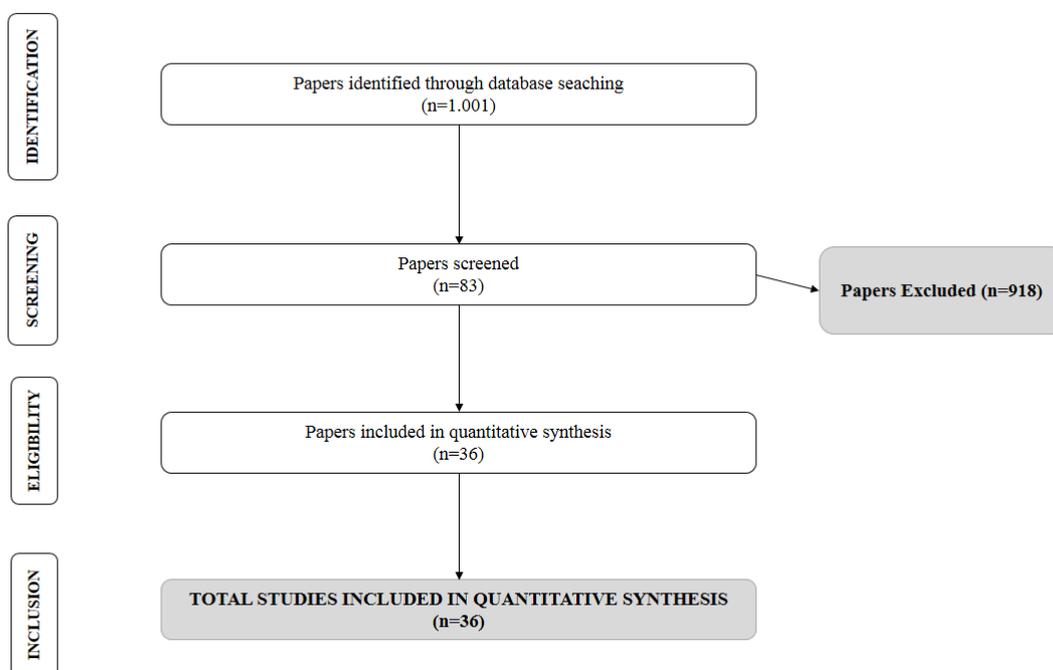
2. Methodology

The databases chosen for this study were PubMed/Medline (Medical Literature Analysis and Retrieval System Online), Web of Science, Scopus (Elsevier), and LILACS (Latin American and Caribbean Literature on Health Sciences). To construct the systematic review design, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) protocol was used, following the PRISMA-P checklist (<http://prisma-statement.org/documents/PRISMA-P-checklist.pdf>).

For the search, the MeSH (Medical Subject Headings) term "Shift Work Schedule" was used and, to increase the scope of the search, the entry terms "shift work," "shift workers," and "night work" were included. For depression, the terms "depression" and "depressive disorder" were used. The date filter from January 1, 2014, to July 1, 2021, was used.

Thus, a total of 1,001 articles were obtained, where the titles, databases, dates, and abstracts were organized in spreadsheets. The articles were first excluded for repetitiveness, and then they were analyzed by reading the title, the abstract, and the full paper. Articles were selected for their nature (only full papers and of experimental/observational nature with humans), condition of interest (depression), and population of interest (shift and/or night workers). After the analysis of these exclusion criteria, only 83 articles remained in this search. After the complete reading of the 83 remaining articles, 36 articles were chosen for the development of the research and that answered the proposed objective (Figure 1).

Figure 1. Flow diagram for identification, screening, eligibility, and analysis of studies included in this systematic review.



Source: Authors.

3. Results and Discussion

The circadian rhythm determines body homeostasis, including the sleep-wake cycle and hormone levels such as cortisol and melatonin. However, despite having endogenous rhythmicity, our biological rhythm is influenced by external cues,

called *zeitberger*, which include light exposure and nocturnal activity level. Thus, any alteration in the sleep-wake phases caused by JTT can affect the endogenous circadian rhythm (Angerer *et al.*, 2017). Given this, the evidence in the literature points out that JTT workers have their biological rhythm misaligned and this may be caused by reduced total melatonin production due to exposure to light during the night. Consequently, changes in the levels of this hormone have been associated with neurophysiological changes that favor the development of depression and other neuropsychiatric disorders such as anxiety and bipolar disorder (Angerer *et al.*, 2017; Lee *et al.*, 2017).

Depression is a health concern worldwide and having causes and endophenotypes knowledge, it would be possible to reduce its incidence and impact on the worker's lives in general (Kalmbach *et al.*, 2015). Working long hours is associated with depression development since the circadian rhythm when it is interrupted can affect the nervous system's homeostasis. In addition, mental stress during work also has a significant effect on productivity, job performance, and worker health (Park *et al.*, 2016). JTT, which involves nights and early mornings, is known to confer the highest risk of circadian disruption and can negatively impact mental health in a variety of ways (Hall *et al.*, 2019; Kang *et al.*, 2017).

Of the 31 studies found in the literature, it was observed that 13 studies were with nurses in shift or night work conditions (Cheung & Yip, 2015; Dai *et al.*, 2019; Gong *et al.*, 2014; Hall *et al.*, 2018; Han *et al.*, 2019; Kassani *et al.*, 2015; Kubik *et al.*, 2018; Machado *et al.*, 2018; Perry *et al.*, 2015; Saquib *et al.*, 2019; Sørengaard *et al.*, 2019; Thun *et al.*, 2014; Tsaras *et al.*, 2018). In all, the depression onset or the already established illness was noted in JTT nurses. These studies highlight that the healthcare work field has a high prevalence of depressive disorder since professionals such as nurses and physicians are exposed to mental stress during on-call hours. Although other healthcare workers' classes are also subject to JTT, work with other professions and the circadian dysregulation impact by JTT are still lacking. It is also important to note that stress can change a mood, which can impair concentration during care, so the direct or indirect stress effects can contribute to depression (Park *et al.*, 2016). Another 11 studies were with nighttime employees of companies having comparison with daytime employees, finding a higher rate of depression in those working at night (Hall *et al.*, 2019; Kalmbach *et al.*, 2015; Kang *et al.*, 2017; Khajehnasiri *et al.*, 2014; Kim *et al.*, 2017; Luca *et al.*, 2014; Moon *et al.*, 2015; Nakata, 2017; Norder *et al.*, 2015; Park *et al.*, 2016; Wirth *et al.*, 2017). This may occur because JTT increases the risk of sleep disorders and stress, producing deteriorating effects on mental health (Park *et al.*, 2016).

The other 6 studies were with physicians that, among other possible factors involved, the burden of hours worked, and the effectiveness charge may contribute to the depression establishment (Gong *et al.*, 2014; Kalmbach *et al.*, 2017; Krug *et al.*, 2017; Marzouk *et al.*, 2018; Ogawa *et al.*, 2018; Tomljenovic *et al.*, 2014). Thus, working long hours can increase job-specific stress and neglect of one's health, significantly increasing the depression risk. Only 1 study among the 31 used in the present review correlates firefighters in rotating/night work with depression, possibly due to their work shift, irregular hours, and the inherent professional stress (Lim *et al.*, 2014).

Thus, the prevalence of depression studies associated with JTT is higher in nursing professionals. One of the reports is that nurses are constantly exposed to various stressful situations such as pain, death, sadness, and conflicts and this can lead to anxiety experience, negative emotions, and depressive symptoms (Tsaras *et al.*, 2018). Among work areas, psychiatric wards are noted as a very stressful department with dismal working conditions, leading nursing staff to experience high levels of work stress and depressive symptoms (Kubik *et al.*, 2018; Tsaras *et al.*, 2018). In another study, it is indicated that nurses who work more than 45 hours per week, as well as those who work two or more night shifts per week, are at greater risk for depressive symptoms that are associated with long working hours and frequent shifts (Gong *et al.*, 2014). Other results of the study found that nurses are an occupational group in which depressive symptoms occur more frequently compared to the general population (Kubik *et al.*, 2018).

General employees outside the healthcare field were also studied, including janitors, secretaries, cleaning staff, and security staff. Of the 11 related papers, depression was found to be more prevalent among shift workers than day workers, including the electronics manufacturing industry (Kang *et al.*, 2017; Park *et al.*, 2016). Another survey found that shift work and depression in hotel workers varied based on shift type (night/day). The depression risk was the highest among workers on the night shift (Moon *et al.*, 2015). It was further shown that the depression workers risk who switched from day shift to night shift could also be increased (Nakata, 2017).

All 6 studies with residents and/or physicians list a high workload as major stress leading source to depression and medical errors due to fatigue from long work hours. Extended work shifts lasting 24 hours or more are associated with higher rates of attention failure during nighttime hours compared to consecutive shifts of 16 hours or less. One of the studies revealed that the longer the work hours, the greater resident's number who developed depressive symptoms. It was also reported that depressed residents make more medication errors per month than those who are not depressed (Ogawa *et al.*, 2018). Medication errors were high among interns reporting short sleep, working 70 or more hours per week, and testing positive for depression (Kalmbach *et al.*, 2017). All papers that cited physicians and medical residents pointed out that depression is also a source of decreased concentration at work, increased medical error rates, dissatisfaction, and work conflicts (Marzouk *et al.*, 2018; Ogawa *et al.*, 2018).

Among the stressful situations that involve working in the healthcare field, the historical and social context must be evaluated. The COVID-19 outbreak (coronavirus disease 2019) caused social impacts, overburdened healthcare systems, and demanded an exorbitant workload from healthcare workers. In a meta-analysis it was reported that healthcare workers working to combat COVID-19 are being more severely affected by psychiatric disorders associated with depression, anxiety, insomnia, and stress than other occupational groups (Da Silva & Neto, 2021). However, more work is still needed that points to the direct association of JTT in the context of COVID-19 with mental disorders, given the socioemotional triggers that the pandemic directly promotes.

Of the 36 studies cited in this paper, only one reports depression tonight and rotating work among firefighters. Firefighters face many occupational stressors that can be dangerous and urgent due to the work environment, workplace structure, and interpersonal relationships. These stressors are known as risk factors that lead to depression. Firefighters often experience stressful times at work and often may not be able to anticipate critical conditions, while always needing to be prepared for urgent calls. They also experience psychological stress in the field or when their co-workers are accident victims and may experience post-traumatic stress after working in severely damaged sites, with dead bodies or tragic injuries in the field (Lim *et al.*, 2014).

As for the dysregulation promoted by JTT and the depression pathophysiology, the possible explanations are varied. The dysfunctions caused by the disrupted circadian rhythm can alter monoamine signaling, regulation of the hypothalamic-pituitary-adrenal (HPA) axis, and neurogenesis, causing daytime sleepiness, mood disorder, and favoring depression (Robillard *et al.*, 2018). Thus, it is important to offer more attention to tonight workers to improve and decrease depressive symptoms, as the assessed papers from the present review point out how circadian disruptions play a prominent role in the depression pathophysiology, making many workers more prone to severe and persistent depressive symptoms.

In addition to depression, it is also pointed out the comorbidities installation that contributes to the wear and tears on the health of shift workers, such as cardiovascular diseases, metabolic syndrome, sleep disorders, digestive diseases, cancer, and other mental disorders. Some studies report that sleep disorders are strongly work-related and contribute to depression (Hall *et al.*, 2018; Marzouk *et al.*, 2018). Another study reported that JTT causes physiological malfunction, leading to sleep disturbances, loss of appetite, and digestive problems (Park *et al.*, 2016; Wirth *et al.*, 2017). This strong correlation pointed out by the studies described the importance of the association study between working conditions and depression in the search for

health promotion measures, from public policies to protect workers to chronobiological interventions such as hormonal regulation. The melatonin system is a promising therapeutic target, not only to readjust the circadian phase but also to restore circadian organization. Exogenous melatonin, when ingested at the appropriate time, can change the endogenous melatonin phase, moreover, the melatonin system is highly responsive to environmental and behavioral manipulations (Robillard *et al.*, 2018).

4. Final Considerations

The present systematic review searched the literature for relationship evidence between JTT and depression, concluding that there is consistent evidence of the association, but there is still a need for further in-depth studies that aim to better explain the pathophysiology and possible preventive measures. Night workers have the disruption of their circadian rhythm caused by sleep deprivation that misaligns their endogenous system and promotes changes that culminate in neural disorders and other systems. This has been studied mainly in health care professionals such as nurses. Depression not only affects personal and professional life but also brings great costs to society. Therefore, more attention should be paid to occupational diseases associated with JTT.

Thus, it is necessary to carry out future studies focused on the evaluation and promotion of health in environments with night workers. New studies that allow a better understanding of the mental health status of these workers, the influence of the workload associated with the circadian cycle, and the impact of post-pandemic reflexes. The objective of the studies aims at the possible direction of action programs in occupational health, minimizing the development of associated mental disorders such as Depression.

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