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The Impact Of Shift Work And Irregular Schedules On The Health And Well-Being Of Healthcare Professionals

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Abstract

The impact of shift work and irregular schedules on the health and well-being of healthcare professionals is a complex issue. Shift work can disrupt the normal sleep-wake cycle, leading to inadequate sleep and increased fatigue. Research suggests that shift work ma[1]y have long-term implications for health and safety, including a higher risk of conditions like breast cancer and coronary heart disease. However, the evidence regarding the causal relationship between shift work and chronic diseases is inconsistent. One major challenge in this field is the limited understanding of the underlying pathways and mechanisms through which shift work affects long-term health. Sleep is a biological necessity crucial for maintaining overall health, safety, and productivity. Adequate sleep, typically around 7-8 hours per night, is associated with a lower risk of various health conditions such as obesity, diabetes, high blood pressure, heart

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attacks, strokes, injuries, and errors. However, recent studies indicate that a growing number of healthcare staff are not getting enough sleep. One contributing factor to the decline in sleep duration is the prevalence of shift work and long work hours among healthcare workers. Working in facilities that operate 24/7 exposes healthcare workers to irregular schedules and disrupts their natural sleep patterns. This misalignment with circadian rhythms can result in difficulties falling asleep, frequent awakenings during sleep, and early morning awakenings, leading to poorer sleep quality and shorter duration. In addition to its potential impact on patient outcomes, fatigue can have detrimental effects on the health and well-being of physicians themselves. Burnout, which is just one consequence of fatigue, is highly prevalent among physicians and is considered an epidemic in the field. This, in turn, affects the recruitment and retention of physicians in both community and acute care settings.

The objective of this review is to critically assess the evidence regarding the connections between shift work, chronic health issues, and occupational accidents. One key aspect of this review focuses on determining whether insufficient sleep could serve as a plausible mechanism leading to adverse health outcomes among shift workers. In order to explore the role of sleep as a pathway to chronic diseases and accidents in the context of shift work, the review also examines the epidemiological association between short sleep duration, poor sleep quality, and the same health outcomes that were investigated in the context of shift work and health. Additionally, the review examines recent experimental models that investigate the effects of sleep deprivation, disruption of circadian rhythms, and physiological changes that may indicate future adverse health consequences.

Introduction

Shift work refers to work schedules that deviate from the typical daytime hours, including early morning, evening, and night shifts. This can involve fixed schedules or rotating shifts where employees alternate between day, evening, and night shifts. A significant percentage of workers in the United States and the European Union are engaged in shift work, with many of them working during nighttime (Alterman et al., 2013).

Shift work disrupts the normal sleep-wake cycle, resulting in inadequate sleep and increased fatigue. Research suggests that shift work may have long-term implications for health and safety, including a higher risk of conditions like breast cancer and coronary heart disease. However, the evidence regarding the causal relationship between shift work and chronic diseases is inconsistent. One major challenge in this field is the limited understanding of the underlying pathways and mechanisms through which shift work affects long-term health (Sixth European Working Conditions Survey: 2015 | European Foundation for the Improvement of Living and Working Conditions, n.d.).

Scientific evidence supports the notion that sleep is a biological necessity crucial for maintaining overall health, safety, and productivity. Adequate sleep, typically around 7-8 hours per night, is associated with a lower risk of various health conditions such as obesity, diabetes, high blood pressure, heart attacks, strokes, injuries, and errors. However, recent studies indicate that a growing number of healthcare staff are not getting enough sleep (Amlaner, 2009; Institute of Medicine (US) Committee on Sleep Medicineand Research, 2006).

One contributing factor to the decline in sleep duration is the prevalence of shift work and long work hours among healthcare workers. Working in facilities that operate 24/7 exposes healthcare workers to irregular schedules and disrupts their natural sleep patterns. This misalignment with circadian rhythms can result in difficulties falling asleep, frequent

awakenings during sleep, and early morning awakenings, leading to poorer sleep quality and shorter duration.

Insufficient time between work shifts and the competing demands of work and personal life can also contribute to shortened sleep duration among healthcare workers. Economic pressures may push them to take on additional jobs or work longer hours, further compromising their sleep. Moreover, a lack of awareness about the importance of sleep may lead individuals to prioritize other activities over getting enough rest(Luckhaupt et al., 2010).

The healthcare sector, including nursing, has one of the highest proportions of workers reporting inadequate sleep duration. In the case of nursing, approximately 32% of healthcare staff, totaling 5 million individuals, experience short sleep duration(Luckhaupt et al., 2010, p. 2).

Insufficient sleep has been linked to negative changes in the immune system and metabolism, cognitive impairments, and an increased risk of chronic diseases. Therefore, it is possible that inadequate or poor-quality sleep, such as insomnia symptoms, acts as a mediator between shift work and adverse health effects. While numerous reviews have explored the impact of shift work on sleep, very few have specifically examined whether insufficient sleep could contribute to impaired health (Sallinen & Kecklund, 2010).

In addition to its potential impact on patient outcomes, fatigue can have detrimental effects on the health and well-being of physicians themselves (Shanafelt et al., 2012). Burnout, which is just one consequence of fatigue, is highly prevalent among physicians and is considered an epidemic in the field. This, in turn, affects the recruitment and retention of physicians in both community and acute care settings. While the importance of physician well-being in sustaining healthcare systems is receiving more attention, finding evidence-based solutions for burnout remains challenging (Brady et al., 2018).

It is evident that addressing burnout requires comprehensive efforts at the organizational level. Simply put, there is a need for research that investigates the factors contributing to burnout and overall physician wellness. This research can then inform strategies and interventions at both the system and individual levels. Currently, there is a lack of synthesized evidence regarding the effects of fatigue and chronic insufficient sleep on physicians in independent practice. As a result, there are still gaps in knowledge that need to be addressed (Lemaire & Wallace, 2017).

The objective of this review is to critically assess the evidence regarding the connections between shift work, chronic health issues, and occupational accidents. One key aspect of this review focuses on determining whether insufficient sleep could serve as a plausible mechanism leading to adverse health outcomes among shift workers. In order to explore the role of sleep as a pathway to chronic diseases and accidents in the context of shift work, the review also examines the epidemiological association between short sleep duration, poor sleep quality, and the same health outcomes that were investigated in the context of shift work and health. Additionally, the review examines recent experimental models that investigate the effects of sleep deprivation, disruption of circadian rhythms, and physiological changes that may indicate future adverse health consequences.

Statement of the problem

Acute sleep deprivation caused by extended work hours and disruption of circadian rhythms has long been a concern in the healthcare field, particularly among junior physicians (Friedman et al., 1973). Despite the demanding nature of their work, junior physicians often have excessively long shifts lasting 24 to 30 hours. These long shifts often lead to limited and fragmented sleep, resulting in acute sleep deprivation. This lack of sleep can have significant impacts on cognitive function, mental state resembling depression or anxiety, and short-term memory difficulties (Gaba & Howard, 2002).

Numerous studies have shown that sleep deprivation significantly affects physician performance and patient safety. For example, one study found that interns working more than 76 hours per week made 36% more serious medical errors compared to those working an average of 65 hours per week (Landrigan et al., 2004).

Working extended shifts can also lead to impaired mood, decreased alertness, and subsequently impair cognitive function and physician performance, posing risks to both patients and doctors' safety. To address this research gap, this study aims to investigate the effects of acute sleep deprivation resulting from extended on-call hours on mood and alertness among junior physicians in a teaching hospital (Howard et al., 2002).

Health effects of shift work

This section provides an overview of the impact of shift work on health and safety outcomes. It summarizes findings on how shift work affects various health and safety-related measures.

Inadequate sleep linked to shift work, long work hours, and sleep disorders

Scientific evidence strongly supports the association between sleep problems and shift work. A study conducted in the Midwest found that 32% of night-shift workers and 26% of rotating-shift workers reported long-term insomnia and excessive sleepiness (Drake et al., 2004). (Ingre & Akerstedt, 2004) studied sets of monozygotic twins discordant on exposure to night-shift work and found that a history of night shifts significantly increased the risk of sleep disturbances into retirement years.

A meta-analysis by Pilcher, Lambert, and Huffcutt (2000) that reviewed 36 studies revealed that permanent day-shift workers slept an average of 7.0 hours per day, permanent and rotating evening-shift workers slept 7.6-8.1 hours, permanent night-shift workers slept 6.6 hours, and rotating night-shift workers slept the least, with an average of 5.9 hours (Pilcher et al., 2000).

Studies examining extended work shifts have shown mixed results. Knauth (2007) reported that 13 studies showed negative effects on sleep with shifts longer than 8 hours, eight studies showed mixed results, and four studies showed positive effects. Long weekly work hours and overtime have also been associated with shorter sleep duration or sleep disturbances in several studies (Hayashi, Kobayashi, Yamaoka, & Yano, 1996; Sasaki et al., 1999).

Sleep disorders, chronic diseases, and certain medications can contribute to poor sleep and sleepiness. Sleep disorders are common but often go undiagnosed and untreated, affecting 50-70 million Americans (Colten & Altevogt, 2006). Insomnia tends to increase with age, with a higher prevalence among older individuals. Sleepiness can be a side effect of medications such as benzodiazepines, narcotic analgesics, antihistamines, antidepressants, and medications used

to treat insomnia. Additionally, chronic diseases like arthritis, asthma, chronic fatigue syndrome, chronic obstructive pulmonary disease, and rhinitis can promote daytime sleepiness and impair cognitive functioning (Smolensky, Di Milia, Ohayon, & Philip, 2011).

Declines in neurocognitive functioning and performance

Laboratory studies have provided evidence that sleep deprivation is associated with various cognitive declines (Goel et al., 2009). When individuals do not get enough sleep, they experience sleepiness, reduced alertness, and may involuntarily fall asleep. Sleep deprivation increases the brain's pressure to initiate sleep, and the transition from wakefulness to sleep occurs rapidly and abruptly in the brain stem (Schwartz & Roth, 2008). This can create hazardous situations if the brain is under high pressure for sleep and the person involuntarily falls asleep during critical tasks like driving or providing patient care. Microsleep episodes, which are brief periods of sleep lasting a few seconds, can also occur. During microsleeps, individuals may appear awake with open eyes, but their brain does not process information, leading to lapses in attention (Boyle et al., 2008).

A sleep-deprived person cannot reliably force themselves to stay awake and alert. Studies on medical residents suggest that factors such as motivation, training, and prolonged experience with restricted sleep do not make individuals more resistant to the negative effects of sleep deprivation on performance (Arnedt et al., 2005; Van Dongen et al., 2003).

Sleep deprivation impairs various aspects of performance, including reduced concentration, slower reaction time, difficulties in memory and learning new information, and motor skill impairment (Goel et al., 2009). It also leads to irritability, a negative mood, reduced communication skills, and challenges in coping with emotional demands in the workplace. Decision-making ability deteriorates, and risk-taking behavior increases. Furthermore, reduced situation awareness can hinder a nurse's ability to respond to patient care needs. Importantly, research has shown that sleep-deprived individuals often fail to recognize their impaired performance and tend to overestimate their abilities (Van Dongen & Belenky, 2009).

Cardiovascular disease

A comprehensive analysis of 34 observational studies involving over two million individuals found that shift work is linked to an increased risk of myocardial infarction and ischemic stroke(Torquati et al., 2018). Night shifts were found to have the highest association with coronary heart disease, while evening shifts did not show a significant relationship.

Metabolic disorders

Shift work has been extensively studied in relation to metabolic disorders. Two systematic reviews indicate that shift work increases the risk of overweight or obesity (Proper et al., 2016; van Drongelen et al., 2011). Recent meta-analyses and systematic reviews have also concluded that shift work is associated with an elevated risk of developing type 2 diabetes (Proper et al., 2016). Several cohort studies have shown increased odds ratios for developing diabetes after adjusting for confounding factors (Anothaisintawee et al., 2016).

Mortality

Several meta-analyses have investigated the relationship between shift work and mortality(Vyas et al., 2012). One study found no significant association between shift work and cardiovascular mortality, while another indicated a small but significant increase in the risk of cardiovascular death. However, pooled risk ratios for cancer-related death and all-cause mortality did not show significant associations(Lin et al., 2015).

Workplace accidents

Decreased neurocognitive performance is associated with a higher occurrence of fatigue-related injuries and errors among workers. Specific work schedules have been linked to increased risks of incidents and mistakes (Gershon et al., 2009). Compared to day shifts, evening shifts have a 15% higher risk, while night shifts have a 28% higher risk. Longer shifts, such as 10-hour and 12-hour shifts, also contribute to increased risks by 13% and 28% respectively. The risk escalates by 17% for the third consecutive night shift and 36% for the fourth(Dembe et al., 2005). Additionally, studies have suggested a potential "dose response" relationship, indicating that as weekly work hours increase, the rates of injuries to workers also increase. Researchers Folkard and Lombardi have estimated that the highest risk occurs when shifts are both long and during the night (Folkard & Lombardi, 2006).

Although limited in number, studies examining mandatory overtime have raised concerns regarding its impact. Research on nurses has shown that mandatory overtime is associated with a higher risk of needlestick injuries, other work-related injuries, work-related illnesses, and increased absenteeism.

Cancer

In 2007, the International Agency for Research on Cancer (IARC) of the World Health Organization declared that there is sufficient evidence to classify shift work with circadian rhythm disruption as a probable carcinogen (Straif et al., 2007). Human studies indicate a possible link between shift work and cancer, while evidence from animal studies is more conclusive. The most extensively studied cancer in relation to shift work is breast cancer. A meta-analysis of 13 studies found that night work was associated with a 48% increased risk of cancer (Megdal et al., 2005). Long-term night shift work (20 years or more) has shown statistically significant increases in the risk of breast cancer (Bonde et al., 2012). However, it remains unclear whether there is a risk for shorter durations of night shift work. It has been suggested that women with a history of breast cancer should avoid working night shifts due to experimental evidence demonstrating accelerated tumor growth caused by the suppression of melatonin secretion.

Regarding prostate cancer, two studies have reported an increased risk in individuals engaged in shift work. Mechanisms proposed for the potential development of cancer in shift workers include disrupted sleep and activity patterns, suppression of immune surveillance, and exposure to light at night leading to reduced melatonin levels (Conlon et al., 2007; Kubo et al., 2006).

Psychological Impact of Shift work

Limited research has been conducted on the relationship between shift work and mental health, but mental health problems are recognized as a significant public health issue. Studies in Australia and the United States have shown high prevalence rates of mental disorders such as

anxiety and affective disorders among healthcare staff (Vogel et al., 2012). The burden on individuals and society due to mental health problems necessitates identifying potential contributing factors, including non-standard work schedules (Slade et al., 2009).

While earlier studies were often qualitative and focused on specific occupations, there is a growing body of population-based research that examines the association between shift work and mental health across different employment types. For instance, one study found that having an unpredictable work schedule was associated with higher levels of anxiety and depression(Niedhammer et al., 2015). Another longitudinal study revealed that shift work had a negative long-term impact on mental health, with variations based on the duration of exposure, type of shift work, and gender (Bara & Arber, 2009).

It is important to note that individual study results may vary due to differences in how shift work is measured, highlighting the need for a systematic review to summarize the complex research literature. Existing reviews have either focused on general health without comprehensive information on mental health or have been limited to specific occupations, shift work types, or mental health symptoms. Therefore, a comprehensive review specifically examining the relationship between shift work and mental health is warranted.

In the short term, health problems associated with shift work are primarily characterized by sleep disturbances, digestive issues, and psychological symptoms such as anxiety and irritability. However, in the long term, more severe disorders can develop, leading to increased illness and absenteeism. This has significant economic and social costs for both individuals and society as a whole.

The review conducted by (Knutsson, 2019) in this particular publication examines the epidemiological evidence linking shift work to health disorders, with a specific focus on gastrointestinal and cardiovascular diseases, as well as the effects on pregnancy.

Research indicates that shift work is generally associated with poorer mental health across different occupations, especially for women, when measured using a broad binary indicator. However, there is some inconsistency and limited evidence when studies categorize shift work into specific types. The relationship between night work and mental health is mixed, with some evidence suggesting that prolonged periods of night work or certain sensitive periods, such as the transition to parenthood, may be more likely to be associated with mental health problems. Longitudinal studies support these findings, indicating an increased risk of depression after several years of night shift work in non-health sector occupations (Zhao et al., 2019).

Furthermore, working irregular schedules is linked to poor mental health, possibly due to the challenges individuals face in adapting and maintaining a balanced lifestyle. The unpredictable nature of their work schedules disrupts circadian rhythms, eating habits, and social/family lives, leading to a sense of loss of control. Lack of perceived control has long been established as a contributing factor to negative emotional states, particularly anxiety. However, there is limited evidence supporting a connection between mental health and other types of shift work, such as weekend shifts or rotating shifts (Zhao et al., 2019).

Regarding gender differences, the systematic review found mixed results. Out of the seventeen studies that examined men and women separately, eleven reported similar impacts on mental health regardless of gender. One study reported a significant impact only among men, while three studies found significant impacts only among women. Two studies that considered

multiple measures of shift work type did not reveal a clear pattern regarding which schedule (irregular or night work) had a greater impact on mental health for women or men. Among the five single-gender studies, only one study showed a significant association between mothers working irregular schedules and depressive symptoms. Although the overall body of research leans towards a stronger association between shift work and women's mental health, further formal testing is needed to draw conclusive conclusions. Additionally, it remains unclear whether specific types of shift work schedules, such as night work, have distinct or heightened effects on women's mental health compared to men (Zhao et al., 2019).

impact of long work hours

Recent research on the impact of long work hours on health has been increasing, although it is not as extensive as the research on shift work. Several studies have found that long work hours are associated with increased fatigue, poor mood, inadequate recovery from work, and lower perceived health. Both men and women working long hours have shown higher prevalence rates of depression and anxiety disorders. Studies have also demonstrated that shorter work hours (less than 12 per day and 58 per week) are associated with better scores for depression and fatigue. Furthermore, a systematic review and meta-analysis indicated that long work hours increase the risk of coronary artery disease by 40%. The association between long hours and high blood pressure and diabetes is not consistently reported in all studies, although some studies have found a significant increase. Additionally, studies with controls for physical demands have linked long work hours to adverse musculoskeletal disorders, possibly due to prolonged exposure to physical demands and insufficient recovery time between work periods. Adverse reproductive outcomes, such as increased time to pregnancy and a possible weak relationship with preterm birth, have also been suggested in some studies.

Impact on Work Performance and Patient Care

This discussion highlights the findings of a study on the effects of extended-duration work shifts on patient safety and medical education(Barger et al., 2006). The study found that longer work shifts were associated with increased risks of fatigue-related medical errors, preventable adverse events, and attentional failures among interns. The number of reported medical errors and attentional failures increased as the hours of reported sleep per month decreased, consistent with the negative impact of sleep deprivation on performance. The study confirmed previous research showing that longer work shifts resulted in more medical errors and attentional failures. These adverse effects not only compromised patient safety but also had emotional consequences for physicians, leading to distress and reduced empathy. Extended work shifts also negatively affected medical education, as interns were more likely to fall asleep during lectures and rounds, impairing their ability to learn and retain information. The study acknowledged some limitations, such as potential biases in the sample of interns and reliance on self-reported data for medical errors. However, despite these limitations, the study's consistent and significant findings support the association between extended-duration work shifts and adverse outcomes in patient care and medical education.

The 1999 report from the Institute of Medicine highlighted that medical errors contribute to a significant number of deaths each year, ranging from 48,000 to 98,000. In an effort to address this issue, the Accreditation Council for Graduate Medical Education (ACGME) has implemented restrictions on resident work hours to reduce fatigue-related errors. However,

despite previous attempts to reduce extended-duration work shifts (lasting more than 24 hours), such shifts remain a common practice in American postgraduate medical education.

The ACGME guidelines introduced in 2003 allow for up to nine extended-duration shifts per month, with shifts lasting up to 30 consecutive hours. However, even within these guidelines, interns working such shifts reported a significant number of medical errors leading to adverse patient outcomes and fatalities. Surprisingly, many interns also reported working more hours than permitted by ACGME standards, despite the introduction of these guidelines.

Contrary to the belief that safety hazards associated with resident fatigue only affect a small subset of trainees, data collected from interns across various specialties in the United States indicate that even those working below the 80-hour weekly limit but engaging in one extended-duration shift per week had a significantly higher likelihood of reporting adverse events compared to those who did not work such shifts. Numerous studies have shown that prolonged wakefulness of 24 hours impairs short-term memory, degrades neurobehavioral performance, and greatly increases the risk of errors and attentional failures.

Research has also demonstrated that the elimination of extended-duration shifts reduces attentional failures and serious medical errors among interns in intensive care units. These findings suggest that the current practice of scheduling extended-duration shifts, as sanctioned by the ACGME, poses increased risks to patient safety, contributes to fatigue-related errors and preventable adverse events, and may interfere with the educational goals of residency training.

Considering the public policy implications of these results, it is recommended that training program directors explore alternative coverage schedules to eliminate extended-duration shifts. In Europe, where the tradition of extended-duration shifts originated, work shifts for all physicians, including trainees, have been limited to 13 consecutive hours, effectively eliminating extended-duration shifts altogether. Strategies such as day and night float teams and the use of physician extenders have been proposed as interventions to reduce resident work hours in the United States.

Strategies and Interventions

A recent study aimed to investigate the differences in sleep strategies and lifestyle behaviors between good and poor sleepers among nurses who work irregular night shifts(Albakri et al., 2022). It also explored whether these differences could provide insights into effective strategies. The study conducted semi-structured interviews with nurses and found both similarities and differences between good and poor sleepers in their approaches to preparing for, during, and after night shifts.

Good sleepers demonstrated more comprehensive strategies and behaviors compared to poor sleepers. They had a clear plan for staying focused during night shifts and for sleep during and after shifts. Good sleepers emphasized strategies such as getting sufficient sleep before the night shift and adjusting sleep schedules, while poor sleepers did not mention these strategies. Good sleepers also tried and evaluated different strategies to find what worked best for them.

Both groups mentioned strategies for staying focused during night shifts and for sleeping between shifts. Good sleepers preferred staying active to prevent sleepiness, while poor sleepers opted for rest or napping. Good sleepers also mentioned more strategies for improving sleep quality, such as maintaining a structured sleep routine, being organized, and using

earplugs. Poor sleepers mentioned fewer strategies, such as avoiding noise and not ordering packages during night shifts.

After finishing a night-shift set, both groups set alarms to switch back to their normal sleep rhythm. However, good sleepers mentioned additional strategies, including exercise, relaxation, and drinking coffee, to aid in the transition. Strategies to improve sleep quality involved eliminating factors that disrupt sleep, such as adjusting the sleep environment and using earplugs.

The main distinction observed was that good sleepers had developed personalized strategies and clear plans for sleeping well and staying focused during a series of night shifts. They invested time and effort in finding what worked best for them. The study suggests designing interventions that encourage nurses to experiment with strategies and find personalized approaches that motivate adherence to a schedule.

The study acknowledges that no single strategy or behavior works for all nurses. It also notes that working irregular night shifts can lead to changes in behaviors and may have health consequences, as indicated by previous research. However, this study did not directly examine the relationship between night shift work and health.

It is important to interpret the results with caution. Good sleepers may have been more inclined to mention strategies, knowing they were classified as such. Poor sleepers might have tried and evaluated strategies but not found effective ones. Additionally, differences in age and years of experience between good and poor sleepers could influence the results. The study acknowledges the possibility of a "healthy worker" effect but suggests that the strategies used by good sleepers can still provide valuable insights for other night shift workers.

Recommendation

1. Design of work schedules

One of the highest priorities in the healthcare services industry is to develop improved scheduling practices for healthcare support and assistant (HCSA) workers. The aim is to ensure the provision of safe services around the clock while prioritizing the health, safety, and well-being of the workers themselves. Particularly important is the need for best practices in scheduling during emergencies that lead to a surge in patient workload. Research is necessary to identify ways to promote positive outcomes for both workers and patients when long work hours are unavoidable during unexpected situations. Additionally, exploring strategies to reduce the reliance on long shifts in the HCSA field is crucial.

Tailored solutions may be required based on the specific job roles within HCSA. For instance, Arbour et al. have developed strategies to enhance sleep among nurse midwives through modifications in work schedules, sleep-promoting techniques, and work reorganization. Addressing the issue of long work hours in resident physicians has been challenging, but outcomes have shown improvement when transitioning from 24-hour shifts to 16-hour shifts or shorter. The impact of work hours, in combination with other job demands, influences outcomes in HCSA workers, highlighting the need for further research in this area.

Emerging evidence suggests that night shift work, with its disruptive effects on circadian rhythms, is likely a carcinogen and is associated with the development of type 2 diabetes and cardiovascular disease. Therefore, research should focus on designing work schedules that allow evening and night shift workers to align their circadian rhythms with their work hours. At a minimum, work schedules should provide sufficient time off between shifts to ensure workers can obtain the recommended amount of sleep and have time for personal tasks. For example, it has been suggested that night shifts should have at least an 11-hour break between shifts and be limited to three consecutive 9-hour shifts.

Guiding principles for determining shift length, as proposed by Gurubhagavatula et al., could be explored for their applicability in HCSA. Further studies on the interaction between staffing levels, work demands, and work schedules can inform the development of best practices. Evidence indicates that schedules may need to be tailored to account for factors such as inadequate staffing, skill-mix, patient acuity, work intensity, task demands, and crisis situations. For instance, patient safety in intensive care units can be influenced by the number of patients per resident physician, suggesting the need for customized scheduling approaches.

2. Workplace culture of safety and leadership

Improving the culture of safety in the healthcare (HC) field and addressing leadership approaches to work hours are identified as the second and third highest priorities. These two priorities are interconnected, as improving the safety culture can influence leadership practices, and vice versa. However, there is limited research available on this topic. Recent findings by Steege et al. indicate that healthcare managers often overlook the impact of shift work, long work hours, and fatigue on worker and patient safety, possibly due to a lack of knowledge regarding evidence-based practices. Leaders may also need to recognize the business case for reducing these risks, as they may not fully appreciate the costs and benefits associated with risk reduction strategies.

Further research is needed to explore effective approaches to improving leadership practices. Theoretical frameworks such as Ajzen's Theory of Planned Behavior and the Total Worker Health® approach can provide guidance in understanding leadership perspectives. Key areas for investigation include leaders' attitudes towards work hours, sleep, and fatigue, as well as their perceived accountability for implementing workplace systems that promote worker sleep and alertness. Additionally, studying the perceived ease or difficulty of implementing evidence-based strategies, anticipated barriers (such as resistance to alternate shift lengths), and beliefs about organizational and stakeholder expectations can provide valuable insights.

Researchers can facilitate collaboration among multiple stakeholders to develop strategies that prioritize sleep health and foster a culture of safety within healthcare operations. This aligns with recommendations from the 2021 Future of Nursing Consensus Study Report, which emphasizes the importance of supporting the health and well-being of nurses. The Institute for Healthcare Improvement also advocates for efforts to enhance the safety of the healthcare workforce and improve safety culture, leadership, and governance. Research can examine and test ways to incorporate practice and policy recommendations from professional and accreditation organizations, health insurers, and The Joint Commission. Furthermore, investigating methods to incentivize the promotion of a healthier and more alert workforce, resulting in improved patient outcomes, would be valuable.

3. Education for workers and managers

A notable issue in the healthcare (HC) field is the lack of education among workers and managers regarding work hours, sleep, and fatigue. These topics are typically not included in professional education or on-the-job training. Research should focus on assessing the knowledge of healthcare staff regarding their personal risks associated with long work hours and shift work. Educational programs are necessary to increase workers' understanding of these risks and provide them with practical strategies to mitigate them. It is important to note that educational interventions have shown promising results in improving sleep duration, quality, and reducing sleepiness during work, as indicated by recent reviews. However, these effects were more consistently observed in day shift workers. Studies examining education programs for police officers and resident physicians, who work long and irregular shifts including nighttime hours, found that education alone did not lead to significant improvements in sleep. Organizational changes were also necessary to increase the available time for sleep. Therefore, research is needed to develop and test educational interventions that effectively lead to behavior change, along with implementation and dissemination strategies.

4. Fatigue countermeasures

Further research is necessary to develop fatigue countermeasures and implementation strategies that are acceptable to both workers and leaders in the healthcare field. Fatigue countermeasures may include napping before and during work, breaks during shifts, exercise, appropriate light exposure, and the judicious use of stimulants like caffeine. A systematic review focusing on napping during night shifts found that it benefits nurses' health and performance. However, challenges need to be addressed, such as management concerns about sleep inertia, lack of napping spaces, and negative perceptions of healthcare workers sleeping on the job. Healthcare workers may also feel guilty about being a burden or perceive patient abandonment during naps. Cultural beliefs surrounding napping at work should be investigated and best practices developed for napping during normal times and catastrophic events.

Research specifically targeting fatigue countermeasures in resident physicians, who often work long hours, is crucial. The Accreditation Council for Graduate Medical Education (ACGME) conducts periodic reviews of accredited institutions through the Clinical Learning Environment Review (CLER) Program. These reviews assess fatigue management, mitigation, and duty hours, among other areas. However, a review of accreditation visits to small institutions revealed that while some fatigue mitigation strategies were implemented, few had systematic approaches focusing on prevention, recognition, and effective mitigation of fatigue and burnout.

Intervention studies have explored combining fatigue countermeasures with other workplace strategies. System interventions to mitigate fatigue include using circadian rhythm principles for scheduling, reducing praise for working extended shifts, reevaluating the practice of three 12-hour shifts, providing education on health and safety risks associated with demanding work hours, and promoting self-care strategies. Additional system interventions involve monitoring staff absentee patterns, limiting involuntary overtime, avoiding unscheduled call-ins for nurses who need recovery time, fostering positive and supportive work environments, and involving staff in unit and organizational councils. Best practice guidelines published by organizations such as the Registered Nurses' Association of Ontario and The Joint Commission also recommend similar interventions, along with adequate funding for education, appropriate staffing levels, suitable rest and break environments, and involvement of accreditation bodies and education programs.

Conclusion

The impact of shift work and irregular schedules on the health and well-being of healthcare professionals is a complex issue. Shift work disrupts the normal sleep-wake cycle, leading to inadequate sleep and increased fatigue. This can result in a higher risk of conditions like breast cancer and coronary heart disease, although the evidence regarding the causal relationship is inconsistent. Adequate sleep is crucial for maintaining overall health, safety, and productivity, and a growing number of healthcare workers are not getting enough sleep due to shift work and long work hours. Insufficient sleep can lead to negative changes in the immune system and metabolism, cognitive impairments, and an increased risk of chronic diseases. In addition, fatigue can have detrimental effects on the health and well-being of physicians themselves, contributing to burnout and affecting the recruitment and retention of physicians in both community and acute care settings. The objective of this review is to critically assess the evidence regarding the connections between shift work, chronic health issues, and occupational accidents, and to determine whether insufficient sleep could serve as a plausible mechanism leading to adverse health outcomes among shift workers.

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