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MEDIATING ROLE OF COGNITIVE FUNCTIONING IN THE RELATIONSHIP BETWEEN SLEEP QUALITY AND SYMPTOMS OF DEMENTIA AMONG NIGHT SHIFT WORKERS

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ABSTRACT

The current study aims to explore the relationship between sleep quality, cognitive functioning, and symptoms of dementia among night shift workers, focusing middle-aged adults. Specifically, it investigates how poor sleep quality may impair cognitive functioning, thereby increasing the likelihood of developing symptoms of dementia among Pakistani night shift workers. The purpose of this study was to examine the role of poor sleep quality as a predictor of developing dementia among night shift workers, and the mediating role of cognitive functioning in the relationship between sleep quality and symptoms of dementia. Furthermore, it also investigates the moderating effects of demographic factors such as age, gender, and work experience on these relationships. Quantitative cross-sectional research was conducted from the sample of 200 Middle-aged adults of (25-45 years). Those Middle-aged adults was selected for the study who have been working in night shift for at least 6 months. Four standardized self-report questionnaires (English version) along with the demographic sheet and consent form were used, i.e., Pittsburgh Sleep Quality Index (PSQI),

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Cognitive Functioning Self-Assessment Scale (CFSS), Montreal Cognitive Assessment scale (MOCA). Analysis run through using SPSS 23 and Process Macro which included Pearson correlation coefficients, independent sample t-test, regression analysis, mediation, and moderation analyses. The current research aims to provide insights into the cognitive risks associated with night shift work, particularly regarding the potential for developing symptoms of dementia. It will raise awareness among the working population and will help in developing workplace policies by introducing flexible working hours, thereby allowing employees to choose shifts that align with their natural circadian rhythm. This may enhance both sleep quality and cognitive performance of employees in different organizations.

Keywords: Cognitive Functioning, Sleep Quality, Dementia

Chapter I
Introduction

Globalization and industrialization have raised the demand for 24-hour services in the modern era, making night shift work crucial to several sectors, such as manufacturing, healthcare, and security (Axelsson, 2016). However, night shift work disrupts the body's natural circadian rhythm, adversely affecting sleep quality, cognitive functioning, and overall health (Walker, 2017). Among the significant health concerns, research indicates that poor sleep quality can contribute to cognitive decline and increase the risk of dementia (Yaffe et al., 2014). Cognitive functioning plays a crucial mediating role in this relationship, as deteriorated cognitive performance due to disrupted sleep may act as a precursor to dementia-related symptoms (Lim et al., 2013). This study seeks to evaluate the mediating role of cognitive performance in the link between sleep quality and symptoms of dementia among night shift workers. The relationship between sleep quality and cognitive health has been widely studied. Research indicates that individuals working night shifts often experience fragmented sleep, leading to disruptions in cognitive performance (Killgore, 2010). Sleep is crucial for memory consolidation and general cognitive resilience, both of which are critical in preventing neurodegenerative illnesses like dementia, according to an increasing amount of research (Cipriani et al., 2015). Night shift workers are at an increased risk of developing sleep disorders, which in turn affect their cognitive abilities and long-term mental health (Spira et al., 2013). Moreover, sleep disturbances have been found to contribute to the accumulation of neurotoxic proteins such as beta-amyloid, which is a hallmark of Alzheimer's disease (Bubu et al., 2017). Chronic sleep deprivation in night shift workers exacerbates cognitive impairments, affecting executive functioning, attention, and memory processing (Yaffe et al., 2014). It has been suggested that poor sleep quality leads to metabolic and neurochemical changes in the brain, fostering conditions that increase the risk of developing dementia (Stern, 2010). The necessity to investigate how cognitive functioning regulates this association is further highlighted by the long-term cognitive decline linked to disturbed sleep habits. The prevalence of night shift work has increased significantly in Pakistan, mirroring trends in other Asian countries because of persistent economic instability, across various sectors, organizations and industries. Hence, many researchers have suggested that nearly 30% of Pakistan's workforce is

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engaged in night shift work in various industries such as hospitals, factories, transportation etc. (Khan et al., 2020).

A Quantitative study was conducted to explored how prolonged exposure to rotating night shift work influences cognitive performance in retired female nurses and teachers. The study found that nurses who worked night shifts for more than 11 years scored significantly lower on cognitive tests like MMSE and MoCA compared to non-shift workers. Even after accounting for compensatory daytime sleep, cognitive deficits persisted, implying long-term neurological consequences. These findings underline the detrimental effects of chronic circadian disruption on brain health, reinforcing concerns about cognitive decline and potential dementia in long-term night shift workers (Gan et al., 2022).

Moreover, a Longitudinal study was conducted among Canadian Middle aged and Older Adults on aging to examine the effects of shift work exposure on cognitive abilities. Their analysis indicated that individuals with a history of night shift or rotating shift work exhibited poorer performance in memory and executive functioning tasks. The authors concluded that chronic disruption to circadian rhythms likely contributes to accelerated cognitive aging and may predispose shift workers to early signs of dementia (Khan et al., 2023).

In a comprehensive meta-analysis, (Wang et al., 2022) reviewed multiple studies examining the relationship between shift work and the likelihood of developing dementia. The pooled results revealed a significant association, with night shift workers having a 12% higher risk of dementia than their day-working counterparts. The analysis also highlighted that cognitive risks increase with age and shift duration, emphasizing the importance of early interventions for those in shift-based occupations to potentially reduce long-term neurocognitive issues.

Studies have shown that due to the high prevalence of night shift work, it leads to the increased risk of developing dementia in young and middle adults (Troung et al., 2018). Research done in United states by Li et al., in 2019, which indicates that people working during night shifts are 13% more at the risk of developing dementia as compared to day shift workers. This finding is particularly concerning for Pakistan, Pakistan is an underdeveloped country where the current prevalence of dementia is around 1.5 million which is projected to triple by 2025 (Khan et al., 2020). Sleep quality which is very important for our overall functioning and well-being whereas poor sleep quality not only effects our physical functioning but overall psychological, social, emotional and cognitive functioning. Studies have shown that 75%-night shift workers gone through sleep disturbances and at the higher risk of developing sleep disorders like insomnia which in turns lead to decline in their cognitive functioning (Husain et al., 2020). Night shift workers who compromise their nighttime sleep are more likely at the risk of developing dementia because of decline in their cognitive functioning including decrease in specific cognitive areas like reasoning, attention, memory, executive functioning, problem solving, decision making as compare to the day shift workers (Xu et al., 2018). Similarly, if our cognitive functioning gets impaired it impact our overall well-being and functioning. Impair cognitive functioning can result in many negative consequences like increased the risk of accidents and decrease quality of life (Killgore et al., 2020). Night shift work disrupts body's natural circadian rhythm which is negatively correlated with the health and

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over all wellbeing of workers doing night shifts (Caruso et al., 2020). After the Covid 19 due to the increase risk of economic and financial crisis the prevalence of night shift work has increased, and evidence have suggested that it has numerous negative effects on physical and mental health of an individual's doing night shifts (Boivin et al., 2014).The current research aims to understand that how poor sleep quality leads to decrease cognitive performance and how impair cognitive functioning will increase the risk of dementia in night shift workers, and to study the relationship between sleep quality and risk of developing dementia in night shift adults with the mediating role of cognitive functioning. which is crucial in understanding that how poor sleep quality in night shift adults leads to increase the risk of dementia among night shift workers. Dementia which falls under the domain of neurodegenerative disease is characterized by a decline in memory, attention, concentration and executive functioning (Alzheimer association 2020). As dementia is a very common growing problem of under developing countries like Pakistan, it's important to study its causes and risk factor, and many of the studies are now being conducting on identifying the causes or risk factors associated with dementia (Prince et al., 2015). Numerous studies have shown that our lifestyle, habits, routine such as disturbed sleep pattern plays an important role plus our poor cognitive health leads to increase the risk of developing dementia in night shift adults. As not only night shift work but also poor sleep schedules, poor diet, physical inactivity, excessive use of social media all these poor lifestyle factors contribute in developing dementia in night shift adults (Livingston et al., 2020). According to (Zhang et al.,) an extensive study should be done to examine the impact of poor sleep quality on the risk of developing dementia in night shift adults across various cultures. As we know that sleep is very important for our brain's overall wellbeing and functioning. It not only plays a role in strengthening our memory, focus and decision making but also maintains our brains overall health (Walker et al., 2017). Night shift workers who often has irregular sleep schedules leads to poor sleep quality which can ultimately leads to impair their cognitive functioning and major higher order skills like memory, focus, attention, concentration (Krause et al., 2017). Over the period this decline of cognitive skills cause an increased the risk of dementia in night shift adults. Moreover, the impact of poor sleep quality on cognitive functioning of night shift workers and its role in increasing the risk of dementia among them also varies with demographic factors, depending on an individual difference e.g., age, gender, education level and work experience (Espie et al., 2012). Many of the studies done on studying the impact of sleep quality on the cognitive functioning of night shift workers across different cultures, religion and demographic factors which shows that older night shift workers whose work experience is more than others, experienced greater cognitive decline or more at the risk of developing dementia as compare to younger night shift workers with less working experience (Prince et al., 2015). An extensive study should be done to examine the risk of developing dementia particularly in young and middle-aged night shift workers (Ohayon et al., 2019). Existing researches primarily focused on older adults, neglecting the impact of sleep quality on dementia risk in younger population. Researches has revealed that gender differences in sleep schedules and cognitive functioning also moderate the relationship between sleep quality and dementia risk (Carrier et al., 2013). Despite of established link between sleep quality and risk of

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cognitive impairment , Studies have largely overlooked the relationship between impaired cognitive functioning and risk of developing dementia in young and middle-aged adults (Li et al., 2020).Furthermore there is a pressing need for context-specific studies in non-western settings particularly in Asian countries where the cultural and social factors influencing sleep quality and cognitive functioning which potentially increase the risk of developing dementia in night shift workers (Lam et al., 2020). This current study will focus on investigating the relationship between sleep quality, cognitive functioning and risk of developing dementia symptoms among night shift adults with particularly focus on middle-aged adults with having age range from (25 to 45 years). Particularly it will focus on how poor sleep quality will impair cognitive functioning and lead to increase the risk of developing dementia symptoms among night shift workers (Zhang et al., 2017). It will also examine that how demographic variable such as age, gender, work experience will moderate these relationships (Prince et al., 2017). By studying this relationship between variables, it develops insight, awareness and educate people about the risk of cognitive decline associated with night shift work with specifically focus on dementia (Carrier et al., 2017).

Sleep Quality

The term "sleep quality" describes how well a person sleeps, considering variables like latency, efficiency, duration, and disruptions (Buysse et al., 2020). Poor sleep quality is common among night shift workers due to irregular sleep schedules, exposure to artificial light at night, and social constraints (Kecklund & Axelsson, 2019). According to studies, sleep disturbances raise the risk of neurodegenerative diseases like dementia and can cause mood swings and cognitive impairments (Cipriani et al., 2020). Furthermore, attention, executive functioning, and memory consolidation all essential elements of cognitive health are hampered by poor sleep quality (Killgore, 2020). Aprolonged sleep deprivation contributes to the buildup of beta-amyloid plaques in the brain, a characteristic of Alzheimer's disease (Yaffe et al.,2020). A study by (Spira et al.,2019) indicated that patients with poor sleep quality exhibited lower hippocampus volume, an important brain region related with memory processing and cognitive performance. Furthermore, sleep fragmentation has been linked to an increased inflammatory response, which may accelerate neurodegeneration (Lim et al., 2018). Chronic disruptions in sleep patterns also contribute to hormonal imbalances, such as increased cortisol levels, which further impair cognitive performance (Walker, 2018). These data imply that enhancing sleep quality among night shift workers may ameliorate cognitive decline and reduce the incidence of dementia.

A study conducted by (Kazemi et al., 2016) examined the effects of shift work on cognitive performance, sleep quality, and sleepiness among petrochemical control room operators. The research found that night shift workers experienced significantly poorer sleep quality compared to day shift workers, as measured by the Pittsburgh Sleep Quality Index (PSQI). Additionally, cognitive performance assessments revealed that night shift workers had increased omission and commission errors, indicating impaired attention and executive function. The study concluded that the combination of poor sleep quality and circadian rhythm disruption inherent in night shift work leads to diminished cognitive functioning.

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Cognitive Functioning

A variety of mental processes, such as memory, attention, problem-solving, and executive functioning, are included in cognitive functioning (Miller & Cuttler, 2020). Various researchers have defined cognitive functioning based on different domains. According to Salthouse (2021), cognitive aging involves the gradual decline of processing speed and working memory, whereas (Baltes, 2021) suggested that cognitive functioning is influenced by both biological and environmental factors. Sleep deprivation frequently causes cognitive deficits in night shift workers, which lowers productivity and increases the risk of mistakes (Lim et al., 2020). Studies have shown that chronic sleep disturbances affect the prefrontal cortex, impacting higher-order cognitive processes such as decision-making and problem-solving (Killgore, 2020). Sleep is critical for synaptic plasticity, which is necessary for memory and learning, according to research (Tomoni & Cirelli, 2018). Deficits in working memory, information processing, and attention have all been linked to poor sleep quality (Cipriani et al., 2019). Furthermore, it has been discovered that sleep deprivation hinders the brain's capacity to eliminate metabolic waste products like beta-amyloid, which are connected to dementia and cognitive decline (Bubu et al., 2017). Thus, night shift workers' deterioration in cognitive functioning could serve as a crucial transitional stage in the development of dementia.

A study by (Marcelli et al., 2023) compared neurocognitive functions between retired night shift workers and retired day workers. The findings revealed that those with a history of night shift work exhibited significantly poorer performance in attention and executive function tasks. These cognitive deficits persisted even after controlling for variables such as age, education, and sleep quality. The study suggests that long-term night shift work may contribute to cognitive impairments, which are indicative of an elevated risk for developing dementia.

Dementia

According to the Alzheimer's Association (2020), dementia is a progressive neurological disease that is typified by memory loss, cognitive decline, and challenges carrying out daily tasks. Lewy body dementia, vascular dementia, and Alzheimer's disease are the three most prevalent forms of dementia (Livingston et al., 2017). Because of mechanisms like neuro inflammation, oxidative stress, and the accumulation of toxic proteins in the brain, researchers have connected poor sleep quality to an increased risk of dementia (Spira et al., 2018). Additionally, a study by (Bubu et al.,2017) showed that poor sleep quality increased the risk of Alzheimer's disease because it affected the lymphatic removal of neurotoxic waste. Because chronic sleep deprivation increases cerebrovascular risk factors like hypertension and impaired cerebral blood flow regulation, it has also been linked to an increased risk of vascular dementia (Shi et al., 2018).

A key mediating factor in the association between dementia symptoms and sleep quality is cognitive ability. Cognitive performance is hampered by poor sleep, which results in issues with executive function, memory, and attention all of which are early signs of dementia (Lim et al., 2018). According to the cognitive reserve theory, even in the face of neurodegenerative changes, people who are more cognitively engaged may see a slower reduction in their cognitive capacities (Stern, 2021). Disrupted sleep

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patterns also increase the risk of dementia and worsen cognitive function by contributing to hormone imbalances and chronic stress (Walker, 2017). According to several long-term studies, sleep disorders that because cognitive impairment raises the risk of dementia considerably in later life (Yaffe et al., 2016; Bubu et al., 2017). Additionally, studies suggest that sleep deprivation-induced cognitive deficits, like diminished attentional control and slowed processing speed, could be early indicators of neurodegenerative diseases (Lo et al., 2016).

Relationship Between Sleep Quality and Symptoms of Dementia

Numerous studies have demonstrated a robust correlation between dementia symptoms and sleep quality, highlighting the role that disturbed sleep patterns play in neurodegenerative processes. Due to the buildup of beta-amyloid plaques in the brain, poor sleep quality including fragmentation and decreased slow-wave sleep has been associated with a higher risk of Alzheimer's disease (Bubu et al., 2018). According to (Xie et al.,2020), sleep is necessary for the brain to eliminate neurotoxic waste, and irregular sleep patterns can hinder this process and cause cognitive impairment. Chronic sleep deprivation has been linked to an increased risk of dementia, according to epidemiological research (Spira et al., 2018). According to a longitudinal study by (Lim et al.,2020), older persons who had trouble sleeping were far more likely to experience cognitive deterioration. Similar findings were made by (Yaffe et al.,2019), who found that people with sleep disruptions showed faster cognitive decline over time. This suggests that sleep quality has a direct impact on how Additionally, studies show that dementia and sleep disruptions are correlated in both directions, with poor sleep quality acting as an early indicator of neurodegenerative diseases and exacerbating cognitive loss (Ju et al., 2019). Deficits in memory, executive function, and attention all of which are typical signs of dementia have been demonstrated in people with insomnia, sleep apnea, and other sleep disorders (Cipriani et al., 2016).

Researchers have also investigated how disturbances in the circadian rhythm contribute to the development of dementia. Research indicates that working night shifts raises the risk of dementia and adds to cognitive deficits by causing a misalignment between the body's internal biological clock and external environmental cues (Axelsson., 2019). dementia-related symptoms develop. Night shift workers' fragmented sleep patterns have been connected to both anatomical and functional alterations in the brain, especially in areas related to executive functioning and memory (Killgore, 2020). Research indicates that persistent disruptions in the sleep-wake cycle reduce synaptic plasticity, which in turn decreases the brain's capacity to efficiently receive and store information (Walker et al., 2017).

Examining cognitive functioning as a mediating factor in this association is essential given the strong evidence that links dementia symptoms to sleep quality. Although neurodegeneration is directly caused by inadequate sleep, further research is still needed to determine the degree to which cognitive decline facilitates this process. Knowing this mediating role could help develop possible intervention techniques meant to enhance night shift workers' cognitive resilience and sleep quality.

In conclusion, working night shifts has a detrimental impact on sleep quality, which raises the risk of dementia and decreases cognitive functioning. Developing preventative interventions to enhance sleep hygiene and cognitive resilience in night

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shift workers requires an understanding of the mediating role that cognitive functioning plays in this connection. To determine causal linkages and investigate potential protective variables including lifestyle changes and cognitive training programs, future research should concentrate on longitudinal studies (Walker et al., 2017).

Objectives

To find out the relationship between sleep quality, cognitive functioning and symptoms of dementia among night shift workers.
To find out the role of poor sleep quality and cognitive functioning as a predictor of developing symptoms of dementia among night shift workers.
To find out the mediating role of cognitive functioning in the relationship between sleep quality and symptoms of dementia among night shift workers.
To determine the moderating effect of demographics (age, gender) on the relationship between sleep quality, cognitive functioning and symptoms of dementia.

Hypothesis

Poor sleep quality will be positively correlated with higher risk of impaired cognitive functioning among night shift workers.
Impaired cognitive functioning will be positively correlated with an increased symptom of dementia among night shift workers.
Cognitive functioning will mediate the relationship between sleep quality and dementia risk in night shift adults, such that the poor sleep quality leads to impaired cognitive functioning, which increases the symptoms of dementia among night shift adults.
Age will moderate the relationship between sleep quality and cognitive functioning, middle aged night shift adults will experience a stronger association between sleep quality and cognitive functioning which increased the symptoms of dementia.
Gender will moderate the relationship between sleep quality and cognitive functioning, such that the females working night shifts exhibit a stronger association between poor sleep quality and impaired cognitive functioning which leads to increased symptoms of dementia in females as compared to males.

Literature Review and Theoretical Framework

According to Cognitive reserve theory which was proposed by Stern, 2020, Cognitive reserve mean an individual cognitive resilience, an ability of the brain to adapt and bear challenges and survive under tough circumstances (Stern, 2020).This theory suggest that an individual has a certain level of capacity and threshold (cognitive reserve) which increase this capacity to bear brain damage or brain changes but disrupt sleep quality is negatively correlated with cognitive reserve of an individual, The more the sleep quality is poor the more it can exhaust or decrease cognitive reserve and when this threshold will break it will leads to different cognitive diseases or disorders like dementia and other neurodegenerative diseases (Yaffe et al., 2019).And this ability or capacity of cognitive reserve to bear brain changes and damage varies from one person to another person depending on their life experiences, social engagement, physical activity etc. (Stern, 2019). This theory best explains the

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relationship among 3 variables sleep quality, cognitive functioning and symptoms of dementia in adults as cognitive reserve means brain ability to cope and adapt with brain damage and brain changes to maintain its health like cognitive functioning and people who have stronger or good cognitive reserve can survive and function better for a longer period of time as theory cognitive functioning will work normal for a long time period as compare to an individual who has lower cognitive reserve and it varies from an individual to individual (Tucker 2018).Cognitive reserve is just like a protective cover or protective shield for example is 2 person has same level of brain damage or disease but one person who has higher cognitive reserve will function good cognitively for a longer time period as compare to person with having lower cognitive reserve (Stern, 2018). As my study focuses on night shift workers, and most of them having a poor sleep quality, which decrease their brain power or capacity to recover and rejuvenate, as a result their cognitive reserve got depleted, because of which they are unable to perform and have difficulty in performing cognitive task that require mental activity, which decline their cognitive functioning, lead to an increase the risk of developing dementia among them (Videnovic et al., 2018). As night shift workers compromise their night sleep leads to disrupt their healthy sleep schedules, their cognitive reserve got depleted faster and quickly, which cause cognitive impairment and increase the risk of dementia in night shift workers that's why it has said that good amount and good quality of sleep is important to maintain cognitive reserve (Luik et al., 2019), and poor sleep quality leads to decrease the cognitive reserve. People who are doing night shift work their cognitive reserve is often lower than day shift workers, and cognitive reserve delay the onset or occurrence of dementia, because of having poor sleep quality it depletes the cognitive reserve and making an individual more at risk of developing dementia (Stern, 2019).

According to Stern Cognitive Reserve Theory, disparities in cognitive engagement, education, and intellectual stimulation cause people to differ in their capacity to manage brain illness. According to this view, even if dementia causes changes in the brain, those with more cognitive reserves can better adjust for neurological degeneration and show less cognitive losses (Tucker et al., 2019). Studies reveal that cognitive reserve serves as a buffer against the adverse consequences of sleep loss (Robertson, 2017). Despite persistent sleep problems, those with greater cognitive reserves may suffer from fewer cognitive impairments when working night shifts.

Those with substantial cognitive reserves may show resilience against these effects, however night shift workers frequently endure sleep interruptions that might result in cognitive impairment (Barulli & Stern, 2017). Research has shown that cognitive enrichment, including working on challenging projects or learning new things constantly, can lessen the negative effects of sleep loss on cognitive function (Wilson et al., 2019). According to the notion, cognitive engagement is crucial for lowering the incidence of dementia in night shift workers who have poor sleep quality.

The Circadian Rhythm Disruption Theory, first presented by Kecklund and (Axelsson, 2019), emphasizes the detrimental impacts of misaligned sleep-wake cycles on physiological and cognitive processes. Numerous body functions, such as hormone release, sleep patterns, and brain activity, are regulated by the circadian rhythm (Czeisler & Gooley, 2021). Cognitive deficits and an elevated risk of dementia result from night shift work's disruption of the synchronization between

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endogenous biological clocks and external stimuli (Lim et al., 2018). According to Circadian rhythm theory given by Halberg, in 2019 explain best the relationship between 3 variables sleep quality, cognitive functioning and risk of developing dementia in night shift adults.

Circadian rhythm theory refers to body's natural clock that regulates our body's internal systems and overall functioning and well-being (Sack, 2020). Good amount of sleep or a quality sleep which is very important for our overall functioning and people who are doing night shift work their internal body clock is disturb because of having poor sleep quality which effect their overall physical, cognitive and psychological health (Xie et al., 2019). There internal circadian rhythm gets disturbed because night shift workers compromised their night sleep, which result in cognitive impairment (Walker et al., 2021). As mention earlier based on this theory good sleep quality is important for our cognitive functioning such as memory, attention, concentration and executive functioning, and if an individual sleep quality is poor it will result in decline in their cognitive functioning which in turns increase the symptoms of dementia among night shift workers (Ju et al., 2019). Poor sleep may lead to build-up a harmful protein in the brain, which are associated with dementia (Spira et al., 2018). Therefore, reduced sleep quality can decrease the cognitive functions and increase dementia risk. Many of them researches have shown that poor sleep quality is associated with cognitive decline result in dementia and on the other hand good sleep quality is positively correlated with cognitive functioning (Yafe et al., 2019).

According to research, circadian misalignment impacts neurochemical processes that lead to cognitive impairment, such as elevated cortisol levels, heightened neuro inflammation, and melatonin suppression (Vetter et al., 2018). Research has indicated that those who work night shifts had higher rates of dementia and cognitive impairments than those who work day shifts (Wang et al., 2020). Chronic circadian rhythm disruption impairs executive function, memory, and attention all of which are vital components of cognitive health (Walker, 2019).

This idea is relevant to the current study because it explains how circadian disruptions brought on by working night shifts contribute to dementia and cognitive decline. Interventions like light exposure therapy and circadian-friendly shift schedules can be investigated to reduce the cognitive hazards related to working night shifts by comprehending this connection (Kecklund & Axelsson, 2019).

In conclusion this theory makes us clear that sleep quality is very essential for our cognitive health while sleep deprivation is associated with increase the symptoms of dementia (Swaab et al., 2018).

Pakistani Context

A study conducted by (Swat et al., 2020) to investigate the prevalence of sleep disorders among nurses working in rotating shifts compared to those with fixed day shifts in public and private hospitals in Peshawar. Utilizing the Pittsburgh Sleep Quality Index (PSQI), the study found that 74.9% of nurses experienced sleep disturbances, with a significantly higher prevalence among those on rotating night shifts. These nurses also reported greater difficulty in maintaining concentration during the day, suggesting a link between disrupted sleep patterns and impaired

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cognitive functioning. The findings underscore the impact of night shift work on sleep quality and cognitive health.

Another Cross-sectional study conducted by (Altaf et al., 2022) to examine the relationship between sleep-wake patterns and cognitive performance among young adults in Islamabad. Using the PSQI and the Montreal Cognitive Assessment (MoCA), the study found that individuals with poor sleep quality and irregular sleep-wake patterns exhibited lower cognitive performance scores. The research highlights the significance of sleep quality in maintaining cognitive functions, which is particularly relevant for night shift workers who often experience disrupted sleep schedules.

There is currently no data on how cognitive performance mediates the association between dementia symptoms and sleep quality in Pakistani night shift workers. Nonetheless, several related studies offer insightful information in this field.

Another study looked at how Pakistani industrial night shift workers' cognitive performance was affected by disruptions to their circadian cycle. Two hundred workers from Faisalabad's textile industries who worked night shifts and two hundred workers who worked day shifts participated in this comparative study. The findings showed that, in comparison to their daytime counterparts, night shift workers had significant deficits in executive functioning, which includes the capacity for decision-making and problem-solving. According to the study's findings, working night shifts disrupts circadian rhythms, which results in cognitive deficiencies. This highlights the need for ways to lessen these impacts and increase workers' cognitive resilience (Yaffee, 2021).

Furthermore, studies on sleep deprivation and cognitive decline in Pakistan's senior population have shown how seriously bad sleep affects cognitive function. In this cross-sectional study, 180 senior citizens from Punjab's rural and urban areas participated. The results showed a robust correlation between sleep deprivation and cognitive deficits, raising the likelihood of dementia in the elderly. The study concluded that maintaining cognitive health and lowering the risk of dementia-related symptoms in older adults requires better sleep habits (Walker, 2021).

These results highlight the significance of sleep quality in preserving cognitive well-being, despite the paucity of direct research on the mediating role of cognitive functioning between dementia symptoms and sleep quality in Pakistani night shift workers. There is a need for more research on this topic in the Pakistani setting because the current research emphasizes the negative consequences of sleep disturbance and circadian misalignment on cognitive functioning (Walker, 2020).

Rationale

The covid-19 pandemic has exacerbated financial pressures on young individuals, making it challenging for sole breadwinners to support their families. consequently, night shift work has become increasingly prevalent in sectors such as healthcare, manufacturing and customer service. Studies have revealed that night shift workers have poor sleep quality are more vulnerable to early onset of cognitive decline as compare to day shift workers (Adams et al., 2020). Dementia is a growing worldwide concern with cases rising significantly over the coming years. WHO report the prevalence of dementia in Pakistan is approximately 1.2 million people. Which is

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expected to triple by 2050 World Health Organization (WHO), 2021. Hence, it's very important to identify the risk factors associated with dementia particularly in populations which are more at risk of developing dementia due to their occupational exposure such as night shift work (Rajaratnam et al., 2021). People who are doing night shift work experience sleep disturbances, effects their natural circadian rhythm which is our body's internal biological clock that regulates our internal body's processes and essential for our overall physical, psychological, emotional functioning particularly cognitive functioning (Wang et al., 2020). Appropriate sleep quality plays a very important role in regulating our cognitive functioning such as memory, attention, concentration and executive functioning, as many of the researches have shown that people whore doing long term night shift work tend to have a disturbed natural body circadian rhythm which leads to poor sleep quality and increase the risk of cognitive decline which in turns effect our major cognitive skills such as memory, attention concentration and executive functioning (Walker et al., 2019). Night shift workers who compromise their night sleep and due to their long-term sleep disturbances, they are more likely at the risk of cognitive impairment which ultimately leads to dementia (Lim et al., 2021). The purpose of conducting this study is to investigate how poor sleep quality leads to cognitive decline and how this cognitive decline increases the symptoms of dementia among night shift worker and to study the relationship among them. The current study will help organizations to develop strategies for flexible working hours so that workers can choose shifts that aligns with their natural circadian rhythm. Another objective is to develop intervention to improve night shift workers sleep quality and to develop insight among them about, how the poor sleep quality leads to the cognitive decline and how to improve it by taking short naps during their night shift work or to choose shift work that aligns with their body's natural circadian rhythm to improve their cognitive health and sleep which improves an individual overall functioning and well-being.

This study will help different organizations to develop strategies, policies and interventions for early detection of cognitive decline and symptoms of dementia at early age and to improve cognitive health (Arendt et al., 2019). It will also help stakeholders, professionals to conduct workshops, seminars, training sessions to educate people and to spread awareness among people about the risk of cognitive decline associated with night shift work and how to address it. Moreover, the current research will also be considering some of the demographic factors such as age, gender and work experience that moderate the relationship between sleep quality and risk of dementia in night shift adults which help us in forming different recommendations, strategies such as how to decrease it, detect it, and to prevent the cognitive decline that increase the risk of dementia and to improve night shift worker's cognitive health (Wang et al., 2020). Understanding how different subgroups of night-shift workers are affected by disrupted sleep can lead to more effective workplace interventions that take into account individual differences (Walker et al., 2019). Furthermore, this current research will also help in forming workplace policies and strategies to improve workers overall well-being and occupational health (WHO, 2021). The current research will also help in developing different health care programs and policies to guide people about the importance of sleep hygiene (Lim et al., 2010). In conclusion, this research addresses a critical gap in understanding how night-shift

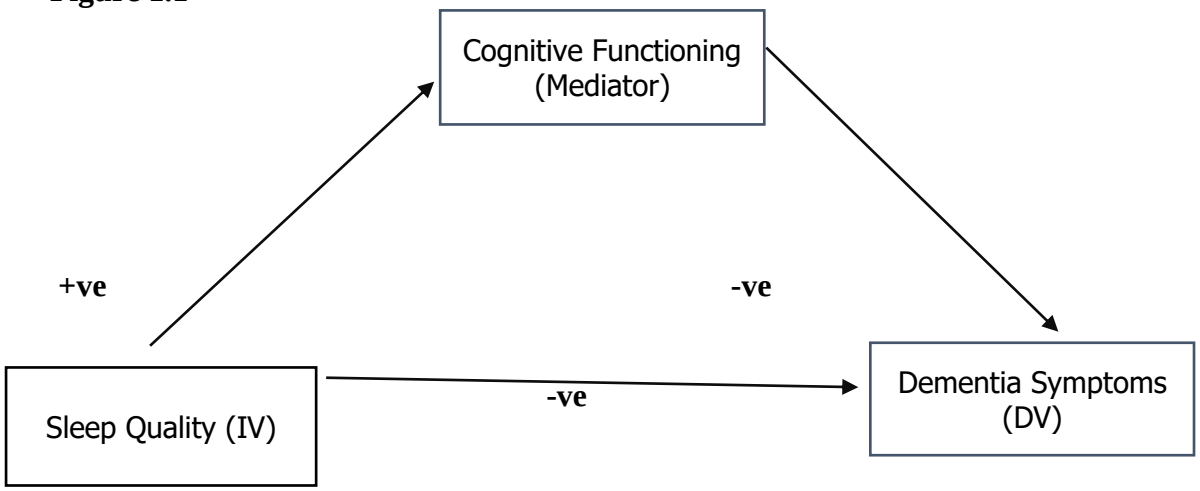
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work impacts long-term cognitive health, with a specific focus on sleep quality and dementia symptoms. By focusing on sleep as a modifiable factor, the study has the potential to contribute to both dementia prevention strategies and the improvement of work environments for night-shift workers (Rajaratnam et al., 2021).

Proposed Research Model
Figure 1.1



The current study conducted by using cross-sectional research design to study relationship between sleep quality, cognitive functioning and symptoms of dementia among night shift workers. The current study collected data from the participants at only one point of time. Data was collected by self-report questionnaire, using non-probability sampling methods, specifically purposive sampling technique.
A sample of 200-night shift workers (N=200) was collected through purposive sampling technique. The study included 200 middle-aged night shift workers between the ages of 20 and 45. Participants were currently working night shifts and had been doing so for at least the past six months. Individuals diagnosed with mental health conditions such as dementia or sleep disorders were excluded. Additionally, those working irregular shifts were not included in the study. Quantitative data will be collected from Rawalpindi and Islamabad. The sample size will be determined based on power analysis to ensure sufficient statistical power for detecting significant relationships among the variables.

Results
The results section outlines the outcome from both descriptive statistical analysis and t-test procedures on research variables. Demographic information about the research participants reveals that females outnumber males in the sample while most participants obtained an undergraduate degree. The participant sample ages range between 21 years and 45 years yet the participant number peaks within the 25 to 30 years age group. The subsequent section presents descriptive data regarding Montreal Cognitive Assessment, Sleep Quality and Cognitive Functioning variables. The statistical evaluation indicates these variables demonstrate moderate distribution variations and somewhat unique distribution patters consisting of mild data skewness.

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The Montreal Cognitive Assessment and Sleep Quality present consistent patterns in data dispersion but Cognitive Functioning spreads data points evenly throughout the range. Results from independent samples t-tests located in the section determine the gender-based differences among variables. The data demonstrated that cognitive functioning scores showed higher performance by males than females whereas no significant differences emerged between genders regarding sleep quality and Montreal cognitive assessment outcomes. The research findings demonstrate understanding of gender-based sleep quality effects on cognitive performance thus opening new investigative possibilities.

Demographic Characteristics of Sample are reported in Table 2.1

Table 2.1

percentages and Frequencies of demographic variables of Study (N=200)

Variable	Category	F	(%)
Gender	Male	100	50.%
	Female	100	50.%
Age Group	25–30 years	60	30.%
	31–35 years	70	35.%
	36–40 years	45	22.5%
	41–45 years	25	12.5%
Education Level	Intermediate	30	15.%
	Bachelor’s	100	50.%
	Master’s or higher	70	35.%
Marital Status	Single	80	40.%
	Married	120	60.%
Job Sector	Healthcare	80	40.%
	Forces	50	25.%
	Industrial/Factory	40	20.%

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	Call Centres	30	15.%
Night Shift Experience	6–12 months	50	25.%
	13–24 months	80	40.%
	More than 2 years	70	35.%

Note: % = Percentage, f=Frequency, SD=Standard Deviation, M=Mean

Table 1 shows demographic statistical breakdowns of the study participants who were between 21 and 45 years old and spanned across different genders and educational levels. The research includes participants with ages between 21 and 45 years where the two most populous age groups are participants who are 25 years old (17.5%) and those who are 24 years old (8.0%). The 21 and 22 age groups together represent 1.5% of the surveyed participants yet older participants spanning from age 39 to 44 significantly reduce the overall sample percentage. Female participants dominate the total population at 82% and the male participants make up 18%. A large number of participants hold undergraduate degrees consisting of 46.5% graduation recipients while undergraduate populations consist of 27.5% Intermediate and 23.0% Matriculation levels. Among the sample population the remaining participants divided almost equally into Intermediate education (27.5%), Matric education (23.0%) and post-graduation qualifications (3.0%).

Table 2

Descriptive Statistics for Study Variables

Category	N	Minimum	Maximum	Mean	S. D	Skewness	Kurtosis
Montreal Cognitive. Assessment	200	6.00	26.00	14.6900	4.84056	0.433	-0.268
Sleep Quality	200	19.00	51.00	37.5450	6.21944	-0.253	-0.610
Cognitive Functioning	200	28.00	76.00	52.8600	10.08409	0.161	-0.208
Valid N (list wise)	200						

Note: N = Number of Participants, Minimum = Minimum Value, Maximum =

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Maximum Value, Mean = Average Value, S.D = Standard Deviation, Skewness = Measure of Asymmetry, Kurtosis = Measure of Peakiness

Table 2 displays descriptive information regarding three variables which include Montreal Cognitive Assessment and Sleep Quality and Cognitive Functioning. The Montreal Cognitive Assessment mean score stands at 14.69 and its standard deviation at 4.84 showing average variation in the reported data. The Skewness value at 0.433 indicates right distribution skewness but Kurtosis at -0.268 shows a relatively flat statistical pattern when compared to normal distributions. The data reveals moderate score distribution for Sleep Quality with 37.55 as mean and 6.22 as standard deviation. A distribution with -0.253 skewness shows leftward skewness yet its comparison with normal distribution shows platykurtic shape with -0.610 kurtosis. Cognitive Functioning exhibits a mean score of 52.86 and standard deviation of 10.08 which indicates a wide distribution of data points. Analysis shows a 0.161 skewness value that points to a normal distribution pattern alongside -0.208 kurtosis demonstrating an extended distribution beyond normal curve boundaries.

Table 3

Descriptive Statistics for Age, Gender, and Education

Category	N	Mean	Std. Deviation	Skewness	Kurtosis
Age	200	31.58	6.885	0.682	-0.732
Gender	200	1.82	0.385	-1.678	0.825
Education	200	2.30	0.855	-0.316	-1.077

Note: N = Number of Participants, Minimum = Minimum Value, Maximum = Maximum Value, Mean = Average Value, Std. Deviation = Standard Deviation, Skewness = Measure of Asymmetry, Kurtosis = Measure of Peakiness

Table 3 contains the statistical descriptions of Age, Gender, and Education variables. The collected participant data points at Age range from a standard deviation of 6.885 around their mean value of 31.58. The age data shows right-skewed tendencies (0.682) and a flat distribution shape (kurtosis -0.732) compared to a normal distribution. The Gender variable's mean value of 1.82 points to a female-dominant sample composition while using 1 for males and 2 for females The distribution shows extreme female-heavy skewness (-1.678) alongside a pointed peak (0.825) in its shape. Most participants exceed high school education according to the mean of 2.30 spanning from matriculation to post-graduation educational levels. A slight left skew exists in -0.316 while the value of -1.077 shows that the distribution shape deviates from typical distribution shapes because it is flatter than the normal distribution type.

Table 4

Reliability Analysis and Psychometric Properties of Study Variables

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	N	α	k	Minimum	Maximum	Mean	SD	Skewness	Kurtosis
Montreal Cognitive Assessment	200	0.817	26	6.00	26.00	14.6900	4.84056	0.433	-0.268
Sleep Quality	200	0.809	19	19.00	51.00	37.5450	6.21944	-0.253	-0.610
Cognitive Functioning	200	0.857	18	28.00	76.00	52.8600	10.08409	0.161	-0.208

Note: N = Number of Participants, M = Mean, SD = Standard Deviation, α = Cronbach's Alpha (reliability coefficient). Range represents the minimum and maximum score for each variable in the study.

The psychometric properties together with reliability analysis for the three study variables appear in Table 4. The internal reliability of the Montreal Cognitive Assessment reaches 0.817 according to Cronbach's alpha calculations from its 26 measurement items. The mean score of 14.69 and standard deviation of 4.84 points were identified from the sample data alongside positive distribution skew (0.433) and flatter curve (-0.268 kurtosis) compared to normal distribution. Applications of 19 items in Sleep Quality have established acceptable reliability through a Cronbach's alpha coefficient of 0.809. The sample mean is 37.55 and standard deviation is 6.22 and the statistical distribution shows negative skewness of -0.253 while exhibiting platy kurtosis of -0.610. The Cognitive Functioning variable demonstrates an excellent reliability score of 0.857 from measuring 18 items. These variables demonstrate wide-ranging dispersion through their 10.08 standard deviation because the mean stands at 52.86. The distribution shows almost normal characteristics having a 0.161 skewness value but slightly flat -0.208 kurtosis measure.

Table 5
Pearson Correlation of Study Variables

Variable	Montreal Cognitive Assessment	Sleep Quality	Cognitive Functioning
Montreal Cognitive Assessment	1	-0.143*	-0.213**
Sleep Quality	-0.143*	1	0.224**
Cognitive Functioning	-0.213**	0.224**	1

Note: *Correlation is significant at the 0.05 level (2-tailed). *Correlation is significant at the 0.01 level (2-tailed).

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The research data derived from Pearson correlation analysis appears in Table 5 with Montreal Cognitive Assessment, Sleep Quality, and Cognitive Functioning serving as the study variables According to Montreal Cognitive Assessment results there is a meaningful inverse relationship between Sleep Quality scores ($r = -0.143$, $p = 0.044$) and Cognitive Functioning scores ($r = -0.213$, $p = 0.002$). This indicates higher Montreal Cognitive Assessment scores correspond to lower Sleep Quality scores and Cognitive Functioning scores. People who experience better sleep quality demonstrate higher cognitive abilities according to statistical results ($r = 0.224$ and $p = 0.001$). The statistical analysis shows that Cognitive Functioning and Montreal Cognitive Assessment share a negative correlation with a value of $r = -0.213$. Data shows a positive relationship between Sleep Quality and Cognitive Functioning since their relation produced an r value of 0.224.

Statistically significant relationships exist between cognitive assessment and sleep quality and cognitive functioning at the 0.05 and 0.01 levels according to these findings.

Table 6

Independent Samples T-Test for Gender and Study Variables (N = 200)

Variables	Male	Female	T	p	95% CI LL	95% CI UL	Cohen's d
Sleep Quality	M = 37.19, SD = 7.51	F = 37.62, SD = 5.92	-0.37	.710	-2.69	1.84	-0.06
Montreal Cognitive Assessment	M = 13.42, SD = 3.83	M = 14.97, SD = 5.00	-1.75	.081	-3.30	0.19	-0.35
Cognitive Functioning	M = 57.78, SD = 9.22	M = 51.78, SD = 9.97	.001	.001	2.48	9.52	0.62

Note: M = Mean, SD = Standard Deviation, F = Levene's statistic for equality of variances, t = t-value for independent samples t-test, p = p-value.

Table 6 demonstrates how independent samples t-test analyses show no significant variances between genders regarding Sleep Quality and Montreal Cognitive Assessment as well as Cognitive Functioning. Males scored 37.19 (SD = 7.51) similarly to females who scored 37.62 (SD = 5.92) with a t value of -0.373 ($p = 0.710$) but Levene's test showed unequal variances ($F = 7.222$, $p = 0.008$). The Montreal Cognitive Assessment scores between male participants ($M = 13.42$, $SD = 3.83$) and female participants ($M = 14.97$, $SD = 5.00$) produced no statistically meaningful

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outcome (t = -1.752, p = 0.081) though Levene's test resulted in F = 1.726 (p = 0.190). A statistically meaningful gender-based difference emerged when cognitive abilities were compared by means of the t-test (t = 3.311 p = 0.001). Male participants yielded a higher score (M = 57.78, SD = 9.22) than females (M = 51.78, SD = 9.97).

Table 7
Mediation Analysis for Sleep Quality and Cognitive Assessment (Dementia) Predicting, Cognitive Functioning (N = 200)

	B	SE B	t	p	95% CI
Constant	39.2310	4.2735	9.1800	0.0000	30.8035, 47.658
Sleep Quality	0.3630	0.1123	3.232	0.0014	0.1415, 0.5845
Cognitive Functioning (Cognit)	-0.0917	0.0341	-2.687	0.0078	-0.1590, -0.0244
Montreal Cognitive Assessment (MCA)	-0.0778	0.0553	-1.407	0.1610	-0.1869, 0.0313
Interaction (Cognit x Sleep Quality)	-0.0333	0.0149	2.2381	0.0266	-0.0674, -0.0094

Note: B = Unstandardized regression coefficient, SE B = Standard error of B, t = t-statistic, p = p-value for the test of significance, CI = Confidence Interval (Lower bound and Upper bound).
Model Summary
$R = 0.2239$, $R^2 = 0.0501$, MSE = 97.0796, F = 10.4484, df1 = 1, df2 = 198, p = 0.0014
The mediation analysis results showing the connection between Sleep Quality with Cognitive Functioning (Cognit) and Montreal Cognitive Assessment (MCA) appear in Table 7. The study investigates the predictive power of Sleep Quality together with Cognitive Functioning on Cognitive Functioning measured through MCA while evaluating their possible interactive influence. The model's constant value demonstrated statistical significance (B = 39.2310, SE B = 4.2735, t = 9.1800, p = 0.0000) showing the initial cognitive ability when all predictor variables are set to zero. The analysis indicates that better sleep quality positively correlates to higher cognitive functioning at B = 0.3630 (SE B = 0.1123, t = 3.232, p = 0.0014) and the predicted range of values stretches between 0.1415 to 0.5845. The Montreal Cognitive Assessment scores decrease as Cognitive Functioning measures increase (B = -

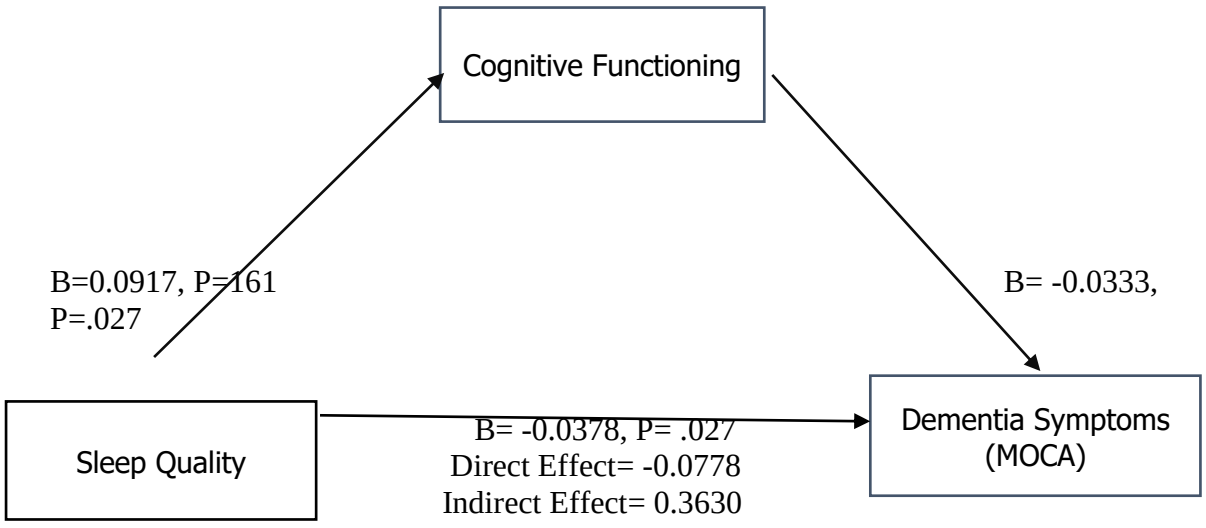
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0.0917, SE B = 0.0341, t = -2.687, p = 0.0078). This relationship is statistically significant and exists within the confidence interval of -0.1590 to -0.0244. Regarding results from the Montreal Cognitive Assessment (MCA), the analysis found no evidence of a significant correlation effect on Cognitive Functioning (B = -0.0778, SE B = 0.0553, t = -1.407, p = 0.1610) with a 95% confidence interval between -0.1869 to 0.0313, showing no direct relationship in this model. The significant interaction effect from Cognitive Functioning and Sleep Quality measurement (B = -0.0333, SE B = 0.0149, t = 2.2381, p = 0.0266) shows that Sleep Quality conditions how Cognitive Functioning affects it (95% CI -0.0674 to -0.0094). The outcome variable shows less dependence on cognitive functioning when sleep quality increases. The findings indicate that Sleep Quality functions as a major determinant of Cognitive Functioning while Cognitive Functioning shows a multi-faceted association with Montreal Cognitive Assessment and Sleep Quality acts as a mediator of their interaction.

Figure 2
Mediation Analysis for Sleep Quality and Cognitive Assessment (Dementia) Predicting, Cognitive Functioning (N = 200)



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Table 8
Moderation Analysis for Sleep Quality and Age Predicting Cognitive Functioning (N = 200)

Variable	B	SE B	t	p	95% CI
Constant	31.4051	20.2289	1.5525	0.1222	-8.41, 71.29
Sleep Quality	0.4978	0.5304	0.9385	0.3492	-0.54, 1.54
Age	0.2458	0.6203	0.3962	0.6924	-0.97, 1.46
Interaction (Sleep Quality × Age)	-0.0042	0.0163	-0.259	0.7959	-0.03, 0.027

Note: B = Unstandardized regression coefficient, SE B = Standard error of B, t = t-statistic, p = p-value, CI = Confidence Interval.
Model Summary
$R = 0.2324$, $R^2 = 0.0540$, MSE = 97.6704, $F = 3.7291$, df1 = 3, df2 = 196, $p = 0.0122$
The Table 8 contains the summary results of the moderation analysis which investigates how Sleep Quality interacts with Age to determine Cognitive Functioning (Cognit). The analysis tests if age affects the connection between sleep quality and cognitive performance. The constant value is statistically insignificant for this model because it measures the baseline cognitive level of 31.4051 when sleep quality and age have a value of zero ($p = 0.1222$). Sleep Quality failed to demonstrate any significant relationship toward cognitive functioning in this research model with a value of $B = 0.4978$ and a standard error $B = 0.5304$ while age revealed a similar outcome with $B = 0.2458$ and standard error $B = 0.6203$. The t value and p value showed no significant relationship between both variables at $t = 0.9385$ and $p = 0.3492$ respectively for sleep quality and $t = 0.3962$ and $p = 0.6924$ respectively for age. Additionally, the interaction between Sleep Quality and Age obtained B = - The link between Sleep Quality and Age fails to reach significance based on the obtained t value. The beta value (B=-0.0042) with standard error (SE B=0.0163) shows no meaningful relation (t=-0.2591, p=0.7959) and its 95% confidence interval extends from -0.0363 to 0.0279. No significant relationship exists between sleep quality along with age and cognitive functioning throughout this sample. The overall model demonstrated statistical significance ($F = 3.7291$, $p = 0.0122$) yet the individual predictors along with their interaction failed to significantly influence cognitive

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functioning prediction.

Table 9
Moderation Analysis for Sleep Quality and Gender Predicting Cognitive Functioning (N = 200)

Variable	B	SE B	T	p	95% CI
Constant	31.4996	17.0507	1.8474	0.0662	[-2.1268, 65.1259]
Sleep Quality	0.8712	0.4494	1.9384	0.0540	[-0.0152, 1.7576]
Gender	4.5010	9.4939	0.4741	0.6360	[-14.2222, 23.2243]
Interaction (Sleep Quality x Gender)	-0.2857	0.2501	-1.1425	0.2546	[-0.7789, 0.2075]

Note: B = Unstandardized regression coefficient, SE B = Standard error of B, t = t-statistic, p = p-value, CI = Confidence Interval (Lower bound and Upper bound).
Model Summary
$R = 0.3336$, $R^2 = 0.1113$, MSE = 91.7540, F = 8.1824, df1 = 3, df2 = 196, p = 0.0000
The results from Table 9 analyse Sleep Quality interactions with Gender to predict Cognitive Functioning (Cognit). The regression constant showed no statistical significance with a value of 31.4996 (SE B = 17.0507, t = 1.8474, p = 0.0662) as it indicated that cognitive functioning remained unchanged when both predictor variables had a zero value. The study results indicate that better sleep quality positively influences cognitive functioning (B = 0.8712, SE B = 0.4494, t = 1.9394, p = 0.0540). The 95% confidence interval is situated between [-0.0152, 1.7576]. The results indicate that better sleep quality improves brain performance however the relationship did not reach significance at the 0.05 level. This study revealed that gender does not significantly impact Cognitive Functioning because the independent variable produces a non-significant effect (B = 4.5010) under the specified conditions (SE B = 9.4939, t = 0.4741, p = 0.6360). The confidence interval extends from [-14.2222, 23.2243]. The investigation of the Sleep Quality by Gender relationship yielded an interaction term of non-statistical significance (B = -0.2857, SE B = 0.2501, t = -1.1425, p = 0.2546) with a confidence interval from [-0.7789, 0.2075]. The analysis indicates that Gender does not act as a significant factor to affect how Cognitive Functioning relates to Sleep Quality. The F value at 8.1824 with p = 0.0000 demonstrates the statistical significance of the complete model yet none of the predictors including the interaction reveal substantial influences upon Cognitive Functioning. Sleep Quality and Gender combination fails to show a significant effect on the relationship connecting sleep quality and cognitive functioning.

Discussion

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The purpose of the current study was to investigate the connection between middle-aged Pakistani night shift workers' cognitive abilities, sleep quality, and dementia symptoms. In particular, research looked at whether cognitive performance influences the association between dementia symptoms and poor sleep quality. The study also looked into whether these associations are moderated by demographic variables like age, gender, and work experience.

At first reliability of the scales were computed. The reliability of the three scales employed in the study was determined at the outset of the analysis. Based on its 26 items, the Montreal Cognitive Assessment had a Cronbach's alpha rating of 0.817, indicating strong internal consistency. Across 19 items, the Sleep Quality scale's Cronbach's alpha was 0.809, indicating acceptable reliability as well. Similarly, the 18-item Cognitive Functioning measure had a Cronbach's alpha of 0.857, indicating great reliability. The skewness and kurtosis values for each of the three variables showed that, with only minor variations, the data distribution was very normal. Sleep Quality was somewhat negatively skewed, Cognitive Functioning displayed a near-normal distribution, and the Montreal Cognitive Assessment displayed a slight positive skew. In contrast to the normal curve, the kurtosis values for every variable indicated a distribution that was somewhat lower. Overall, the results of the distribution and reliability studies supported the validity of the study's scales and the suitability of the data for additional statistical analysis.

According to the first hypothesis, persons who work nights would be more likely to have cognitive impairments if they had worse quality sleep. Nonetheless, the study revealed a positive correlation between cognitive performance and sleep quality ($B = 0.8712$, $p = 0.0540$); nonetheless, this result was marginally above the 0.05 cutoff, indicating that it was not statistically significant. H1 is therefore not supported. This indicates that although improved sleep seemed to enhance cognitive performance, there was insufficient data to definitively support this association. Prior studies have repeatedly demonstrated that inadequate sleep impairs memory, focus, and attention (Altena et al., 2008; Lo et al., 2016), particularly for those with erratic sleep schedules such as night shift workers (Wang et al., 2019).

According to the second theory, persons who work night shifts are more likely to get dementia if they have cognitive impairment. This hypothesis is supported by the results of the Pearson correlation analysis, which indicate a statistically significant negative correlation ($r = -0.213$, $p = 0.002$) between cognitive functioning and Montreal Cognitive Assessment (MCA) scores. This finding supports a significant correlation between cognitive decline and early dementia symptoms since lower cognitive functioning scores are associated with higher MCA scores, which indicate a higher likelihood of dementia. This result is in line with previous research. Prior research has indicated that cognitive impairment, namely in executive functioning, memory, and attention, is frequently an early indicator of dementia (Petersen et al., 2014; Livingston et al., 2020). Because disturbed circadian rhythms and poor sleep quality have been connected to long-term cognitive impairment and neurodegenerative disorders, night shift workers are particularly at risk (Musiek & Holtzman, 2016). Furthermore, persons with diminished cognitive function have a higher chance of eventually developing Alzheimer's and other types of dementia, according to research by Lim et al. (2013).

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According to the third hypothesis, the association between dementia risk and sleep quality in persons who work nights would be mediated by cognitive functioning. This theory is supported by the mediation analysis's findings. A substantial indirect impact was discovered, indicating that cognitive functioning is favourably predicted by sleep quality (B = 0.3630, SE B = 0.1123, p = 0.0014), implying that people who get more sleep typically have higher cognitive performance. Better cognitive functioning is therefore associated with a decreased risk of dementia, suggesting that cognitive functioning is a key factor in the relationship between dementia symptoms and sleep quality. This result is consistent with previous studies. Sleep issues have been linked to cognitive deterioration, which over time may make people more susceptible to dementia, according to Zhang et al. (2017). Similar to this, Lo et al. (2016) highlighted how sleep deprivation affects memory, attention, and brain function—all of which are crucial domains impacted in early dementia. According to other research, sleep disturbances have an impact on the structure and function of the brain, impairing cognitive function and possibly hastening the onset of neurodegenerative changes (Spira et al., 2013).

Overall, the current study demonstrates that cognitive performance is a critical mechanism by which night shift workers' dementia symptoms may be brought on by inadequate sleep. This emphasizes how crucial it is to address sleep quality in order to reduce the risk of dementia and cognitive decline in populations with erratic work schedules.

According to the fourth hypothesis, middle-aged night shift workers would exhibit a larger correlation between poor sleep and cognitive loss than younger persons because age would reduce the relationship between sleep quality and cognitive functioning. The moderation analysis's findings, however, contradicted this theory. Age did not significantly affect the association between sleep quality and cognitive functioning, as seen by the lack of statistical significance in the interaction between age and sleep quality (B = -0.0042, p = 0.7959). H4 is so disregarded. This conclusion is in line with other studies that have examined age as a moderator and found conflicting or non-significant results. For instance, Blackwell et al. (2011) discovered that although sleep issues have an impact on cognitive function, the degree of this association did not change substantially among age groups. In a similar vein, Nabes et al. (2009) observed that while inadequate sleep affects cognitive functioning throughout adulthood, there was no discernible difference in the level of cognitive impairment brought on by sleep disruption between younger and older persons. Accordingly, the current study indicates that poor sleep quality has a detrimental effect on night shift workers' cognitive functioning at any age. These results demonstrate that rather than concentrating solely on middle-aged people, sleep-improving therapies should target people of all ages.

According to the fifth hypothesis, women who work night shifts are more likely than men to have cognitive decline and, as a result, dementia. This suggests that gender would influence the association between sleep quality and cognitive functioning. This assumption was not supported by the moderation analysis, though. Gender does not significantly alter how sleep quality affects cognitive functioning, as evidenced by the lack of statistical significance in the interaction between gender and sleep quality (B = -0.2857, p = 0.2546). H5 is thus disproved.

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This result is consistent with research like that of Lo et al. (2016), which discovered that while both sexes suffer from the detrimental cognitive effects of inadequate sleep, the gender difference was not statistically significant. In a similar vein, Beaudreau and (Spira, 2013) discovered that although women are more likely than males to report sleep problems, there was no discernible difference in the effects of these disturbances on cognitive function. Accordingly, the current study indicates that both male and female night shift workers' cognitive functioning is equally impacted by poor sleep quality. Therefore, sleep-related interventions to enhance cognitive health should be inclusively planned, without presuming increased risk based just on gender.

Conclusion and Prevention

The current study investigated the relationship between dementia risk, cognitive functioning, and sleep quality in persons who work night shifts. The results demonstrated that, although the association was not as strong as anticipated, sleep quality does affect cognitive functioning. Although there was a weak correlation, improved sleep was generally associated with improved cognitive function. Nonetheless, it was evident that a higher risk of dementia was linked to worse cognitive performance; in other words, the likelihood of getting dementia symptoms rises as cognitive abilities deteriorate. The findings also demonstrated how cognitive ability serves as a crucial link between dementia risk and sleep quality.

Cognitive performance was found to be negatively impacted by poor sleep, and this, in turn, increased the likelihood of dementia, demonstrating the critical role that cognitive health plays in this process. However, age and gender did not appear to have a significant impact on these associations, indicating that sleep deprivation has a similar impact on cognitive health in males and females of different ages. The study's overall findings underscored the importance of preserving cognitive health and lowering the risk of dementia in those who work night shifts, and the potential long-term benefits of sleep-improving therapies for preserving mental capacities.

In Conclusion, this study emphasizes how important good sleep is for preserving cognitive function and avoiding dementia in adults who work nights. Overall, the results indicate that sleep deprivation might impair cognitive ability, which may raise the risk of dementia, even though certain correlations were less than anticipated. The notion that enhancing sleep quality may be a useful strategy for long-term brain health protection is further supported by the mediation role of cognitive functioning. The study emphasizes the need of treating sleep problems in night shift workers as a preventative measure to lessen long-term cognitive impairment, even if age and gender did not significantly change these associations.

Limitations

The data was collected from just two cities of Pakistan that was Rawalpindi and Islamabad.

Longitudinal monitoring of sleep and cognitive changes over time was not feasible due to the short study period.

Because the study was carried out in a particular cultural setting, the findings may not be as applicable to other areas or demographics.

Sample size was small.

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Suggestion

To increase generalizability data should be collected from number of other cities.
In order to avoid social desirability, some tactful questions should be asked in informed consent.
Sample size could be large.
Urdu translated scales could be used as it would be easier for the participants understand them.
We can also conduct longitudinal study.

Implications

The study will help people understand how working at night can affect their sleep and memory and increase the chance of dementia.
It will guide health workers to create better wellness programs to help night-shift employees sleep better.
The research will support companies in making flexible work hours, so workers can choose shifts that match their natural body clock.
Organizations can use the study to start regular mental health and memory check-ups for night-shift workers to catch problems early.
The findings will help companies launch awareness programs about how night work affects brain health.
The study will encourage teaching night-shift workers to take short naps during work, which can improve their thinking skills and overall health.

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