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PHYSIOLOGICAL IMPACT OF SHIFT WORK ON NURSES

A literature review

ABSTRACT

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Physiological impact of Shift Work on Nurses.
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This study aimed to examine the physiological impact of shift work on nurses. And figure out coping strategies to manage health challenges caused by shift work. The study uses qualitative literature review method to synthesize the findings of 15 articles. Inclusion was limited to articles relevant to the topic while articles focusing on shift work specific to other professions were excluded.

Shift work, particularly in healthcare settings, involves irregular and non-standard working hours. This includes night shifts, rotating shifts, or long working hours. Previous studies have demonstrated that shift work disrupts the body's natural circadian rhythm, resulting in physiological effects.

Findings show that nurses' physiological health is affected by night and shift work. Impacts such as cardiovascular disease, diabetes, obesity, pain complaints, and fatigue were identified. Long-term impacts of shift work on nurses, including an increased risk of cancer, diabetes, and cardiovascular disease, were discussed. Coping strategies, such as providing healthy snacks in breakrooms to improve nutrition and exercising, were suggested.

The study highlights the need for interventions targeting individuals and Institutions. Flexible scheduling options, and employer support for nurses' wellbeing. Improving work environments and providing nutritional education. Implementing programs that increase worker awareness. Individual approaches include improving sleep, exercising, eating healthy, and relaxing. Integrating these coping strategies into nurses' routine care can improve their health. Leading to better job satisfaction and patient care.

Keywords: Coping, Circadian rhythm, Nurse, Physiological impacts, Shift work.

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1 INTRODUCTION

European countries face a nurse shortage, and the elderly population is on the rise. This strains the healthcare system. Healthcare work, in hospitals or care facilities, can be physically and mentally demanding. In previous studies increased physical exertion during work linked with health risk. An increase in developing and sustaining musculoskeletal disorders and long-term sickness absences. (Andersen et al., 2020). Taking care of patients and their loved ones can be difficult when the nurse is sick. Nurses' work is rewarding in many ways, but also stressful. As a nurse, you can help patients and their loved ones better when you are healthy. By taking care of yourself and managing your work and life effectively, you increase your well-being. (Suomen Sairaanhoitajat, 2023).

Shift work is linked to biological functions changes. Physiological responses result in physical and mental health problems. Sleep disturbance is the result of desynchronization between the light and dark phases. This, in turn, affects physical and psychological wellness and work performance. (Revasta Latino, 2018). Shift work and sleep disturbances affect health. Hospitals need shift work for care continuity. Nurses are among the professionals who must adhere to this form of labor organization as they provide care 24 hours. Considering this, nurses should recognize the implications of working a variety of shifts. Also consider countermeasures to increase workplace tolerance. It is possible to reduce the physiological impacts of shift work by taking measures. (Berger A & Hobbs B, 2006).

Most workers cannot avoid rotating shifts or working at night. This thesis focuses on nurses. This thesis study contributes information on potential physiological health effects on nurses. It also suggests ways of coping with shift work individually and as an organization in nursing.

2 PHYSIOLOGICAL IMPACT

2.1 Physiological Impact

Changes in core temperature rhythms, hormone levels, immune function, and activity rest cycles are among the physiological impacts (Berger, et al., 2006).

The circadian system regulates behavioral and physiological processes. As a result, the body can adapt to changes in the environment. Daily glucose metabolism depends on it. Researchers say glucose homeostasis is a physiological process controlled by the liver, pancreas, muscle, adipose tissue, and gut. (Qian, 2016).

2.2 Shift Work

Shift work has numerous definitions, which make comparisons difficult. The following are some categories. Shift work schedules come in many options. The term 'shift work' refers to working outside of daylight hours. In other words, outside from 7 a.m. to 6 p.m., during which most people spend seven or eight hours. Depending on the shift, shift workers may work evenings, nights, overtime, or extra-long hours. Occasionally, they may also work regular days. Shift workers often rotate between daytime and evening or daytime and night-time work schedules. Week or month dates may vary (CDC, 1997).

The shift work cycle disrupts biologic rhythms (circadian rhythms) affected by the light and dark cycles. As a result, it disturbs the synchrony between the body's internal clock and the environment. Often, these disruptions cause problems. Mammalian circadian clock has adapted to the 24-hour day and night cycle. Since the circadian clock regulates neuronal, metabolic, and hormonal functions, night shift work can have a big impact. Night shift work interferes with the body clock system and affects metabolism and cardiovascular health. (Skogstad et al., 2023). Nurses must understand the implications of working various shifts and consider countermeasures to improve shift work tolerance (Berger, 2006).

2.3 Shift work in Nursing Context

Unlike other workplaces, hospitals and long-term care facilities run continuously. As a result, working in them is unique. Caregiver must be available every second, minute, and hour. The nature of a facility dictates different shifts. In these facilities, nurses can work morning, evening, night, weekends, swing shift, or on call. Nurses typically work 8-16 hours per shift. (Joelle Y, jean,2023)

The Working Hours Act defines overtime as working hours that exceed the regular weekly work schedule. However, overtime only applies when the employer approves work done beyond normal working hours on his own initiative. An extended work schedule of 10-12 hours per shift within a regular 40-hour week. As defined in the Working Hours Act, it is work between agreed working hours and the maximum number of regular working hours. (Tyosuojelu,2022)

Healthcare settings practice shift work, rather than eight-hour workday. Other relevant terms include fixed shift, rotating shift and alternating between different shifts. (Andersen, 2005).

In Finland, working time is arranged so that it is a maximum of 120 hours in a three-week period or a maximum of 80 hours in a two-week period. Shift work can only be used for law-regulated work. (Working Act,2019)

Short shift intervals in shift work can cause sleep deprivation and stress for employees. As a result, it would be in violation of the Health and Safety at Work Act. Finnish law requires at least an 11-hour break between shifts to ensure adequate rest. Exceptions can be made to work requirements. Finnish care sector workers experience short shift intervals. Finland has had steady short shift intervals for a decade. Women, particularly those under 25, experience more than men. A study by the Finnish Institute of Occupational Health examines the health risks associated with shift work. It involves evening and night work and irregular hours. There are usually not enough recovery times between shifts. According to a study published in 2022, women over 50 who work shifts in social welfare and health care are twice as likely to develop breast cancer. Besides, frequent night shifts might raise your risk of heart disease and stroke. Earlier studies have shown that shift work increases sickness absences and accidents. (FIOH,2022)

3 ALLOSTASIS THEORY

3.1 Allostasis Theory

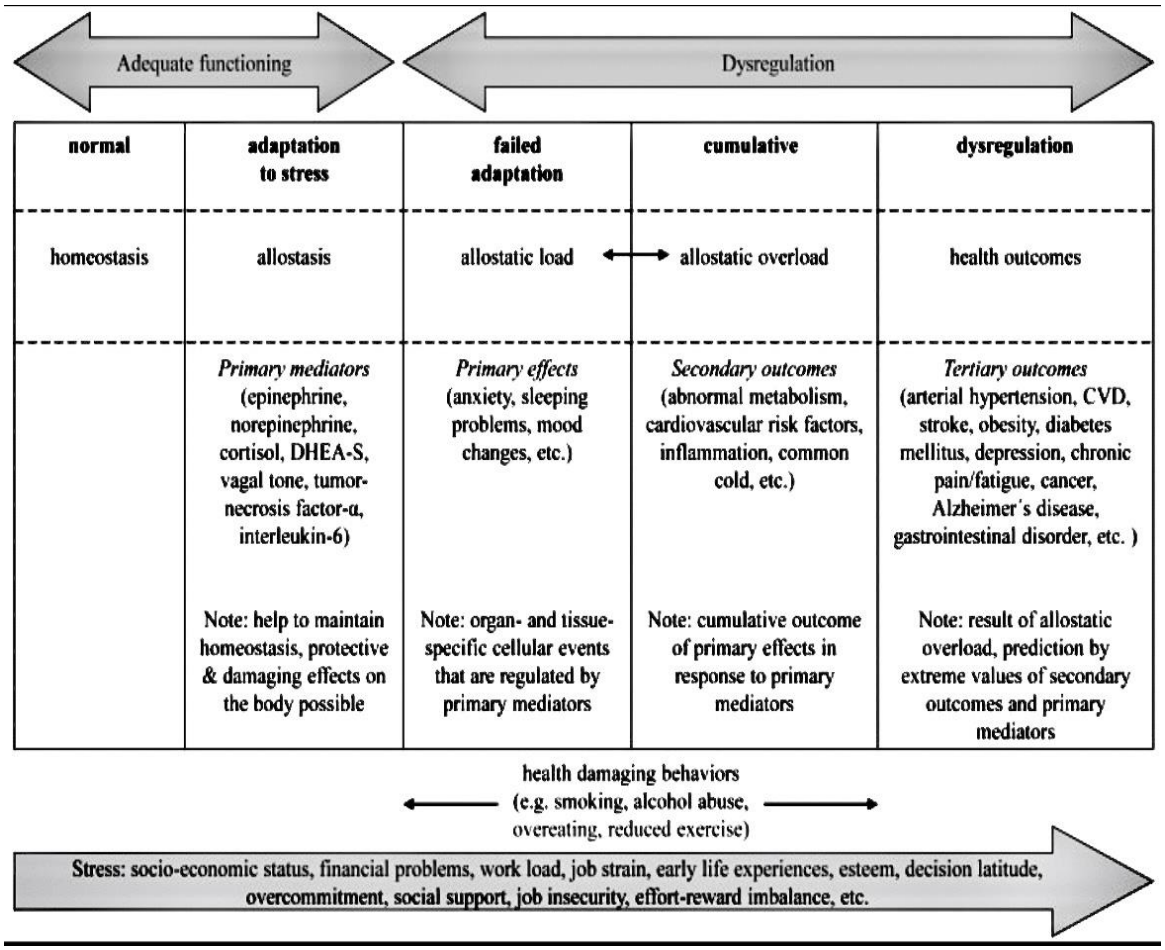
In physiological terms, allostasis refers to the process of supporting stability within an organism. Adapting internal environment parameters in response to its environment. (McEwen, 2003). Most industries, including healthcare, require shift workers. Health care workers can suffer negative physiological effects from shift work, even though it is necessary for operational reasons. Shift work effects on nurses can be explained using the Allostasis theory. This chapter will provide an overview of the Allostasis theory.

Adaptation of complex physiological systems to physical, psychological, and environmental challenges is called allostasis, which is an extension of homeostasis. Homeostasis refers to the state of being relatively stable inside an organism due to the regulation of homeostasis. It is critical to note, however, that many physiologic responses, such as hormones, temperature, and blood pressure, vary in response to perceived challenges. Allostasis continuously evaluates and adapts physiological needs. Allostasis accounts for normal fluctuations in a dynamic biological system. Despite being very similar to homeostasis, allostasis emphasizes flexible adaptation to changing environments. When the body system is in allostasis, more variability means that the internal environment can accommodate a wide range of environmental challenges. An allostatic load occurs when allostatic processes cease to function or fail to disengage, therefore, physiological systems cannot adapt. (Logan et al., 2008).

A revolutionary paradigm for health and illness is appearing in nursing science. Allostasis illuminates several issues nurses have tried to understand for years. For nurses working with stressed or vulnerable populations, allostatic load is a key concept to understand. With the help of an interpretable allostatic load index, nurses can intervene at the various stages of allostasis adaptation. As a result, interventions can also be adapted accordingly. (Groer et al., 2012).

3.2 Key Concepts

Allostasis: Allostasis evaluates and adjusts biological needs as needed. Biological systems are dynamic and allostasis takes these variations into account. Allostasis resembles homeostasis. It emphasizes the process of adapting to environmental change. Homeostasis maintains system balance. It also allows the internal environment to respond to challenges. Allostatic load: Allostatic load occurs when allostatic processes fail to shut off. Physiological systems cannot adapt as a result. Chronic challenges dysregulate several major physiological systems. Stressors: A stressor is an event, or set of events, which threatens an individual. Changes in physical and behavioral characteristics occur due to stressors. Chronic stress impacts brain function and coping abilities. To enhance coping and adaptation, strategies must be implemented. Stress is associated with cardiovascular disease. Few have explained how stress affects health. Stress-induced physiological responses can be explained by allostasis and allostatic load. Adaptation: The process of coping with stressful situations or changing environments. Adaptation to stress and chronic illness is linked to cardiovascular disease biomarkers. When adaptation mechanisms are insufficient, compensatory mechanisms are activated to meet the challenge. Intervention: Interventions aim to increase resilience and enhance health outcomes. Management of physiological responses can prevent chronic diseases. The development of brain resilience and health can also improve health outcomes. Stress and allostatic load can be managed by changing behaviors. Improving sleep and physical activity can improve cardiovascular function, memory, and mood. (Logan et al., 2008)



(Figure 1 Allostasis process. Mauss et al., 2015)

4 PURPORSE AND OBJECTIVES

This study aims to examine the psychological impacts of shift work. It also seeks determine how nurses cope with health challenges caused by working shifts.

Research questions are: What is the physiological impact of shift work on nurses? How can nurses cope with shift work's health challenges?

5 METHODOLOGY

A qualitative literature review examines published qualitative research on a specific topic. This involves selecting, evaluating, and identifying qualitative studies based on pre-defined criteria. By synthesizing the findings, it provides a comprehensive understanding of what's known. This involves highlighting recurring themes, patterns, and gaps. Reviews ensure unbiased, transparent, and replicable analysis. By doing so it leads to novel insights, theories, and conceptual frameworks (Elo & Kyngäs, 2008).

5.1 Data collection

The study answered the research questions with existing data. The data focused on the physiological impact of shift work on nurses' health. Literature searches were conducted in the CINAHL, PubMed, ProQuest, and MEDLINE databases. Search terms were derived from the thesis topic and research questions. The search terms were (physiological effects or impacts or physical impacts or health) AND (shift work or night work or rotating shift work) AND (nurse or nurses or nursing or nursing staff or health care professional) AND (adaptation or adjustment or coping or strategies) AND (duration or length or time) AND after 10 years. The search was limited to studies published between 2013 and 2023. The limit of 10 years was chosen to get current information. The search strategy and selection process are presented in the flow diagram in (Figure 2). The selection process was done in steps. Selection of articles to be reviewed was based on inclusion and exclusion criteria. Each database was searched using the same search terms.

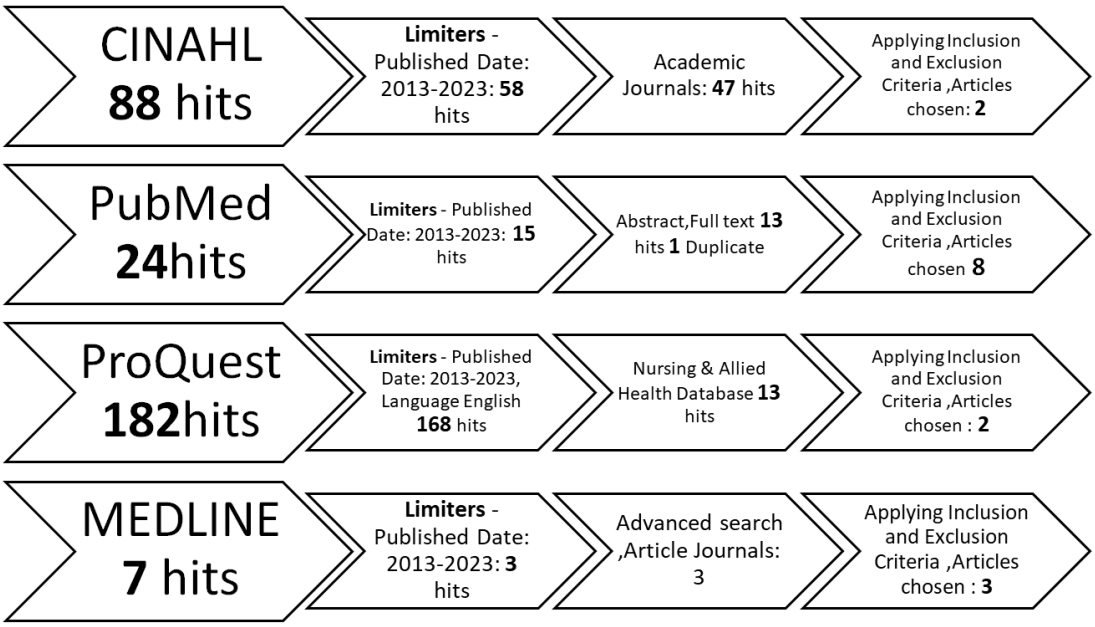


Figure 2 Data collection and selection flowchart

Inclusion and exclusion criteria

It is based on these criteria that an article pool is established, and a practical review is made.

Table 1Inclusion and Exclusion

Inclusion	Exclusion
Articles that focus on physiological impacts of shift work on nurses and articles that included healthcare professionals and impact of shift work on nurses after working in health care for several years	Articles focusing on shiftwork specific to other professional fields
Academic articles	Duplicate articles
Published in English 2013–2023	Language other than English
Relevance to the topic	Articles which were not freely available
Free Full text articles.	

Through the database searches, in total 301 original studies were found. After duplications were excluded (300) remained. The studies were then screened by date and (243) remained. After Academic journals, Abstract, Full text, Nursing & Allied Health database in ProQuest, Advance search in MEDLINE (76) remained. Finally, after Inclusion and Exclusion criteria (15) remained.
A list of the selected 15 articles is included in the appendix 1.

5.2 Data analysis

Data analysis was conducted using deductive content analysis. This is often used when researchers wish to retest existing data in an entirely different context. In deductive content analysis, the organization phase involves the development of categorization models. To illustrate the identified categories, the data is coded and reviewed for content. When the categories represent the concepts in the categorization matrix it is valid. The categorization matrix captures what was intended. (Elo & Kyngäs, 2014)

After choosing deductive content analysis, a few main categories were chosen as the first physiological impacts of shift work. Second, coping strategies. This were guided by the research questions related to the topic. To analyze the data, a structured matrix was created. Since the study is based on literature reviews, the study aims to retest the existing data with the chosen categories. Finding out the physiological impacts of shift work on nurses. (Elo & Kyngäs, 2008)

After developing a categorization matrix, the study reviewed data for content. Then each category was coded in correspondence with the identified categories. As shown in table 2 below. Only data categories that fit the categorization framework were used in the study. Alternatively, this is called testing categories, concepts, models, or hypotheses. (Elo & Kyngäs, 2008)

The data was categorized into significant physiological impacts on nurses. Especially those who have been working shifts for a long time. Found impacts are categorized into acute health effects and long-term effects. Acute health effects include pain complaints and hormone changes. Poor sleep quality, and fatigue. Obesity and cardiovascular disease. Circadian rhythm disruption and increased risk of cancer, and diabetes.

To overcome these challenges, the data shows that interventions were implemented that target both individual interventions that include regular physical activity and healthy lifestyle behaviors. Providing rest opportunities during shifts and individualized scheduling. Monitoring to improve sleep quality.

Interventions targeting all nurses include flexible shift scheduling and shift duration. Additionally, policies that promote shift workers' health and education programs.

Table 2 Summary of data analysis

Main category	physiological impacts of shift work		Coping strategies	
Generic category	Acute health impacts	Long term health effects	Interventions targeting individuals.	Interventions targeting all nurses.
Sub-category	Pain complaints Sleep Quality Changes in hormone levels Fatigue	Obesity Cardiovascular disease Circadian rhythm Increased risk of developing cancer	Lifestyle behaviors Rest opportunities during shifts. Individualized scheduling and monitoring for improving sleep quality. Regular physical activity Good nutritional intake Uninterrupted meal timings	Duration of shiftwork Flexible shift scheduling Work organization Policies to promote the health and well-being of shift workers. Education programs that prioritize the health and well-being of shift workers.
Articles	2,3,4,5,6,7,9,15	4,8,10,11,12,14	2,4,5,6,7,9,12,15	1,3,6,8,9,11,12,13,14,

6 RESULTS

During the reporting phase, results are categorized based on their contents. This is achieved by describing the phenomenon using a selected deductive approach (Elo & Kyngas, 2018).

From the data analysis the following content was categorized. Based on the deductive analysis of 15 articles, several key findings emerged. As a result of the analysis, nurses' physiological health is affected by night and shift work. Nursing interventions can help nurses manage their well-being and health. Coping strategies were also identified to support nurses doing shift work.

6.1 Physiological Impact of Shift work on Nurses

A review of the articles revealed that shift work can affect nurses' health, especially after extended shift work. Cardiovascular disease, diabetes, obesity, and pain complaints are among these impacts. Shift work can disrupt eating patterns, causing fatigue, impacting nurses' health.

6.1.1 Acute health impact

The term acute effects refer to physiological reactions in the human body that occur within a short period of time. This is due to exposure to substances or circumstances. In this chapter, the immediate physiological effects of shift work are explained. (Safeopedi, 2022)

Pain complaints.

In 2020, Katsifaraki et al., found out that some nurses complained of headaches if they worked night shifts with a short break between them. Also, lower extremity pain was reduced associated with night shifts. This finding shows a lower activity level during nightshifts than morning shifts. Although the association was significant, headache risk was higher after three days of night shifts.

Three days of morning shifts showed a lower headache risk. The risk of upper-extremity pain was reduced after a quick return from an evening shift to a morning shift.

There was no interaction between shift type pain positions. On workday 3 for night shifts, headaches were more likely to occur than on workday 2. When sleep duration was considered, the risk was reduced. There was no conclusive evidence to support the theory that pain is more likely to occur after a quick return than after a morning shift. Shift changes between evenings and mornings did not induce or aggravate pain complaints.

Sleep quality

According to Azmi et al. (2020) shows that poor sleep quality influences shift workers' eating behaviors. It increases their appetite late at night, which results in obesity. Sleep deprivation alters leptin and ghrelin, raising night appetite. Shift workers' appetite may also be influenced by factors other than hunger.

Li et al., (2016) examined the impact of shift work and sleeping difficulty on type 2 diabetes risk. Also analyzed sleep quality, snoring and sleep apnea in association with shift work. The researchers concluded that sleep continuity plays a crucial role in human physiology. Further, the study shows that high risk of diabetes is associated with other sleep disorders, suggesting that these conditions may exacerbate each other's negative effects.

Shi et al., (2022) conducted a study on rotating night shift work and healthy aging after 24 years. The researchers followed nurses' health over time. Study concluded that long-term shift workers had less sleep duration and were more likely to experience health effects.

Hormonal levels change.

Gromadzińska et al., (2013) found that women before menopause are protected from reactive oxygen species. This is because estrogens play a crucial role as endogenous antioxidants. Shift work affects oxidant-antioxidant balance and oxidative stress. The study included 136 nurses who worked rotating night shifts and 126 nurses who worked regular day shifts. In the study,

postmenopausal nurses were found to have higher erythrocyte and plasma glutathione peroxidase (an enzyme that protects the body from oxidative damage) activities and vitamin E levels. Those working day shift compare with premenopausal women.

The study concluded that lower glutathione peroxidase in plasma results from oxidative stress. This was associated with lower estrogen concentrations and light exposure during the night in postmenopausal nurses. Evidence indicates that exposure to light at night may alter antioxidant levels in female shift workers. Melatonin operates as an antioxidant in the body that regulates its circadian rhythm.

Several studies have concluded that light exposure at night suppresses melatonin synthesis. It decreases glutathione peroxidase activity and inhibits other enzymes in the antioxidant pathway. Gromadzikas study supports an association between exposure to light at night and altered antioxidant levels in female shift workers.

Previous research shows nurses who work night shifts are exposed to light at night. As a result, melatonin production is suppressed. There is also a possible correlation between this suppression and an increase in estrogen levels. Increases in estrogen may inhibit melatonin synthesis. It is suggested that night-shift workers are at increased risk of breast cancer due to this biological mechanism.

Reszka et al. (2013) analyzed the impact of rotating night shift work on circadian gene expression in peripheral blood leukocytes. AMT6s, a melatonin metabolite, did not differ between shift-work and daytime nurses. AMT6s results of shift-work nurses were likely to be affected by sleep the night before sampling. The results of this study are in line with a previous study in which a decrease in AMT6s was only associated with eight night shifts a month.

Fatigue

The health consequences of shiftwork are numerous. They include fatigue, sleep disturbances, cardiovascular diseases, and obesity. (Azmi, 2020). Previous studies compared nurses working night and day shifts. Moreover, risk

factors predisposing nurses to poor health were investigated. Compared to day shift workers, nurses engaged in rotating night duties reported more chronic fatigue. As a result, Azmi et al. Concluded that fatigue in shift workers may explain their inability to prepare healthy meals. They instead substitute industrial snacks, fast food, and sugary treats.

Thompson (2019) examined the effects of cumulative work shifts on fatigue among hospital nurses and aides. To participate in the study, participants worked three 12-hour shifts. The results showed that three consecutive 12-hour nursing shifts impaired reaction times, decreased muscle function, and caused attention lapses. Also, muscle function assessments were sensitive to nursing work fatigue from a single 12-hour shift to the end of the third shift. Vigilance-based reaction time measures showed progressive impairment from the end of the first shift to the end of the third shift. After one 12-hour shift, these assessments were reduced due to early impairment in the work cycle.

6.1.2 Long term impact of shift work

Long-term, a demanding work schedule can affect health. Demanding schedules can also aggravate an existing health concern. (Rosa R, Colligan M,1997)

Cardiovascular disease

According to Bigert et al., (2022) night and shift work are associated with cerebrovascular disease among healthcare workers. Results showed that nurses with shift work and those with only night shifts were at risk cerebrovascular disease after a year. Also, employees with consecutive night shifts had greater stroke risk. Then those with fewer consecutive night shifts.

Obesity

Shi et al., (2022) report that a previous study confirmed the link between night shift work and overweight and obesity. According to Shi et al. Findings, obesity might play a significant role in the association between shift work and healthy aging.

According to Kim et al. (2013) increased shift-work duration is associated with obesity among shift-working nurses. Workers who do not work shifts exercise more than those who do. There are several factors associated with obesity. This includes age, current smoking status, marital status, income, education, and sleep issues. Nurses may be at higher risk of obesity due to irregular eating patterns and lack of access to healthy food during their shifts.

Circadian rhythm

A study published in Bigert et al., (2022) indicates that night shift frequency is significant components of cerebrovascular disease risk. Researchers have confirmed that circadian rhythm misalignment amplifies metabolic dysfunction. This leads to weight gain. Azmi et al. (2020) revealed that metabolic dysfunction results in weight gain. After late night, the biological clock switches to energy-restricted mode. Nurse eating patterns may be affected by shift work, which may lead to nutrient imbalances and long-term health problems.

The findings of Minelli et al. (2021) state that cortisol output during night shifts is higher among morning chronotypes. Thus, contributing to circadian misalignment between biological and working rhythms. As well as dysfunctional coping styles at work. Furthermore, higher diurnal cortisol secretion during leisure days is associated with higher cortisol secretion. On non-workdays for individuals with higher cortisol secretion during shifts. A significant increase in self-reported sleep duration and quality as well as wellbeing ratings was noted among extreme chronotypes. As a result of misalignment of physiological function, sleep loss and a disruption of circadian rhythm occur. (Vetter et al., 2015).

As compared to rotating day workers, Reszka et al., (2015) found that alternating night shift workers exhibit higher circadian gene expression. But they did not find significant changes in gene expression among nurses who worked night shifts compared to day shift nurses. There was no association between circadian gene expression and rotating night shift work. According to the results, nurses working rotating night shifts did not show significant changes in circadian genes. As a result, human circulating leukocytes do not exhibit circadian gene expression due to alternating night shift work.

Increased risk of cancer

A study by Manouchehri et al., (2021) found that night shift workers had a higher risk of breast cancer. In the analysis, flight attendants on long overnight flights had elevated breast cancer risk. But unmeasured confounders limited these results. Short- and long-term night-shift workers have a higher breast cancer risk.

Diabetes

A study conducted by Li Y, Gao X, et al., (2016) found that shift work and sleeping difficulties were associated with type 2 diabetes. In a way that was more than additive, risk increased. This implied that women with insomnia who worked in shifts were more likely to develop diabetes than women with other risk factors. Results have shown that shift workers are at risk of metabolic disorders, including type 2 diabetes. Due to sleeping difficulties. Insulin resistance, high blood sugar levels and poor sleep may contribute to type 2 diabetes. Vimalananda et al., (2015) found a higher risk of incident diabetes among African American women working long night shifts. The fact that the association remained, even after adjustment for lifestyle and BMI, suggests that other pathways, such as disruption of the circadian system, may be involved. People who work night shifts for a long time are more likely to develop type 2 diabetes by 23%. Shift work and diabetes were associated more strongly among younger women than with older women. The association between years of shift work and diabetes was stronger among younger women (50 years of age). There is a possibility that shift work may have a significant effect on younger women with a lower diabetes risk. This is because their effects are easier to detect.

6.2 Coping Strategies

The concept of coping strategies encompasses cognitive and behavioral efforts. Efforts to manage specific external or internal demands exceeding individual resources. (Ganjiwale et al., 2016).

Shift work is prevalent in various occupations, including healthcare. Effective coping strategies are needed to mitigate shift work's adverse impacts on nurses' health.

Intervention targeting individuals and specific groups.

According to Kim et al., (2013) female nurses who work long shifts should receive special attention. Additionally, it is necessary to investigate which shift schedules are associated with obesity. Vetter et al. (2015) customized working schedules based on an individual's chronotype for shift-working nurses. The study demonstrated that circadian disruption is influenced by individual internal time. Evidence suggesting that these interventions could reduce circadian disruption and improve sleep-related outcomes. For shift workers, Azmi et al. (2020) recommends focusing on the type of food consumed during shift duties. Also suggest the timing of meals, and how to maintain a healthy diet during shift work.

Interventions targeting all nurses.

Awasonga et al., (2020) To protect night shift workers, organisations such as the Workers' Health and Safety Centre, The Institute for Work and Health can help. It is imperative to consider shift work risks and adverse outcomes, such as burnout. Health care workers face a risk of burnout syndrome due to shift work. Early intervention and prevention of burnout syndrome can be achieved through gradual development. To decrease burnout among employees, organizations need preventative measures. As well as address shift work problems. Workers can provide the highest quality care for their clients if organizations take preventative measures. To prevent adverse consequences from shift work. Considering Awasonga et al findings, caregivers should be supported. For better intervention, employers and caregivers must share responsibility for

preventing shiftwork disorders. There is evidence that employees perform better when they have input, choice, and flexibility in their schedules.

As Minelli et al., (2020) emphasizes that psycho-behavioural factors should be evaluated professionally. They can be addressed with tailor-made psychological interventions to improve job satisfaction and reduce work-related distress. And prevent shift workers' chronic cortisol exces ses. Based on Azimi's (2020) study, shift workers worldwide are more likely to be overweight and obese. Nutritionists and dietitians need to be present in 24-hour industries. This includes the healthcare sector. Checking shift workers' nutritional status.

Using a work schedule design aimed at minimizing night shift effects may lower the risk, according to Bigert et al., (2020). Even so, preventive measures should also include protection from other adverse health effects. These are heart disease, cancer, pregnancy disruption, and work accidents. Shi et al. (2022) concluded that shift workers should keep a healthy weight.

Thompson (2019) says nurses and administrators should consider fatigue management strategies. When dealing with nurse fatigue's safety consequences. He provides evidence that the computer-based program is an effective and sensitive test for identifying and tracking fatigue in this specific population. He recommends more mobile muscle function assessments. For women with night shift jobs, Manouchehri et al., (2021) suggest integrating breast cancer screening into routine care.

7 DISCUSSION

7.1 Impact of Shift work

This thesis investigates the health effects of shift work on nurses. With the focus on the physiological impacts of shift work and coping strategies. The research questions were drafted to investigate the extent of physiological impacts of shift work on nurses. And emphasizing on potential coping strategies. Allostasis theory provides a framework for understanding shift work's physiological impacts. Allostasis explains how complex physiological systems adapt to physical, psychological, and environmental challenges. It emphasizes a flexible adaptation process to changing environments. When allostatic processes fail to shut off, an allostatic load occurs. Physiological systems cannot adapt. Allostasis provides interventions aimed at improving health outcomes and managing allostatic load.

Shiftwork is a common form of labor organization in various industries, including healthcare. The results suggest that shift work has a significant physiological impact on nurses' health. These impacts include pain complaints and sleep quality. Hormonal levels, fatigue, and disrupted circadian rhythms are common issues. Also examined are chronic diseases such as obesity, cardiovascular disease, cancer, and diabetes. These impacts are due to circadian rhythm disruption caused by working at odd hours.

Studies have shown that shift work affects nurses' physiological health. Study done by Vyas et al., (2012) revealed that shift work is associated with coronary heart disease and cerebrovascular disease. The findings of this thesis match previous studies. The results have shown that nurses with rotating shifts, and those with only night shifts are at risk of cerebrovascular disease. This is compared to those who have never worked night shift. Night shift workers and consecutive night shifts are at higher risk of this condition. This is due to insufficient recovery after night shifts.

Studies indicate that workers exposed to rotating shifts experience more frequent headaches. Gastrointestinal issues such as ulcers or irritable bowel syndrome, and musculoskeletal pain related conditions. This thesis study found that some nurses would complain of headaches if they worked night shifts with a short break between them. Also, there was a reduction in lower extremity pain associated with night shifts. This finding links to the lower activity level during night shifts compared to morning shifts.

Nursing shift work has been linked to a variety of acute health impacts. These impacts are pain complaints, sleep quality, hormone levels changes, and fatigue. Based on Katsifaraki et al., (2020). Nurses who worked night shifts with quick returns reported experiencing pain. Headache risks and increased pain in the lower extremities. A reduction in lower extremity pain was linked to lower activity levels during night shifts than morning shifts. No conclusive evidence supports the hypothesis that pain is more likely to occur after a quick return than after a morning shift. Additionally, night light suppresses melatonin synthesis. It decreases glutathione peroxidase and inhibits antioxidative enzymes. Leading to altered antioxidant levels in female shift workers (Gromadzińska et al., 2013).

According to Li Y et al., (2016), sleep continuity plays a crucial role in regulating daily patterns in human physiology. Lack of quality sleep patterns due to disturbed circadian rhythms may result from short recovery time. Reduced sleep quality influences shift workers' eating behaviours by increasing their appetite at night. People with night shifts are more likely to suffer from chronic sleep deprivation. Poor sleep quality, or sleep disorders that affect their cognitive performance. Results of this study also show that long-term shift workers snore more and have shorter sleep durations. Diabetes links with sleep deprivation; short sleep durations, frequent snoring, and sleep apnea. (Li et al., 2016).

It is common for shift workers to become fatigued. This explains nurses' inability to prepare healthy meals. They instead substitute industrial snacks, fast food, and sweets. Nurses engaged in rotating and night shifts reported more chronic fatigue than day shift workers. (Azmi et al., 2020). Three consecutive 12-hour nursing shifts can impair reaction times. It can also cause attention

lapses and reduce muscle function. Vigilance-based reaction time measures showed progressive impairment. Measured from the end of the first shift to the end of the third shift (Thompson, 2019).

Long-term impacts of shiftwork may result in chronic health problems. These are obesity, cardiovascular disease, and cancer. Long term risks include breast cancer among female nurses working night and shift rotations. Compared with women working day duty nursing jobs. Nurses who worked night shifts had an increased risk of cerebrovascular disease. In comparison to those who have never been on night shift (Bigert et al., 2022). Night shift work is also associated with overweight and obesity. Obesity plays a significant role in the association between shift work and healthy aging (Shi et al., 2022). Due to irregular eating patterns and lack of access to healthy food options during shift work, nurses might be at high risk of obesity (Kim et al., 2013). Circadian rhythm misalignment amplifies metabolic dysfunction. This results in weight gain and obesity (Bigert et al., 2022).

Nurses who work night shifts are at an increased risk of breast cancer. Suppressed melatonin production correlates with estrogen levels increase. This leads to breast cancer. (Manouchehri et al., 2021). Diabetes risk is higher for women with sleeping difficulties who work shifts (Li et al., 2016).

7.2 Coping Strategies

Researchers have also identified coping strategies that support nurses who work shift work. Coping strategies are recommended in these studies to combat some adverse effects. Improving nutrition planning and engaging in exercise related activities. By utilizing technology-based applications, you can stay organized and maintain your wellbeing.

Kim et al. (2013) found that female nurses working long shifts should receive special attention. Study findings suggest it would be valuable to determine which shift schedules are associated with obesity. To address the adverse effects of shift work on the circadian rhythm, Vetter et al. (2015) designed flexible schedules tailored to shift workers' chronotypes. The study demonstrated that interventions could reduce circadian disruption and improve sleep-related

outcomes. Employers should provide flexible scheduling options for nurses. Implementing policies promoting daytime napping opportunities, afew minutes during regular day-time operations. This would help restore balance, energy & alertness among healthcare providers.

Maintaining a healthy diet and exercise routine. Practicing healthy sleep hygiene and seeking social support from colleagues and family members. Azmi et al., (2020) recommend emphasizing the type of food consumed during shift duties. Meal timing, and how to maintain a healthy diet during shift work. They also suggest promoting healthy nutrition and psychological wellness. Nurses who work shifts should promote self-care practices, mindfulness, and stress management.

Awasonga et al., (2020) suggests that early intervention and prevention of burnout syndrome is achievable. Through gradual development. Organizations need preventative measures. They also need to address shift work problems. They can provide their clients with the best care possible with these tools. There is evidence that employees perform better when they have input, choice, and flexibility in their schedules. Minelli et al., (2020) suggest that psycho-behavioural factors should be evaluated in professional settings. They can be addressed with tailor-made psychological interventions to improve job satisfaction. Also reduce work-related distress and prevent shift workers' chronic cortisol excesses. Nutritionists and dietitians need to be present in 24-hour industries. They can check shift workers' nutritional status, based on Azimi's (2020) study.

Thompson (2019) recommends nurses, managers, and administrators consider fatigue management strategies. Institutions should focus on nurse fatigue's safety consequences. The computer-based program appears useful for identifying and tracking fatigue, he says. He recommends the establishment of more mobile muscle function assessments. This is to improve the feasibility of torque development. As an alternative indicator of impaired lower body muscle function.

Manouchehri et al., (2021) suggests integrating breast cancer screening into routine care for women.

7.3 Conclusion

This study highlights the significant impact of shift work on nurses' physiological health. These include pain complaints, sleep quality, hormone changes and fatigue. Also, long-term physiological impacts such as obesity, cardiovascular disease, cancer, and diabetes. This thesis study supports previous studies. Research indicates that shift work disrupts circadian rhythms and causes long-term health problems. Coping strategies, such as improving nutrition and exercising, are promoted. Technology-based applications and well-being monitoring are recommended. Employers should also provide flexible scheduling options. Promote daytime napping opportunities, and address shift work problems. Support nurses' wellbeing by providing facilities. These recommendations can help reduce physiological impacts of shift work. It will also relieve job-related distress and chronic cortisol excesses. As a result, it will lead to better job satisfaction and patient care. There is a need to integrate these coping strategies into nurses' routine care. Improving nurses' health and wellbeing benefits healthcare workers and patients.

7.4 Recommendations

This thesis study contributes information on physiological health effects on nurses. Individuals’ nurses and nursing organizations can benefit from the study's findings. Future studies should build on this work. This includes future problems we have yet to discover, as well. Previous studies recommended several effective interventions. Nursing staff, managers, and administrators should consider increasing access to nutrient-rich food options during shifts. Providing healthy snacks in break rooms and implementing healthier options in hospital cafeterias. Promoting physical activity during breaks such as yoga and body stretching. Gym, swimming or walking after shift work to increase cardiovascular health.

In this modern age, the study suggests utilising technology to monitor and track sleep and circadian rhythm patterns. Wearable devices, phone applications: To monitor your sleep patterns and wake you up during a light sleep phase. Plan your life around your work schedule, manage your shift schedule, track your hours worked, and manage your shift schedule. To create a personalised calendar that displays your work schedule in a clear and easy-to-read format. Guided meditation and mindfulness exercises to reduce stress and improve wellbeing. These applications allow for better individualised interventions. It is necessary to conduct more studies to determine whether technology can evaluate shift work physiological effects effectively.

Institutions should offer training on shift work effects on nurses to encourage informed choices. This will enable them to take care of their physiological health. Workplace health programs that address shift-work issues.

7.5 Strength and Limitations

This thesis is derived from a literature review. Based on the deductive analysis of 15 articles, several key findings emerged. The articles were from reliable and valid sources, which ensured accuracy and trustworthiness. Previous research provided conflicting results and different perspectives. Which led to novel insights and hypotheses. The selection of articles, however, was biased, since only few sources supporting the topic were examined. Some of the relevant articles were difficult to access. Some required buying. There was a limited amount of time in the placement writing process.

8 ETHICAL CONSIDERATION

Hultgren et al., (2016). Research ethics are standards for conducting research and protecting human subjects. Primarily during decision-making and action processes. In this chapter, critical ethical issues in information generation are discussed. Also focusing on its use in professional practice. The study discusses ethical decisions made during the writing process of this thesis.

This study followed the TENK principles. Thus, the study acknowledged other researchers' work. This study cited their publications throughout the process of data collection and data analysis. By evaluating and reporting her results, the study applied scientific methods. With the help of international scholarly databases for nursing, provided by the Arcada and Diak libraries. This study ensured that copyright rules were not violated. (TENK,2023)

The study followed Diak’s ethical principles for research by adhering to thesis guidelines. Which include knowledge of the topic, ethical review, and processing of literature review data. Research permits were not needed for this study. The study ensured that the articles reviewed followed scientific criteria as well as being credible. The study did not violate copyright rules. Source texts were paraphrased to avoid plagiarism. (ARENE,2019)

9 PROFESSIONAL DEVELOPMENT

Writing this thesis opens various pathways for professional development. I have grown as a researcher. Am also honoured to contribute to the advancement of knowledge. Presenting the thesis enhance my communication skills and writing skills. Presenting the thesis to supervisors and in seminars, allowed for sharing of knowledge. I have had opportunities to engage in discussions with peers and thesis superviosrs. I have demonstrated ability to conduct research and add to my academic portfolio. This thesis contributes to the body of knowledge in the field of nursing. It also increases visibility and credibility.

After this thesis I am going to mentor students in nursing or related disciplines. Sharing my research insights and experiences with aspiring nurses. I can contribute to the development of the next generation of nurses and researchers. This will also build on personal growth and the refinement of skills. I have made recommendations which contribute to the development of policies and interventions. Aimed at mitigating the adverse effects of shift work and promoting nurses' health.

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APPENDIX 1. Presentation of Literature

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APPENDIX 2. Table Summary of Articles

AUTHOR	STUDY DESIGN	SAMPLE	INTERVENTION	RESULTS
Awosoga et al. (2020)	Survey conducted across 39 facilities in Alberta, Canada	Long-term and assisted-living professional caregivers in Alberta, Canada	Shift work	Lack of energy Caregivers reported frequent neck and back pain. Sleep problems are more common among night shift workers. Shift workers are supported by better work schedules, frequent. Burnout syndrome is associated with shift work
Azmi et al. (2020)	Narrative review	Shift Wokers	Circadian disruption in shift wokers and their well being	Prolonged exposure to shift work related to complications compared with those working at normal daytime hours. Chronic fatigue, psychological and cardiovascular symptoms. Physiologically, sleep disturbance The effect of circadian rhythm disruption
Bigert et al. (2022)	Prospective cohort study	21,403 healthcare employees	Association between night and shift work and the incidence of cerebrovascular disease	There was no significant increase in cerebrovascular disease among shift workers without night shifts. There was an increased risk of stroke among shift workers working night shifts.
Gromadzińska et al. (2013)	Cross-sectional study	310 female nurses, aged 30-59 years	Relationship between the intensity of night shift work and antioxidant status in the blood of nurses.	Night shift workers had significantly lower levels of GSH, an important antioxidant. Non-night shift workers and low- and medium-intensity night shift workers did not differ significantly. Compared to non-night shift workers, high-intensity night shift workers had significantly higher SOD activity.

Katsifaraki et al. (2020)	Observational design	1,715 Norwegian nurses	Associations between consecutive night shifts, quick returns, and pain complaints	Night shifts increase the risk of pain complaints. The risk of pain complaints was higher for nurses who worked three or more consecutive night shifts. The nurses with shorter time intervals between shifts had a higher risk of pain complaints than those with longer intervals. Female and male nurses experienced similar associations between consecutive night shifts, quick returns, and pain complaints.
Kim et al. (2013)	Cross-sectional analysis/Survey	8,741 female nurses aged 20-59 years	Association between shift work and obesity among female nurses	Rotating shift workers were more likely to be obese than fixed day shift workers. Nurses over 40-year-old were more likely to have obesity associated with shift work. Rotating shift nurses had a 67% higher obesity risk than fixed day shift nurses. Married nurses had a greater association with obesity than unmarried nurses. Nurses on rotating shifts had a 58% higher obesity risk than those on fixed day shifts.
Li et al. (2016)	Prospective cohort study	50,711 women without diabetes at baseline for up to 10 years	Relationship between sleeping difficulty and type 2 diabetes in women	Type 2 diabetes was more likely to develop in women who reported frequent sleeping difficulties. Studies have shown that shift workers are at greater risk of metabolic disorders, including type 2 diabetes, because of sleeping difficulties. Insulin resistance, higher blood sugar levels and poor sleep may lead to type 2 diabetes risks.
Manouchehri et al. (2021)	Systematic review and meta-analysis	2,457,746 participants, with 112,534 cases of breast cancer	Association between nightshift work duration and breast cancer risk	Night-shift workers had 12% more breast cancer risk than those who did not. Nightshift work increases breast cancer risk.

				Breast cancer risk was higher in case-control studies (17% increased risk) than cohort studies (9% increased risk). It was found that nightshift work increased breast cancer risk significantly more in North America (20%) than in Europe (10%) or Asia (9%).
Minelli et al. (2021)	Cross-sectional design	184 nursing staff		The morning cortisol levels of individuals with higher cortisol levels were associated with a lower tolerance to rotating shift work. Adapting to shift work schedules depends on circadian preferences. Problem-focused coping strategies may provide better solutions to shift work challenges.
Reszka et al. (2013)	Quantitative polymerase chain reaction	50 female rotating night shift nurses	Effect of rotating night shift work on circadian gene expression in peripheral blood leukocytes	Circadian rhythm genes were significantly altered among rotating night shift nurses. Nurses who worked extended shifts or more nights in a row showed more gene expression changes. Rotating night shifts may disrupt the body's circadian rhythm and have negative health effects.
Shi et al. (2022)	Large cohort study	70,768 women enrolled in the Nurses' Health Study	The long-term effects of rotating night shift work on healthy aging	Those who worked rotating night shifts were more likely to develop chronic diseases such as cancer, diabetes, and cardiovascular disease. Rotating night shift work alters circadian rhythms. Disruption of circadian rhythms could contribute to insulin resistance, impaired glucose regulation, and development of diseases.

Thompson (2019)	Repeated-measures observational design	20 hospital nurses and aides working in medical-surgical units of a large university hospital in the United States.	Work-induced fatigue accumulates across three consecutive 12-hour shifts among hospital nurses and aides	Following three consecutive shifts, fatigue levels decreased on the first day off, suggesting recovery from accumulated fatigue. Fatigue accumulation occurs regardless of the shift time, given the compressed 12-hour schedule.
Vetter & Wegrzyn (2016)	Prospective cohort study. The Nurses' Health Study II is a well-established 1989	Participants from the Nurses' Health Study II	Individual and work characteristics	The duration of shift work was associated with an increased risk of chronic diseases. Working night shifts and getting little sleep put nurses at risk. Chronic disease risk. Those who work rotating shifts are more likely to develop chronic diseases. Shift workers were more likely to suffer chronic diseases due to job strain. Evening nurses are at greater risk of chronic disease than morning nurses.
Vetter et al. (2015)	Literature review and prospective cohort study	177,269 women who participated in the Nurses' Health Study I and II.	Mismatch of sleep and work timing	Obesity, diabetes, and cardiovascular disease is associated with shift work. The optimized schedule improved sleep quality and reduced circadian disruption. Late chronotypes had a significantly increased risk of type 2 diabetes. If work times interfere with sleep timing, shift and day workers may be at an increased risk for type 2 diabetes.

Vimalananda et al. (2015)	Prospective analysis of data from the Black Women's Health Study,28,000 participants	African American women	Night-shift work	Night shift workers were also more likely to develop diabetes. Alterations in the normal sleep–wake cycle have profound effects on metabolism. circadian misalignment leads to decreased leptin levels, increased glucose, and insulin levels, increased mean arterial.