

REVIEW

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Shift work sleep disorder in nurses: a concept analysis

Liangmeng Yu^{1†}, Huiyue Zhou^{2†}, Jiamei Li¹ and Xiaoling Yu^{1*}

Abstract

Aim This study seeks to elucidate the concept of shift work sleep disorder (SWSD) among nurses, thereby offering a comprehensive understanding that can inform future research and practical interventions.

Methods Walker and Avant's concept analysis method was employed to guide the study. A systematic literature review was conducted utilizing various databases, including PubMed, Embase, EBSCO, Web of Science, CNKI, WanFang, and Sino Med. The inclusion criteria were specifically designed to focus on studies that define SWSD, along with its attributes, antecedents, consequences, and assessment tools relevant to nursing professionals.

Results The analysis identified four key attributes of SWSD: internal/external circadian rhythm imbalance, impaired sleep, multidimensional health problems, and dynamic changes in symptoms. Antecedents include individual factors like personal health, lifestyle, family support, shift patterns, work environment, and other organizational factors. Consequences of SWSD encompass physiological health issues, mental health challenges, impaired social adaptability, and decreased nursing performance.

Conclusion SWSD has a significant impact on the health and performance of nurses. Understanding its attributes, antecedents, and consequences is crucial for developing targeted interventions. Enhancing sleep hygiene, fostering supportive work environments, and implementing appropriate shift scheduling can help mitigate the adverse effects associated with SWSD.

Keywords Concept analysis, Shift work, Sleep disorder, Nurses

Introduction

Globally, approximately 20% of the working population is engaged in shift work to meet the demands of 24-hour continuous operations and services [1]. Shift work refers to work hours that fall outside the traditional 9:00 am to 5:00 pm schedule [2]. This work pattern is particularly

prevalent in the healthcare sector [3]. Due to the nature of their responsibilities, nurses are required to provide round-the-clock patient care, which leads to irregular and highly disruptive work schedules, making them a high-risk group for developing shift work sleep disorder (SWSD).

Shift work directly disrupts the body's natural circadian rhythms, which follow a 24-hour biological cycle that regulates critical physiological functions, including sleep, hormone release, and cardiovascular activity [4]. When these rhythms are disturbed due to irregular working hours, the body's ability to maintain normal physiological processes is significantly impaired. Studies have shown that circadian disruption not only accelerates biological

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aging but also affects gene expression through mechanisms such as DNA methylation, increasing the risk of cardiovascular disease, digestive problems, and even cancer [5]. In the context of persistent circadian rhythm disruption, SWSD has emerged as a significant health issue. According to the American Academy of Sleep Medicine (2014), SWSD is classified as a subtype of circadian rhythm sleep disorder, characterized by recurrent insomnia and excessive daytime sleepiness [6]. These symptoms are typically exacerbated by the conflict between work schedules and natural sleep times, preventing individuals from obtaining adequate rest during their regular sleep periods.

The concept of SWSD encompasses two fundamental elements: “shift work” and “sleep disorder.” Shift work refers to the regular rotation of staff [7], while a sleep disorder is defined as “a medical condition that impedes an individual’s ability to sleep normally” [8]. Therefore, SWSD can be understood as a disruption of the sleep cycle induced by shift work. This disorder not only compromises sleep quality but also has extensive negative repercussions on physical health, particularly concerning the cardiovascular system. Research indicates that SWSD raises levels of inflammatory markers, such as C-reactive protein (CRP) and interleukin-6 (IL-6), which increases the risk of atherosclerosis and other cardiovascular diseases [9]. Furthermore, SWSD disrupts blood pressure and cholesterol levels, which exacerbates cardiovascular health issues [10]. These health risks underscore the necessity of addressing SWSD in occupational health management for nursing personnel.

Although a considerable body of research that exists on SWSD and its impact on cognitive function, sleep quality, and overall health [10–12], there is a lack of in-depth exploration of the unique challenges faced by nurses. The role of nurses is crucial to global health development, particularly in addressing social challenges such as aging, chronic diseases, and the increasing demand for mental health services [13]. Unlike other professions, nursing is directly linked to the health and safety of patients. Nurses suffering from sleep disorders face heightened risks at work, which can lead to nursing errors and, in severe cases, patient fatalities. Furthermore, compared to other healthcare professionals, such as physicians, nurses have more frequent and prolonged interactions with patients. This necessitates that nurses often sacrifice their own rest to monitor changes in patients’ conditions. Currently, there is a global shortage of approximately 5.9 million nurses, indicating insufficient manpower to adequately cover shifts and allow for necessary rest periods [14]. Consequently, the frequency and duration of nurses’ shifts are increasing, which adversely affects their physical and mental well-being, further exacerbated by disrupted circadian rhythms.

To address the issue of SWSD in nurses, it is essential to first clearly define the concept of SWSD within this population. Concept analysis is a widely used research methodology that clarifies the meaning and scope of a concept, thereby facilitating further related research. This study employs Walker and Avant’s concept analysis method [15] by selecting the concept, clarifying the purpose of the analysis, systematically reviewing the literature, and identifying how SWSD is applied in existing studies. The objective of this study is to systematically analyze the concept of SWSD in nurses, delineating its attributes, antecedents, and consequences, as well as identifying associated factors and commonly used assessment tools. By providing a comprehensive conceptual framework, this research aims to enhance theoretical understanding of SWSD and support future studies in developing evidence-based interventions to address its impact.

Methods

Concept analysis method

This study was conducted using the structured method of Walker and Avant’s [16] to conceptualize SWSD in nurses. The central research question that guided the analysis was: ‘What is the conceptual definition of SWSD in the context of nursing practice, and what are the key attributes, antecedents, and consequences of SWSD as identified in the nursing literature?’ To support the concept analysis, a systematic literature review was conducted to identify and synthesize relevant studies on SWSD in nurses. The systematic review provided essential data on the attributes, antecedents, consequences, and assessment tools associated with SWSD, forming the foundation for the concept analysis. The eight steps of the concept analysis are as follows: (1) selection of a concept: the study chooses to analyze SWSD in nurses; (2) determination of the purpose of the analysis: the study aims to clarify the conceptualization of SWSD in nurses; (3) identification of the uses of the concept: the scope of the use of SWSD in nursing literature; (4) identification of defining attributes: characteristics most relevant to SWSD in nurses are determined; (5) creation of a model case: a representative example of SWSD in nurses that includes all attributes is constructed; (6) development of additional cases: contrasting cases are built to better understand the concept; (7) analysis of antecedents and consequences: events occurring before and after the onset of SWSD in nurses are identified; (8) provision of empirical measurement indicators: measurement tools for SWSD in nurses are reviewed based on literature.

Data source

The electronic databases searched included PubMed, Embase, Ebsco, Web of Science, China National

Knowledge Infrastructure (CNKI), WanFang Database (WanFang), and Chinese biomedical literature service system (Sino Med). The search time frame spanned from the inception of each database to August 2023, ensuring a comprehensive inclusion of both historical and up-to-date studies on SWSD. The search strategy used a combination of subject terms and free text terms, and the final search strategy was confirmed by several pre-searches, and the specific search terms, the search strategy, and the search results are shown in Table 1.

Qualitative or quantitative studies related to the research question, published in Chinese or English with

complete texts, were included in the analysis. Case studies, conference abstracts, and papers discussing sleep disorders in shift work that fall outside the nursing scope of care, or that involve other healthcare professionals, were excluded from the detailed screening. These exclusions were made to avoid potential misunderstandings and to maintain the focus on SWSD within the nursing profession. Literature related to pharmacological treatments for insomnia and excessive sleepiness was also excluded, along with studies that focused solely on the biological mechanisms underlying circadian rhythm sleep disorders, without examining the relationship between shift work and these sleep disturbances. We also manually reviewed the bibliographies of all included articles to identify relevant studies on the topic.

Table 1 Search strategies and results of each database

Database	Search strategies	Results
PubMed	#1 ((Sleep Disorders, Circadian Rhythm [MeSH Terms]) OR (shift work sleep disorder [Title/Abstract])) OR (shift work disorder [Title/Abstract])	2895
	#2 (Nurses [MeSH Terms]) OR (nurs*[Title/Abstract])	571,968
	#3 #1 AND #2	260
Embase	#1 'shift work sleep disorder'/exp/mj OR 'shift work sleep disorder': ti, ab, kw OR 'shift work disorder':ti, ab, kw	466
	#2 'nurse'/exp OR nurs*: ti, ab, kw	698,683
	#3 #1 AND #2	71
EBSCO	#1 SU "sleep disorders, circadian rhythm" OR SU "shift work sleep disorder" OR SU "shift work disorder"	6037
	#2 SU nurs*	240,355
	#3 #1 AND #2	714
Web of Science	#1 ((TS= ("sleep disorders, circadian rhythm")) OR TS= ("shift work sleep disorder")) OR TS= ("shift work disorder")	2745
	#2 TS=(nurs*)	1,301,736
	#3 #1 AND #2	408
CNKI	#1 (SU = nurse + nursing staff)	324,500
	#2 (SU = work by turns + shift work + night shift)	5231
	#3 (SU = sleep disorder + insomnia + drowsiness)	43,600
	#4 #1 AND #2 AND #3	87
WanFang	#1 theme: (nurse) OR theme: (nursing stuff)	393,084
	#2 theme: (work by turns) OR theme: (shift work) OR theme: (night shift)	9635
	#3 theme: (sleep disorder) OR theme: (insomnia) OR theme: (drowsiness)	111,312
	#4 #1 AND #2 AND #3	162
Sino Med	#1 ("nurse"[All Fields: Smart] OR "nursing stuff"[All Fields: Smart])	255,873
	#2 "work by turns"[All Fields: Smart] OR "shift work"[All Fields: Smart] OR "night shift"[All Fields: Smart]	3699
	#3 "sleep disorder"[All Fields: Smart] OR "insomnia"[All Fields: Smart] OR "drowsiness"[All Fields: Smart]	83,362
	#4 #1 AND #2 AND #3	123

Data analysis

Note Express software was used to manage the literature and research papers included in this study. It facilitated the search, download, and management of citations, as well as helped identify recurring literature across sources. After the duplicate data removal process, two reviewers (Y. L & L. J) independently screened the titles and abstracts of each study based on the inclusion and exclusion criteria. Discrepancies were resolved through discussions with a third party (Z. H). The same method was also used to screen the full texts of these studies. Subsequently, the two reviewers extracted data from each study, including the authors, year of publication, country, target population, sample size, as well as the definition, attributes, antecedents, and consequences of SWSD. The differences in data interpretation among research team members were discussed and resolved through a consensus-based approach. This process involved a thorough review of the relevant articles, and when discrepancies in data extraction or interpretation arose, they were addressed through detailed discussions until a consensus was achieved among all team members. The first author (Y. L) performed a narrative analysis of the extracted data for a more comprehensive review.

Rigor

The researchers had at least two years of shift experience in bedside work, with the longest experience being up to 30 years. All of them obtained a master's degree in nursing, during which time they successfully completed course work including concept analysis as well as systematic reviews. Members of the research team had led or supported at least three systematic reviews each, ensuring their qualification to complete this study. To ensure the rigor of the methodology, this study strictly followed Walker and Avant's approach for concept analysis.

Results

The initial search resulted in 1,825 papers. After eliminating duplicate studies, 1,240 studies remained. An additional 5 papers were found through other sources. After a detailed screening of titles, abstracts and full texts, we selected 36 studies, including 33 quantitative studies and 3 qualitative studies for the final analysis (Fig. 1).

Use of the concept

Identifying all instances of SWSD in the literature is essential to clarify its scope and deepen understanding of its applications [15]. SWSD is initially defined as a sleep disorder caused by the disruption of normal sleep cycles due to shift work, typically manifests as insomnia and excessive sleepiness [7, 8]. Early research by Regestein revealed that shift work not only disrupts sleep but also triggers broader systemic health problems by interfering with sleep patterns [17], laying the foundation for SWSD to be recognized as a formal sleep disorder. In 2000, the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) expanded the concept to include social and occupational impairments [18], acknowledging SWSD's significant impact on daily functioning. The International Classification of Sleep Disorders (ICSD) further refined the diagnostic criteria for SWSD. ICSD-2 (2005)

provided precise criteria, and ICSD-3 (2014) introduced stricter standards, requiring symptoms to persist for at least three months [19, 20], reflecting SWSD's multifaceted impact on physical and mental health. As research progressed, SWSD classifications became increasingly detailed. Gumenyuk (2015) proposed categorizing SWSD based on the presence of insomnia and/or excessive sleepiness, while Vanttola (2020) identified three subtypes: insomnia only, both insomnia and excessive sleepiness, and excessive sleepiness only [21, 22]. This classification highlights symptom variability among shift workers, underscoring the need for more personalized diagnostic and treatment approaches. In summary, SWSD has evolved from a focus on sleep disturbances alone to a multidimensional disorder encompassing impacts on health, social interactions, and occupational performance. The ICSD framework remains the primary basis for SWSD diagnosis and research (Table 2).

Defining attributes

The features or phenomena associated with a concept are referred to as the attributes of the concept, which help distinguish it from other phenomena [16]. Attributes of SWSD identified through the analyses included internal/external circadian rhythm imbalance, impaired sleep,

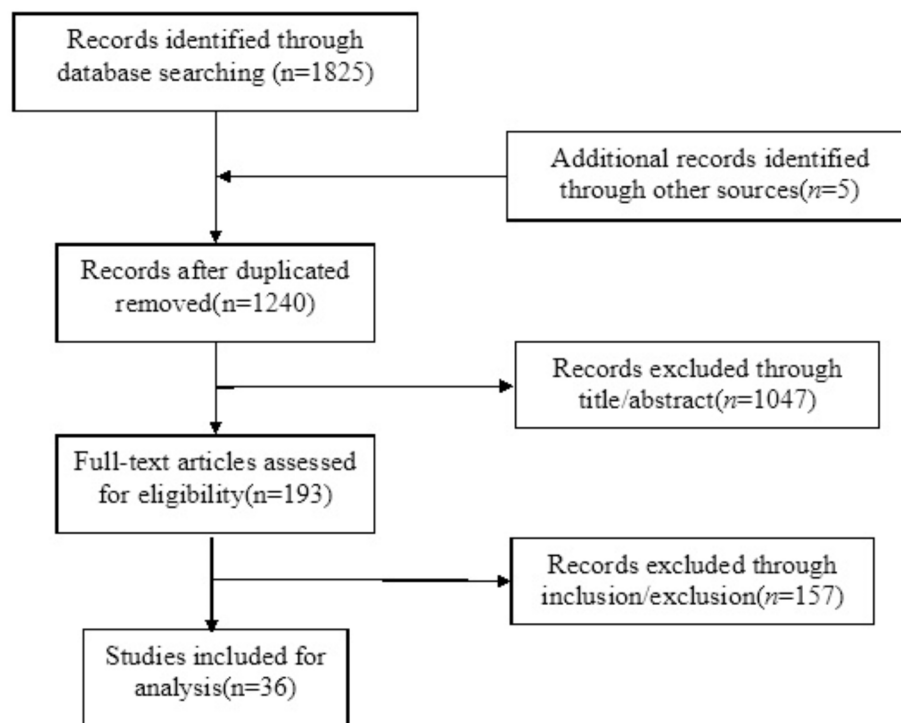


Fig. 1 Study selection process of the concept analysis

Table 2 Application and development of the Concept of Shift Work Sleep Disorder

Author/Year of Publication	Study Subjects	Definition
Regestein et al/1991 [17]	Shift Workers	The adverse sleep consequences caused by shift work is a kind of sleep disorder, that is to say, the adverse consequences of shift work are not only manifested in sleep problems, but also in physical and mental health, family and society.
DSM-IV-TR/2000 [18]	Shift Workers	SWSD refers to the circadian sleep-wake cycle disorder of shift workers, which is caused by the shift work time-related insomnia. The duration is at least 1 month, and it can affect social function and work.
Drake et al/2004 [23]	Community population	SWSD is the misalignment between shift work schedules and the body's natural circadian rhythm, resulting in symptoms of sleep deprivation, excessive daytime sleepiness, various health issues, and disruptions in family and social relationships.
ICSD-2/2005 [19]	Shift Workers	The diagnostic criteria for SWSD encompass the following elements: (1) individuals working shifts consistently report experiencing drowsiness and/or difficulty falling asleep due to their work schedule overlapping with their usual sleep time; (2) these aforementioned sleep issues are specifically linked to shift work and persist for a duration exceeding one month; (3) at least seven consecutive days of documented sleep patterns or activity records demonstrate disruptions in circadian sleep timing; (4) the presence of this sleep disorder cannot be attributed to other existing sleep disorders, physical or mental ailments, substance abuse, etc.

multidimensional health problems, and dynamic changes in symptoms.

Internal/external circadian rhythm imbalance

An imbalance between internal and external circadian rhythms represents a core characteristic of SWSD, arising from conflicts between work schedules and the body's natural sleep-wake cycle. Shift work misaligns the body's endogenous circadian rhythms with external environmental cues, disrupting the regulation of the suprachiasmatic nucleus (SCN) and the pineal gland. This misalignment ultimately leads to altered melatonin secretion patterns, often manifesting as reduced or shifted melatonin release [24, 25]. Gumenyuk's research reveals that, in night shift workers, peak melatonin levels are reached during the day rather than at night, causing a substantial misalignment between sleep cycles and work demands, which, in turn, contributes to poor sleep quality [26]. Additionally, studies indicate that night

shifts (starting after midnight) and early morning shifts (between 4:00 AM and 7:00 AM) are particularly disruptive to circadian rhythms, thereby exacerbating SWSD symptoms [27].

Impaired sleep

Impaired sleep is also a defining characteristic of SWSD among nurses, typically presenting as insomnia, excessive daytime sleepiness, and reduced sleep quality. Circadian disruptions and irregular melatonin secretion contribute significantly to these symptoms, as night shift nurses often experience heightened difficulty with insomnia and increased daytime sleepiness [28]. Insomnia in this context often includes challenges with sleep onset, sleep maintenance, and early awakening, all of which are commonly reported among shift-working nurses [29]. A study conducted in Spain found that 51.8% of nurses suffer from excessive daytime sleepiness, underscoring the prevalence of this symptom in shift-working populations [30]. Poor sleep quality is another common issue; numerous nurses report insufficient restorative sleep and frequent nighttime awakenings, which can have a deleterious impact on their health and well-being [31, 32].

Multidimensional health issues

Shift work, as a significant environmental stressor, disrupts circadian rhythms and affects hormonal balances closely related to metabolic processes. For example, the secretion of insulin and melatonin declines, while levels of dopamine and norepinephrine increase [33], potentially elevating risks for conditions such as diabetes, cardiovascular diseases, and cancer [1]. Studies indicate that circadian disruptions caused by shift work alter nocturnal melatonin and reproductive hormone levels in women, which has been associated with an increased risk of breast cancer [30]. Wyse's research further supports that shift workers have a higher prevalence of obesity, diabetes, sleep disorders, and mental health issues [34]. Additionally, a study observed that night-shift nurses tend to consume more snacks, sugary drinks, and alcohol, which correlates with higher incidences of diabetes, cardiovascular symptoms, and gastrointestinal problems [35]. Jaradat also identified elevated psychological stress among shift-working nurses, a factor linked to functional gastrointestinal disorders [36].

Dynamism of symptom changes

The symptoms of SWSD demonstrate dynamic variability, often fluctuating in response to changes in shift schedules. When shift workers discontinue shift work, adverse effects on sleep quality and overall health generally diminish. For instance, a study reported that the prevalence of SWSD among trainee nurses was 35.2% after three months and increased slightly to 37.7% after

six months of continuous shifts. After nine months, a two-week period of sufficient rest reduced the prevalence to 14.8% [37]. However, sleep-related symptoms tend to recur once shift schedules are reintroduced, highlighting the recurrent and chronic nature of SWSD in relation to sustained shift work.

Cases of SWSD

Model case

Maria, a nurse with 10 years of intensive care experience, works at least five-night shifts per month. After her shifts, she must care for her three-year-old daughter, and on her days off, she is often obligated to attend to additional commitments, such as teaching and exams. This demanding schedule resulted in a misalignment between her internal circadian rhythm and the external environment, manifesting as a decreased tolerance for night shifts, particularly from 2:00 a.m. to 5:00 a.m. During this time—her peak period of sleepiness—Maria was expected to stay awake. The combination of night shifts and insufficient rest contributed to a significant increase in nighttime insomnia and daytime sleepiness, which in turn limited her social activities and interactions. Over time, these disruptions led to multidimensional health issues, including sleep disorders, endocrine imbalances, and other health complications. Subsequently, Maria enrolled in a three-month mentorship training program organized by her hospital. This program resulted in notable improvements in her sleep quality and social relationships, as she was no longer required to work night shifts, demonstrating a positive shift in her health and well-being (dynamics of symptom change).

Contrary case

A contrary case, which lacks the core attributes of SWSD, is exemplified by James, an anesthesia nurse with 12 years of experience who works at least four-night shifts per month. Prior to his shifts, James takes a restorative nap of one to two hours, which enables him to manage night duties effectively. During shifts, he often takes a brief 30-minute rest between 3:00 a.m. and 5:00 a.m. After completing his night shift, he follows a structured rest schedule by sleeping from 9:00 a.m. to 1:00 p.m. and going to bed before 11:00 p.m., using blackout curtains and disabling his phone and alarm clock to maintain sleep quality. James reports no history of sleep disorders. On his days off following night shifts, he actively participates in social activities and attends to his children's needs, demonstrating effective adaptation to night shift work and seamless integration of this schedule into his lifestyle.

Antecedents

Antecedents are factors that trigger conceptual events. According to literature analysis, the occurrence of SWSD is based on shift work and arises due to various factors such as the circadian rhythm patterns of shift workers, the nature of the shifts, the number of shifts, and the shift patterns. Therefore, the occurrence of SWSD can be attributed to a variety of factors at both the individual and organizational levels.

Individual factors

Several individual factors contribute to nurses' sleep quality, including physical and mental health, lifestyle choices, sleep hygiene, and family support [38, 39]. Physical and mental health conditions interact with SWSD in complex ways. Prolonged exposure to shift work can impair physical health and increase negative emotions, which further deteriorate overall well-being and may even prevent shift workers from continuing their roles effectively [40]. During night shifts, lifestyle factors such as excessive eating, drinking, and caffeine intake can overstimulate the sympathetic nervous system, leading to heightened physiological stress [36]. Irregular sleep patterns, engaging in strenuous exercise before bedtime, and sleeping in uncomfortable environments are additional factors that can negatively impact sleep quality [41]. Family support and circadian rhythm type also play a significant role in a nurse's sleep quality. Circadian rhythms are typically classified into morning and evening types, with morning types showing poorer adaptability to shift work compared to evening types, who are generally better able to adjust to irregular schedules [38]. Furthermore, limited family support and the added responsibility of caring for children make shift workers more susceptible to developing SWSD [24].

Organizational factors

Organizational factors contributing to SWSD include shift type, the interval between shifts (e.g., rapid rotation), shift regularity, the number and duration of night shifts, and the lack of opportunities to nap during night shifts [2]. Rotating or night shifts disrupt the body's internal clock, making it challenging for individuals to adjust to irregular sleep schedules. Frequent and consecutive night shifts contribute to cumulative sleep deprivation, further impairing sleep quality. Irregular shift schedules, in which nurses frequently alternate between day and night shifts, impede the body's ability to establish a stable sleep pattern. Collectively, these organizational factors disrupt natural circadian rhythms and the production of sleep-regulating hormones, such as melatonin, exacerbating SWSD symptoms [41].

Consequences

Consequences are events that occur as a result of this concept, they can manifest in aspects such as nurses' physiological health, psychological well-being, social adaptation, and nursing work.

SWSD on nurses' physiological health

Shift work, as an environmental stressor, disrupts synchronization between the body's internal biological clock and external circadian rhythms, leading to sleep-related issues such as insomnia and excessive sleepiness [22]. This misalignment also impacts metabolic hormones, decreasing insulin and melatonin levels while increasing dopamine and norepinephrine, thereby elevating risks for diabetes, cardiovascular disease, and cancer [30]. Molzof's survey indicates that nurses consume snacks and sugary drinks more frequently during night shifts, which significantly raises the incidence of diabetes, cardiovascular complications, and gastrointestinal disorders [35].

SWSD on nurses' mental health

Individuals with SWSD commonly experience fatigue, decreased alertness, and cognitive impairment during night shifts. They also often face insomnia and difficulty falling asleep after night shifts, which can lead to adverse emotional states, including anxiety and depression [36, 39]. Research indicates that prolonged exposure to night shifts elevates the likelihood of these negative emotional outcomes, with shift nurses facing a 1.5 times higher risk of depression compared to non-shift nurses [42].

SWSD on nurses' social adaptability

Irregular work schedules and night shifts often misalign nurses' social time with that of family and friends, leading to social isolation [1]. Shift work can also conflict with childcare and family responsibilities, creating additional strain. Furthermore, prolonged shift work has been linked to deteriorating mental health, with increased levels of anxiety and depression making social interactions more difficult [43].

SWSD on nursing care

Sleep disorders related to shift work impair nurses' performance and compromise occupational safety [1]. Working more than 12 h a day or over 40 h per week significantly raises the risk of occupational hazards [44]. Performance notably declines between 4:00 and 8:00 a.m., during which medical errors increase. Nurses working shifts longer than 12 h show reduced vigilance, doubling their risk of medical errors compared to those on shorter shifts [12]. Additionally, SWSD negatively impacts job satisfaction. Studies indicate that as shifts transition from day to permanent night duty, both sleep quality and job satisfaction decline [45]. Shift nurses also experience

greater effort-reward imbalances, heightening stress and potentially leading to poorer nursing outcomes.

Empirical referents

Empirical referents are methods used to assess a concept's definition, attributes, and characteristics [15]. A literature review reveals that no comprehensive instrument currently captures all attributes of SWSD. The Bergen Shift Work Sleep Questionnaire (BSWSQ) is commonly used to evaluate insomnia symptoms among nurses engaged in shift work [46]; however, it cannot definitively attribute these symptoms to shift work alone, necessitating further validation. The Pittsburgh Sleep Quality Index (PSQI), widely utilized internationally to assess sleep quality and disturbances [47], is effective in diagnosing sleep issues yet does not account for sleep patterns across different shifts and may not be suited for specific sleep disorders in shift workers. Other scales, including the Epworth Sleepiness Scale, Stanford Sleepiness Scale, and Karolinska Sleepiness Scale, measure sleepiness levels but have limited capacity for detecting underlying sleep disorders [48]. Additionally, tools like the Athens Insomnia Scale and the Insomnia Severity Index are useful for identifying insomnia and assessing intervention efficacy but lack sufficient specificity for SWSD [49]. Thus, further research should focus on developing instruments that comprehensively measure SWSD's characteristics and severity in the nursing context. A universally validated tool would improve nurses' awareness of SWSD and foster broader discussions on this issue within the nursing profession.

Definition of the concept

Combining the analysis of the prerequisite conditions, attribute characteristics, influencing factors, adverse consequences, and related case introductions and analyses for SWSD, the concept of sleep disorders in nurses working shifts can be defined as a phenomenon that adversely affects the sleep and health of shift nurses, which is influenced by shift patterns, frequency, and duration, as well as lifestyle, family support, and sleep hygiene. Shift work is a prerequisite for SWSD, sleep disturbance is a core conceptual attribute, and impaired physical and mental health is an endpoint. A conceptual model is shown in Fig. 2.

Discussion

In previous literature, the phenomenon of SWSD has been examined using terms like insomnia, hypersomnia, and shift tolerance [41]. However, the inconsistency of these terms has become a major obstacle to understanding SWSD, particularly in the context of nursing. This study addressed this issue by systematically analyzing SWSD in nurses, explicitly focusing on its conceptual

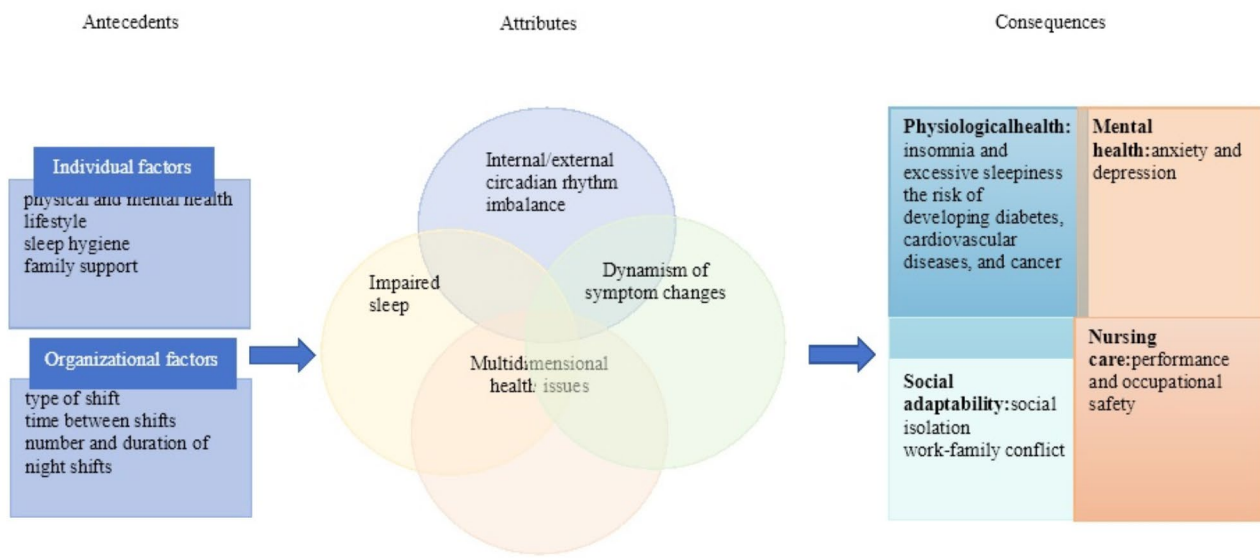


Fig. 2 The antecedents, attributes and consequences of SWSD

definition, key attributes, antecedents, and consequences. Through a concept analysis, the study provides a clearer understanding of the underlying factors of SWSD, offering valuable insights that inform both theoretical development and clinical practice.

SWSD cannot simply be viewed as insomnia or daytime sleepiness. The findings of this study clarified the conceptual boundaries of SWSD, identifying four key attributes that collectively define its unique profile: mismatch of internal/external circadian rhythms, impaired sleep, multidimensional health problems, and the dynamics of symptom change. These attributes contribute to a holistic understanding of the disorder, differentiating SWSD from other sleep disturbances and situating it within the specific demands of nursing practice.

The misalignment between internal circadian rhythms and external work schedules is a core factor contributing to the onset and persistence of SWSD. This study emphasizes that understanding this mismatch is critical to addressing the root cause of SWSD and developing targeted interventions, such as circadian-based shift scheduling or light therapy [50]. Impaired sleep—whether as difficulty falling asleep, maintaining sleep, or experiencing non-refreshing sleep—has cascading effects on nurses' performance and well-being. Both the quality and quantity of sleep are compromised, directly impacting nurses' ability to deliver high-quality patient care. This highlights the importance of interventions like Cognitive Behavioral Therapy for Insomnia (CBT-I) and improved sleep hygiene practices [51, 52]. However, SWSD extends beyond poor sleep; it also disrupts other aspects of

health, such as cognitive impairments, emotional disturbances, and an increased risk for cardiovascular diseases, gastrointestinal issues, and occupational hazards like needlestick injuries [5].

These multidimensional impacts underline SWSD's profound implications for nurses' physical and mental health, necessitating holistic management strategies. Furthermore, the symptoms of SWSD are dynamic, varying in intensity and type depending on external stressors and changes in work schedules. Thus, the findings of this study emphasize the importance of adopting more flexible and adaptive strategies for managing SWSD symptoms.

Examining the antecedents of SWSD in nursing gives insight into why nurses frequently confront this disorder frequently. Antecedents were categorized into individual and organizational factors, both of which offer actionable intervention points. From the individual perspective, nurses can adopt better sleep hygiene practices, such as maintaining a consistent sleep schedule even on days off and creating a sleep-friendly environment at home. CBT-I is beneficial for those with sleep problems [51]. Nurses should also consider lifestyle changes such as regular exercise and balanced nutrition. Family support can also play a crucial role, such as synchronizing sleep schedules with family members or arranging external care for children when needed [53]. From an organizational perspective, managers should implement more humane scheduling practices, such as avoiding fast shifts and providing fixed shifts for long periods of time. Providing specialized rest areas and allowing short

naps at night can alleviate the acute symptoms of SWSD. Organizations should also consider emotional wellness programs to help nurses cope with work-related stress, which can be achieved through counselling services or stress management workshops [41]. By addressing these antecedents systematically, both individuals and organizations can mitigate the onset and impact of SWSD.

The study also highlights the consequences of SWSD, including impaired sleep, reduced work performance, and long-term health issues. By explicitly linking these consequences to nursing practice, the findings underscore the urgency of addressing SWSD as both an individual health challenge and an organizational priority. Recognizing the intricacies of SWSD can prompt healthcare organizations and nurses to proactively address the issue, opening avenues for systemic reform and individual lifestyle adjustments. For example, educating nurses on proper sleep hygiene and fostering an organizational culture that emphasizes wellness can mitigate SWSD's detrimental effects while improving the overall healthcare environment [54, 55].

The results of this concept analysis emphasize the vulnerability of nurses to SWSD, manifested through impaired sleep, reduced work performance, and long-term health issues. Recognizing the intricacies of SWSD can prompt healthcare organizations and nurses to proactively address the issue, opening avenues for systemic reform and individual lifestyle adjustments. Strategies such as educating nurses on proper sleep hygiene, implementing more humane scheduling practices, and fostering an organizational culture that emphasizes wellness can not only mitigate the negative aspects of SWSD but also serve as a catalyst for broader improvements in healthcare delivery and employee well-being [41]. Thus, while SWSD inherently carries detrimental implications, it also offers an opportunity to address a pervasive issue within the healthcare sector. By understanding its underlying causes and implementing appropriate interventions, SWSD can be transformed into an opportunity for both individual and organizational growth.

This study systematically analyzed the concept of SWSD and developed a conceptual model through a comprehensive review of related literature. The model identifies key elements of SWSD, including circadian rhythm misalignment, impaired sleep quality, multidimensional health issues, and symptom dynamism. By clarifying these essential attributes and providing an operational definition, the study establishes a foundation for the development of reliable measurement tools and intervention strategies.

Limitation

This study has several limitations that should be acknowledged. First, while Walker and Avant's concept analysis

framework provided a systematic approach, it lacks specific criteria for assessing the quality of included literature, which may have implications for the reliability of the findings. Second, due to language constraints, only English and Chinese literature were included, potentially omitting relevant studies published in other languages and thereby limiting the comprehensiveness of the analysis. Finally, it is important to consider that nurses across the globe experience different working conditions such as type of shifts, intervals between shifts, regularity of shifts and work-related stress, all of which can affect the prevalence and severity of SWSD. In addition, individual factors such as personal health, lifestyle choices and family support systems further complicate the issue. These limitations underscore the need for future research to address these methodological and contextual complexities.

Conclusion

Nurses' SWSD is a serious threat to their physical and mental health and increase nursing safety risks. Core attributes of SWSD include internal/external circadian rhythm imbalance, impaired sleep, multidimensional health problems, and dynamic changes in symptoms. SWSD for nurses are severely challenged by individual and organizational factors. Establishing healthy sleep habits, obtaining family support and implementing a rationalized shift system by managers can have a positive effect on addressing sleep disorders in shift nurses.

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Author contributions

Y.L. and Z.H. wrote the main manuscript text and L.J. and Y.X. prepared Figs. 1 and 2; Table 1, and 2. All authors reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This study does not involve experimental research on humans or animals, and therefore does not require traditional ethical approval or participant consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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