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**RESEARCH ARTICLE**

## The Impact of Shift Work on Nurses' well-being and Patient Care Excellence in Inpatient Settings

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**ABSTRACT**

The reviewed document extensively examines the impact of shift work (SW) on nurses' health and patient care quality in inpatient settings. Shift work, especially night shifts, has been associated with significant disruptions to nurses' circadian rhythms, leading to adverse outcomes such as sleep disturbances, chronic diseases, psychological stress, and decreased cognitive function. These health challenges correlate with diminished patient care quality, manifesting in errors, poor communication, and delayed treatments. The study emphasizes the necessity of addressing these issues through organizational policies and interventions. Strategies such as optimized scheduling, stress management, and adequate support systems are proposed to mitigate the negative effects of SW, ensuring nurse well-being and sustained healthcare quality.

**KEYWORDS**

shift work, nurses, health, patient care quality, inpatient settings

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**1. Introduction**

Professional health caregivers (PHCs), especially nurses, doctors, and health administrators, frequently encounter significant challenges in their work environments, which impact not only their personal well-being but also the quality of care they deliver to patients. These challenges include long work shifts, emotionally charged situations, the responsibility of caring for others, and making critical life-or-death decisions (Moreno-Jiménez et al., 2023; Moretti & Pronzato, 2024). Such pressures can profoundly affect their mental health and overall well-being.

After the industrial revolution, societies began structuring daily life around the amount of time individuals devoted to their jobs, creating a clear distinction between "working hours" and "non-working hours" (Silva & Costa, 2023). Up until the mid-20th century, work schedules typically followed a standard pattern: employees worked during the daytime on weekdays and rested during evenings and weekends. However, as societies advanced and technology and economies evolved, businesses found it necessary to expand operational hours. This shift sometimes led to around-the-clock operations, requiring workforces to adopt nontraditional schedules. These alternative arrangements include shift work (SW), night shifts, evening hours, and weekend work (Brown et al., 2020; Blodgett et al., 2024).

The definition of the term "shift work" clearly articulates employment outside of the traditional hours of 8 a.m. to 6 p.m., with work operated in longer extension hours, which is around 20% of the whole workforce. Harris et al. added to this assertion that shift work must be part of promotive health as it is evident to be involved in appropriate services such as healthcare and public safety. Declines are unlikely to happen in prevalence as the movement towards increased shift work might incorporate areas like social care in which developments occur (Anttila et al., 2021).

It is interesting and important for medical organizations to ensure regulation of SW to ensure patient care over 24 hours, therefore guaranteeing continuity of essential services wherein patient care is configured around the clock and emergency responses (McElroy et al., 2020; Costa et al., 2021). Most healthcare centers, such as hospitals are operating 24 hours because injuries or accidents can happen at any moment concerning the patient's critical treatment or continuous needs (Dunnion et al., 2024). The system has existed for all types of casualty cases, chronically ill patients, pandemic emergencies, and rehabilitation of patients in need of uninterrupted care. Therefore, the framework is crucial regarding public health and, thus, patient safety, as well as societal demand, which necessitates 24-hour service from health facilities. Research has implicated these types of working patterns, especially in the case of night shifts, in negative health outcomes. The night shifts have been reported in research as highly detrimental work schedules to PHCs. The requirement for wakefulness at night and sleep during the daytime disrupts natural sleep and circadian rhythm (Moreno et al., 2019). As a result, they tend to suffer from shorter, worse sleep and higher rates of sleep problems than workers on other schedules (Harris et al., 2024). Such an adverse impact of work schedules is well documented in some PHCs.

The demand for personal health care in long-term care centers and assisted living facilities becomes higher in correlation to the growing number of senior patients with the need for such services. Everyone knows that quality aged care will benefit from addressing the particular needs of the caregivers, which arise from the demands of their jobs, both physical and emotional (Januario et al., 2019; Bamonti et al., 2019; Andersen et al., 2020; Awosoga et al., 2020). Awosoga et al. investigated the consequences of SW on the population of PHCs in Alberta, Canada, in terms of health and well-being in long-term care and assisted living. The results showed that caregivers working night shifts experience much poorer health-related consequences, such as fatigue, neck-and-back pain, insomnia, and dissatisfaction with their overall health and quality of life. In addition, these individuals engage in much less healthy behavior patterns or expect improvement in health. This has proven to be significant in underscoring the paramount need for healthcare stakeholders to create policies and strategies that focus on the wellbeing of caregivers to ensure quality service delivery (Awosoga et al., 2020). The aim of this review is to examine the impact of SW on nurses' health and the quality of patient care in inpatient settings; it understands how nontraditional work schedules affect the physical, mental, and emotional well-being of nurses and how that, in turn, affects their ability to provide safe and effective care. It will also identify inherent strategies to alleviate the negative effects of SW on the sustainability of healthcare services and the workforce's well-being.

- **Search Strategy**

A comprehensive literature review was conducted using various databases, including PubMed, Scopus, Web of Science, Saudi Digital Library, and others. The search was restricted to English-language papers published from the earliest available date to 2024, covering both historical and contemporary research. The keywords utilized in the search included: "shift work," "nurses," "health," "patient care quality," and "inpatient settings". This review encompasses a wide range of literature, including original research studies, review articles, and opinion pieces.

## **2. The Role of Nursing and the Impact of SW in Healthcare Professions**

Nursing, one of the oldest professions, involves the art and science of caring for the sick and injured, with its roots tracing back to the dawn of human existence and even observed in animal behavior (David et al., 2024). The term "nurse," derived from the Latin word *nutricia* (meaning "nourishing"), reflects its original association with caregiving, which Florence Nightingale revolutionized into a structured and professional practice (Dumitrascu et al., 2020; David et al., 2024). Today, nursing encompasses diverse responsibilities such as patient care, therapy administration, collaboration with medical teams, and health education. Despite its critical role and a global workforce of approximately 28 million, the PHCs face significant challenges, including a global shortfall of 6 million nurses, as reported by the World Health Organization, highlighting the urgent need for enhanced support and resources (Lovelace, 2020; David et al., 2024).

A considerable sector of a nurse's workday is consumed by providing patient care, requiring high levels of concentration and willingness, particularly during emergencies, pandemics, surgeries and intensive care (Wolf et al., 2016). SW is a cornerstone of PHCs, enabling round-the-clock patient care (Costa, 2020). Several scientific studies have shown that SW significantly disrupts sleep patterns, leading to negative health issues, with nurses being among the most exaggerated in healthcare (James et al., 2017). It was found that nearly half of the nurses engaged with SW suffer from sleep disturbances and fatigue, which can adversely impact the quality of care provided to patients (Querstret et al., 2020). Healthcare protocols have persisted in meeting the health requirements of individuals, often involving night shifts and extended hours to ensure uninterrupted service (Alanazi et al., 2024).

## **3. Types of SW Schedules in Healthcare**

Healthcare settings operate continuously to ensure patient care is always available, requiring PHCs to work under various shift schedules (Alanazi et al., 2024). These schedules are designed to balance workload distribution while maintaining uninterrupted service. The primary types of SW schedules in healthcare include fixed shifts, rotating shifts, on-call shifts, and split shifts (Fig. 1) (Spekker, 2022).

Fixed shifts remain consistent, with nurses working the same hours every day. Fixed shifts are typically categorized into day, evening, or night shifts. This schedule offers stability, allowing workers to plan their personal lives around their professional commitments. However, those assigned permanent night shifts may experience long-term disruptions to their circadian rhythms (Seong et al., 2020; Roman et al., 2023).

Rotating SW involves a schedule where a significant portion of work hours falls outside the traditional daytime period, typically starting between 7:00 and 9:00 a.m. and ending between 6:00 and 8:00 p.m. This type of work schedule also poses significant challenges to an individual's biological rhythms, as it disrupts the body's natural circadian cycles. The PHCs engaged in rotating shifts are required to remain active during times traditionally reserved for rest and sleep. This misalignment with natural biological patterns forces their physiological systems to adapt, often leading to a need for readjustment. However, the extent to which the body can achieve a new equilibrium under such conditions remains uncertain (Chang & Beng, 2021; Roman et al., 2023).

The PHCs on call must be available to work if needed, often outside their scheduled hours. On-call shifts are common in emergency departments and surgical teams, where unexpected cases may arise. Although on-call work ensures rapid response to urgent situations, it can increase stress and disrupt sleep due to its unpredictability (Almarzouki, 2024).

Nurses may work in split shifts or the division of working hours into separate blocks with an appreciable unpaid break in between. Such arrangements are really common in healthcare to allow an influx of patients in the peak hours and to minimize the overhead costs during the slow hours. Another shift schedule that corresponds to split shifts among nurses is the split-sleep schedule where sleep is split into two or more episodes within a 24-hour period to cope with the effects of disrupted circadian rhythms. While remedies such as napping during night shifts or even blocks of sleep could really minimize the chances of fatigue, the actual application in clinical settings has been a challenge due to logistics and because there has been little research on the long-term success of these ways (Willeumier, 2017).

#### **4. The effect of nurses' SW on patient care quality in inpatient settings**

Nurses' SW dramatically affects the quality of patient care in inpatient settings and is, therefore, a significant issue for health care systems all over the globe. It includes continuous patient care but is riddled with challenges that affect both the nurses concerned and the quality of care delivered (Shujaa et al., 2019). Prolonged or irregular working hours generally lead to fatigue and burnout among nurses, and this makes them unable to concentrate on their jobs. Attention diversion of this magnitude causes errors in both administration of medications and in clinical judgments, sometimes even lapses in documentation. The above-mentioned issues threaten patient safety, hence resulting in adverse events such as falls, infections, and other treatment delays in inpatient settings (Babapour et al., 2022; Ryu & Shim, 2021). The other major issue is communication breakdown when there is shift change. Handover between nurses at close shifts would frequently be very prone to errors, leading sometimes to missing critical patient information and reduced continuity of care (Fig. 1) (Dorgahm & Obied, 2021).

Nevertheless, in good practice, SW also possesses several advantages as it serves 24/7 care coverage, which is essential for inpatient wards requiring a constant regime for monitoring and intervention (Magerøy & Wiig, 2023).

#### **5. Health Impacts of SW on nurses**

In the organization of nursing labor, working hours are extremely critical, meeting the central needs of patient care with the working demands of health-care facilities. In the modern healthcare landscape, continuous human involvement is essential to ensure 24-hour care delivery (Alanazi et al., 2024). SW, integral to nursing, supports uninterrupted healthcare services necessitated by patient needs, emergency care, and hospital operations. However, working irregular hours, particularly night shifts, presents significant challenges for nurses (Fig. 1) (Albakri et al., 2024).

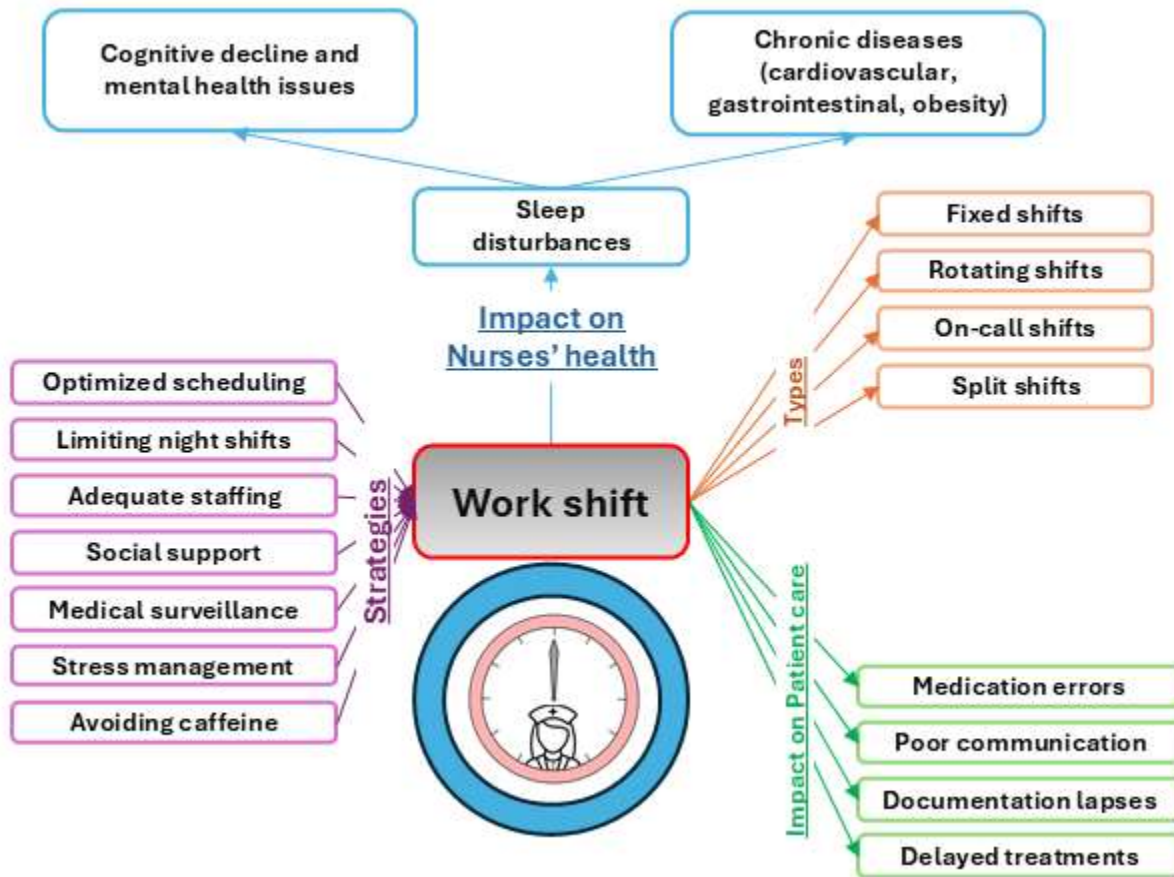


Fig. 1 Graphical abstract

Shift work disrupts circadian rhythms, leading to reduced cognitive and physical performance, an increased likelihood of errors and accidents, and adverse health outcomes, including mood disturbances, sleep disorders, and chronic psychosomatic conditions (Jehan et al., 2017). These effects not only jeopardize the well-being of nurses but may also compromise the quality of patient care. Moreover, SW can strain personal and family relationships, reducing social engagement and work-life balance (Costa, 2020).

### 5.1 Effect of SW-induced sleep disturbances on mental health of nurses

Liu et al. suggested that sleeping quality has a very strong influence on the mental well-being of the primary health care workers. Sleep disturbance among the pregnant women in this third trimester of pregnancy increased the risk of depression by a 5.27 times fold (Tsai et al., 2021). Insomnia conditions usually develop in a progressive manner in terms of disruption of natural sleeping cycles as induced by stress, trauma, major life change, personality types, emotional states, and environmental conditions; all are more likely to get aggravated due to high stress work settings and stressful work loads, mostly observable in health-care settings. This may manifest as insomnia, broken sleep, and nightmares. Long term sleep deprivation on the nurse's side could lead to body fatigue, energy deficit, poor appetite, impaired functioning, little attention span, and great error possibility in their working environment. The nurses have also been put under scrupulous scientific investigation for sleep disorders. A cross-sectional survey was once reported which observed that most nurses were afflicted with sleeping-related problems, mostly revolving around anxiety and depression indicators (Yue et al., 2021). Meta-analyses have estimated high prevalence rates for insomnia among PHCs as evidenced according to different roles in their profession (Pappa et al., 2020). Nurses showed tremendous high prevalence rates of sleep disturbances and therefore it is imperative to attend to these in the health care system (Hu et al., 2022; Salari et al., 2020).

Mental health concerns commonly arising among PHCs during a public health crisis include burnout, stress, anxiety, depression, sleep disturbances, and post-traumatic stress disorder (Wang et al., 2024). The prevalence rates of these problems have been reported to differ among PHCs, with frontline workers reporting high rates compared to non-frontline workers (Salari et al., 2020; Hu et al., 2022). Most of the studies used in this regard having cross-sectional nature—they employed psychological questionnaires to evaluate the incidence and psychological contributing risk factors for mental health issues. Still, differences in populations, geographical settings, and the timing of data collection with respect to the health crisis may have resulted in inconsistencies in findings across studies. While evidence is clear as regards the fact that mental health problems in nurses during an event is not generally agreed upon defining or having a universal incidence rate, it maintains its strong evidence for the problem's negative

impact. This accentuates the readiness to face those mental health challenges during the next public health emergencies. Major international organizations such as WHO have emphasized the preparedness concerning threats posed by emergent health problems. By reviewing past events and collating successful interventions and consolidating functional support mechanisms, mental wellbeing for whole health systems can be better safeguarded. It is essential for mental health action among human health care workers so as effectually contribute to the wellbeing of both individual and patients-as well as better from a public health point of view during crises (Wang et al., 2024).

### 5.2 Effect of SW-induced sleep disturbances on gastrointestinal system of nurses

Cytokines are cornerstone substances in the inflammatory and immune systems. The circadian biological clock is regulated by the release of these substances (Zeng et al., 2024). Evidence indicates that most gastrointestinal disorders are associated with increased levels of proinflammatory cytokines, which also influence the sleep-wake cycle. For instance, a study by Vgontzas et al. showed that restricting sleep from 6 to 8 h per night elevated interleukin (IL)-6 secretion in both men and women and increased TNF levels in men, highlighting cytokines' role in sleep regulation.

In gastroesophageal reflux disease, IL-8 is produced in high concentration in affected mucosa, while IL-1 and IL-6 have fundamental roles in mediating inflammation. Similarly, cytokines are crucial for activating inflammatory cells in Helicobacter pylori-induced ulcers (Yang et al., 2024). Patients with irritable bowel syndrome exhibit significantly higher serum levels of cytokines like IL-1, IL-6, and TNF compared to control individuals (Khanijow et al., 2015; Seyedmirzaee et al., 2016). Research by Tang et al. also suggests that chronic sleep deprivation worsens colonic inflammation, potentially triggering disease flares in irritable bowel syndrome.

### 5.3 Effect of SW-induced sleep disturbances on body weight of nurses

Sleep deprivation disrupts appetite-regulating hormones, increasing hunger and caloric intake, while genetic studies link circadian rhythm genes to obesity traits. Insufficient sleep also impacts the gut microbiome, reducing beneficial bacteria and increasing inflammation, which further exacerbates obesity risk (St-Onge, 2017).

Huang et al. highlight a significant relationship between poor sleep quality and the prevalence of overweight and obesity among PHCs, particularly in those with higher body weight. Reduced sleep duration and disturbances were strongly linked to an increased risk of obesity, aligning with prior research that underscores insufficient sleep as a key factor in weight gain. Lifestyle factors, including gender, marital status and education, influence obesity risks in PHCs, with higher educational attainment linked to healthier habits (Grzymisławska et al., 2020; Li et al., 2021; Mahboobifard et al., 2022).

### 5.4 Relation between SW-induced sleep disturbances and cardiovascular diseases

Sleep disturbances, including short and long sleep durations and poor sleep quality, are strongly linked to cardiovascular diseases (CVDs) (Williams et al., 2007; Zonoozi et al., 2017; Addo et al., 2024). Sleep deprivation negatively affects coronary microcirculation, impairs endothelial function, and accelerates vascular deterioration, thereby increasing CVD risk (Sekine et al., 2010; Covassin & Singh, 2016). Additionally, it disrupts glucose homeostasis and insulin sensitivity, which are key factors in cardiovascular health (Nedeltcheva et al., 2009). Because sleep problems are modifiable, addressing them offers a valuable opportunity to reduce the onset and progression of CVDs.

Research has also been conducted by looking into sleep disturbances and their relationship with cardiovascular disease (CVD) risk associated biomarkers, which include C-reactive protein (CRP-biomarker levels), low- and high-density lipoproteins (LDL and HDL), total cholesterol, triglycerides, and glycosylated hemoglobin (HbA1c) (Williams et al., 2007; Fernström et al., 2020; Zonoozi et al., 2017; Addo et al., 2024). The literature findings related to these studies have been conflicting. For example, a number of studies report on the increase of CRP levels, an inflammatory biomarker for CVD, associated mainly with both short and longer sleep durations (Grandner et al., 2013). In contrast, other studies, especially those targeting older cohorts, seem to report no relationship between sleep duration and CRP or any other biomarker (Zonoozi et al., 2017).

In fact, despite all these contradictions, sleep disturbances and biomarkers of CVD have shown how sleep monitoring could also be a part of CVD preventive interventions. It would therefore enable the recognition of abnormal sleep profiles from individuals and the design of a targeted intervention which would eventually lead to better cardiovascular outcomes as it tackles sleep-related risk factors (Grandner et al., 2013; Fernström et al., 2020).

### 5.5 Relation between SW-induced sleep disturbances and reproductive health

Sleep disturbances are intricately linked to reproductive health and may contribute to infertility through disruptions in hormonal regulation, a process closely tied to the body's circadian rhythms (Lateef & Akintubosun, 2020). Sleep deprivation impairs the synthesis, secretion, and metabolism of sex hormones, leading to adverse effects on fertility in both men and women (Attia et al., 2021; Writer, 2024). For men, poor sleep reduces testosterone levels, impairs sperm motility, and induces apoptosis in Leydig cells, partially through heightened activation of the hypothalamic-pituitary-adrenal (HPA) axis and increased corticosterone production (Lateef & Akintubosun, 2020; Moraes et al., 2022). For women, sleep deprivation disrupts melatonin secretion, alters

gonadotropin and sex steroid levels, and is linked to menstrual irregularities, anovulation, failed embryo implantation, and early pregnancy loss (Beroukhim et al., 2022).

Shift work, particularly at night, aggravates sleep disturbance that results from circadian misalignment. This refers to the desynchronization between the body's internal clock and the external light-dark cycles causing disruption in physiological processes and reproductive health. Studies, including meta-analyses, have shown an increased risk of menstrual irregularities, infertility, and early pregnancy loss among female shift workers. For instance, night shift workers are greatly at risk for early miscarriages, a finding corroborated by research on flight attendants whose sleep schedules overlapped with work times across time zones (Archer et al., 2014; Stocker et al., 2014; Grajewski et al., 2015).

Such information regarding these mechanisms is highly lacking with regard to how they connect circadian rhythm disruption and sleep deprivation with one's reproductive health. Also, multifactorial interaction, such as light exposure and time of shift, and how circadian misalignment could play a role should be further researched to completely comprehend causation and consequences regarding reproductive health risks (Lateef & Akintubosun, 2020).

### **5.6 Relation between SW-induced sleep disturbances and Alzheimer's disease**

Disruption of sleep is increasingly being recognized as an alterable risk factor for Alzheimer's disease (AD) and cognitions-decline (Niu et al., 2022; Owen et al., 2021). Even short periods of sleep deprivation result in cognitive impairment and aggregation of beta-amyloid (A $\beta$ ) (Wang & Holtzman, 2020). These changes occur, in most cases, before the clinical symptoms of the disease manifest and are closely associated with early pathophysiological events, including oxidative stress and production of reactive oxygen species (ROS) (Tonnie & Trushina, 2017).

Chronic sleep deprivation generally increases oxidative stress as defined by its characteristics of containing excessive levels of reactive oxygen species (ROS) and malondialdehyde (MDA) as well as decreased activity of superoxide dismutase (SOD) (Beiyu et al., 2024). Such oxidative imbalance leads to metabolism of A $\beta$  through  $\beta$ -secretase (BACE1), the key enzyme for A $\beta$  generation. Likewise, it jeopardizes A $\beta$  clearance mechanism due to oxidative stress. For example, oxidation of lipoprotein receptor-related protein 1 (LRP1) causes the loss of affinity for A $\beta$  and prevents its efflux from the brain while increasing its entry into the brain by enlarging its receptor for advanced glycation end products (RAGE)-mediated transport (Sagare et al., 2012; Ma et al., 2017). These combined mechanisms increase A $\beta$  buildup, which is an essential characteristic of AD (Zhao et al., 2019; Beiyu et al., 2024). Moreover, A $\beta$ , in itself, produces "neuronal damage-induced cognitive impairment" enhancement through oxidative stress, leading to feedforward circuitry for amplifying damage. Changes in lipid rafts and HIF-1 $\alpha$  and LXR $\alpha$ /ABCA1 pathways that mediate BACE1 activity have been linked too to experimental oxidative stress (Lee et al., 2016). Peripheral oxidative stress further affects sLRP1 and sRAGE levels in the bloodstream, therefore affecting the A $\beta$  clearance in the brain (Beiyu et al., 2024).

While the amyloid cascade hypothesis remains debated, evidence supports A $\beta$  aggregation as a critical factor in AD pathogenesis, with oxidative stress playing a significant role in both A $\beta$  toxicity and deposition (Barge & Sonawane, 2015).

### **5.7 Effect of SW-induced sleep disturbances on cognitive function of nurses**

Sleep disturbances, particularly among shift workers, significantly impair cognitive function. Cognitive performance declines markedly during night shifts compared to day shifts (San et al., 2011). Key deficits include lower scores in intellectual ability, response inhibition, working memory, attention, and reaction time (Rouch et al., 2005). These impairments are linked to the vulnerability of the frontal and prefrontal cortex to sleep deprivation (Ricchio et al., 2002). For instance, tasks involving working memory and episodic memory, governed by the temporal lobe, show poorer performance during night shifts. The disruption of circadian rhythms, driven by internal biological clocks and environmental cues like light, exacerbates cognitive deficits during night work (Kuhn, 2001).

Again, sleep deprivation brings about different forms of unfavorable results like affecting attention, learning, and working memory (Hershner & Chervin, 2014). Any change in configuration tends to lead to extremely increased neural reactivity as well as impair continuation of physiological and behavioral functions. Among PHCs, particularly nurses with long shifts, the error rates and vigilance are significantly higher and directly affect patient care and safety (Kaliyaperumal et al., 2017).

The study on sleep deprivation of 97 female and 3 male nurses aged 20-50 years took that Epworth Sleepiness Scale (ESS) measure for determining the levels of sleepiness by the participation and possible effects on the Montreal Cognitive Assessment (MoCA) in determining cognitive function. Mobile applications were also applied for evaluation to determine vigilance, reaction time, photographic memory, and numbers decoding. These studies were implemented at the end of day shifts and 3-4 days at night shifts again. The study intended to see the effect SW had in cognitive performance, highlighting the cognitive defects triggered by sleep disturbances and changes in circadian rhythm due to night shifts (Kaliyaperumal et al., 2017).

It states that out of the 69% of shift-work nurses suffering from sleep deprivation, factors associated with such conditions are high amounts of hours, disturbed circadian rhythms, and irregular patterns of sleep-wake cycles. Likewise, these findings coincide with findings from other PHC-type workers with similar work schedules. The night shifts set the work hours considerably longer, thus shortening the sleeping period, leading to fatigue, decreased concentration, increased error rates, and poor decision-making (Kaliyaperumal et al., 2017). Sleep deprivation with an altered circadian rhythm deteriorates key cognitive functions that are

needed for professional activities, thus creating the need for adequate sleep hygiene to keep a worker healthy, safe, and effective in the work of shift workers (Beiyu et al., 2024).

## 6. Addressing the impact of night SW on nurses in the middle east and opportunities in Saudi Arabia

Since limited space has existed particularly in the area of the physiology, performance, and safety of nurses in the Middle Eastern literature (Dall'Ora et al., 2016). Research in Palestine focused on women working night shifts because, for a woman's job-related distress, there is a higher level than for a man (Jaradat et al., 2018). Other studies have come from Iraq, Iran, and Turkey; all found that night SW among nurses caused them fatigue, family conflicts, and decreased job and life satisfaction (Abdulah et al., 2020; Nasrabadi et al., 2009; Yildirim & Aycan, 2008). Job stress and night shifts were found to contribute to reduced performance and an unhealthy diet among nurses in two studies in Saudi Arabia (Almajwal, 2016; Al-Makhaita et al., 2014). Besides, recent findings show that up to 90% of hospital nurses have psychosocial impacts due to night SW, especially those who have worked night shifts for more than 20 weeks per year (Alsharari, 2019). However, contrary to all these particular lines of evidence, no comprehensive studies have yet been executed in Saudi Arabia concerning the cameras' influence of night shift rotation on the performance of the nurse, patient safety, or understanding of physiological well-being from the nurses' point of view. Indeed, most have been limited to contexts which could not in any way generalize their finding to the nursing work force in the country.

Recently, there has been a heightened focus in Saudi Arabia on fostering safer and healthier workplace environments, particularly in healthcare, to align with employees' needs. This aligns with the Saudi Vision 2030 initiatives, which aim to drive extensive transformations in the healthcare system and improve citizens' quality of life (Alharbi, 2018). As nurses represent the largest segment of the healthcare workforce and deliver most patient care services, addressing the challenges associated with SW is essential for the success of these transformational plans and for ensuring the effective delivery of nursing care.

## 7. Strategies to mitigate the impact of SW on nurses' health and patient care quality

The ability to adapt to SW varies among nurses, influenced by individual, familial, occupational, and socioeconomic factors. Effective shift rotations can enhance teamwork and enable balanced workload distribution, limiting night shifts, stress management training, and improving sleep hygiene, avoiding caffeine and nicotine intake, and optimizing the sleep environment (Zhang et al., 2023; Ofei-Dodoo et al., 2020; Baranwal et al., 2023). However, the key lies in mitigating the adverse effects of SW through optimized scheduling, adequate staffing, ergonomic principles, fostering work flexibility and autonomy, and providing robust social support and counseling services (Flaubert et al., 2021). Forward-rotating schedules, sufficient rest periods, and standardized handover protocols are practical measures that can help improve communication and reduce fatigue. Additionally, medical surveillance and a holistic approach to integrating work demands with societal and personal needs are vital for enhancing nurse well-being in a demanding 24/7 healthcare environment (Albakri et al., 2024). Coordination of frontline positions, rest periods, and shift rotations should be planned thoughtfully, with particular attention to preventing quick, counterproductive transitions (Li et al., 2022). A detailed assessment of staffing needs should be conducted to allocate patients and medical teams fairly across facilities. Establishing emergency medical reserve teams can help fill gaps, alleviate workforce shortages, and prevent backlog issues. These measures aim to foster a healthier work environment, reduce negative emotional impacts, and promote a more positive and sustainable work-life balance. These initiatives aim to strengthen nursing staff' resilience, foster emotional stability, and enhance their capacity to cope with crisis situations (Pang et al., 2020; Wang et al., 2024).

## 8. Conclusion

Shift nursing work is primary since patient care comes 24/7; however, it impacts nurses' health and patient care indeed. Exposure to nonregular shift schedules for prolonged periods has worsened the mental and physical states affecting sleep disorders, cardiovascular conditions, cognitive changes, and stress. Such health outcomes lower the working capacity of nurses, their ability to make proper decisions, and ultimately their capacity for quality care. It is systemic change that must follow this shift working pattern since most modern healthcare systems today operate on that kind of shift work. The main challenge would be addressing how to change the need of the workers between the operational demand and endangering the workforce themselves. The ultimate goal will be improving both sides at the optimal level of contribution towards maximizing patient outcomes.

## 9. Recommendations

- There should be shifts designed to rotate forward with adequate rest periods to match nurses' circadian patterns and relieve fatigue.
- Establish workplace programs that advocate the education on sleep hygiene, stress management, and mental well-being.
- Foster and develop advocacy programs for consistent health monitoring, counseling, and resilience-building targeted at health workers.
- Reduce dependence on long night shifts and equitable load distribution to prevent burnout.
- Ergonomics principles should be applied according to the scheduling and be flexible to meet the individual needs of the workers.

- Such surveys, especially in Middle Eastern countries, should also be performed for context-specific recommendations and for policy changes.

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