

**SHIFT WORK: THE IMPACT ON SLEEP QUALITY
AMONG CRITICAL CARE NURSES IN
HOSPITAL UNIVERSITI SAINS MALAYSIA**

NOR RASIDAH BINTI MOHD JAAFAR

**SCHOOL OF HEALTH SCIENCES
UNIVERSITI SAINS MALAYSIA**

2023

SHIFT WORK: THE IMPACT ON SLEEP QUALITY
AMONG CRITICAL CARE NURSES IN
HOSPITAL UNIVERSITI SAINS MALAYSIA

by

NOR RASIDAH BINTI MOHD JAAFAR

Dissertation submitted in partial fulfillment
of the requirements for the degree of
Bachelor of Nursing (Honours)

June 2023

ACKNOWLEDGMENT

I wish to express my sincere appreciation to my supervisor Madam Norliza binti Hussin who has convincingly guided and encouraged me to be professional and do the right thing even the road got tough. I truly appreciate having their valuable guidance, encouragement, and patiently directing me upon this research process. It was difficult for me to finish this study without their guidance and sharing expertise as it is my first time handling the research study. Without their persistent help, the objective of this research would not have been achieved.

I wish to acknowledge the support and great love of my parents, Mr. Mohd Jaafar and Halimah Motaji and my friends for their constant moral supports. They kept me going on for me who have always been helping and encouraging me throughout the year. My thanks and appreciation also go to my friend's classmates. I am lucky to have them for their assistance, support, and opinion along with the encouragement to me to complete my study. I really appreciate their helping hands in the success of this study.

Last but not least, I would like to thank all the participants, and nurses in selected area for their cooperation and willingness to participate in this research. I sincerely acknowledge the efforts of all those who have directly or indirectly helped me in completing my thesis successfully. I have no valuable words to express my thanks, but my heart is still full of the favors received from every person.

TABLE OF CONTENTS

CERTIFICATE.....	i
DECLARATION	ii
ACKNOWLEDGMENT	iii
LIST OF TABLES	vii
LIST OF FIGURES.....	viii
LIST OF ABBREVIATIONS	viii
ABSTRAK	ix
ABSTRACT.....	x
CHAPTER 1 : INTRODUCTION.....	1
1.1 Introduction	1
1.2 Background of Study.....	1
1.3 Problem Statement	4
1.4 Research Questions.....	6
1.5 Research Objectives	6
1.5.1 General Objectives.....	6
1.5.2 Specific Objectives	6
1.6 Research Hypothesis.....	7
1.7 Significance of the Study	8
1.8 Conceptual and Operational Definitions.....	10
CHAPTER 2 : LITERATURE REVIEW	12
2.1 Introduction	12
2.2 Critical Care Nurse	12
2.3 Shift Work	13
2.4 Overview of Sleep	14
2.4.1 Stages of sleep	14
2.5 Sleep Quality	16
2.6 Shift Work and Sleep Quality.....	17
2.7 Factors Associated with Sleep Quality.....	17
2.8 Theoretical Framework of Study	19

2.8.1	Description of Multiple Mediation Model.....	20
CHAPTER 3 : METHODOLOGY AND METHODS	23
3.1	Introduction	23
3.2	Research Design.....	23
3.3	Research Location and Population	23
3.4	Research Duration.....	24
3.5	Sampling Plan	24
3.5.1	Sample Criteria	24
3.5.2	Sampling Size Estimation.....	25
3.5.3	Sampling Method.....	29
3.6	Research Instruments.....	30
3.6.1	Instrument	30
3.6.2	Translation of Instrument.....	32
3.6.3	Validity and Reliability.....	32
3.7	Variables.....	32
3.7.1	Variable Measurable	33
3.8	Data Collection Plan	37
3.9	Ethical Consideration.....	39
3.10	Data Analysis.....	40
CHAPTER 4 : RESULTS	42
4.1	Introduction	42
4.2	Result of the Study.....	42
4.2.1	Sociodemographic Characteristics Among Critical Care Nurses in HUSM ..	42
4.2.2	The Overall Frequency and Percentage Level of Sleep Quality Among Critical Nurses in HUSM	44
4.2.3	Frequency and Percentage of Participants' Shift Work and Sleep Quality Descriptions.....	44
4.2.4	Distribution of Participants by Sleep Quality Elements	46
4.2.5	Pittsburgh Sleep Quality Index Score for Shift Worker and Non-Shift Worker 47	
4.2.6	Association between Shift Work with Level of Sleep Quality	48

4.2.7	Association between Selected Sociodemographic Characteristics with Sleep Quality	48
-------	--	----

CHAPTER 5 : DISCUSSION		50
5.1	Introduction	50
5.2	Sociodemographic Characteristics of Respondents	50
5.3	Level of Sleep Quality Among Critical Care Nurses in HUSM	51
5.4	Association Between Selected Sociodemographic Characteristics and Level of Sleep Quality Among Critical Care Nurses in HUSM	54
5.5	Strength and Limitations of the Study	56
CHAPTER 6 : CONCLUSION		57
6.1	Introduction	57
6.2	Summary of Study Findings	57
6.3	Implications and Recommendation	58
6.3.1	Nursing Practice	58
6.3.2	Nursing Education	58
6.3.3	Recommendation	59
6.4	Conclusion	59
7.0	REFERENCES	61
8.0	APPENDICES	66
	APPENDIX A: INSTRUMENT (SURVEY QUESTIONNAIRE)	66
	APPENDIX B: RESEARCH INFORMATION AND CONSENT FORM	74
	APPENDIX C: PARTICIPANT INFORMATION AND CONSENT FORM	77
	APPENDIX D: PERMISSION TO USE THE INSTRUMENT	80
	APPENDIX E : INSTITUTIONAL APPROVAL	82
	APPENDIX F : ETHICAL APPROVAL	85

LIST OF TABLES

Table 1.1	Conceptual and Operational Definitions (Shiftwork, Sleep Quality, Critical Care Nurses).....	10
Table 2.1	Sleep Recommendation by Age Group (S. Foundation, 2022).....	14
Table 3.1	Dependent and independent variables.....	32
Table 4.1	Sociodemographic Characteristics Among Critical Care Nurses in HUSM.....	43
Table 4.3	The Overall Frequency and Percentage Level of Sleep Quality Among Critical Nurses in HUSM.....	44
Table 4.3	Frequency and percentage of participants' shift work and sleep quality descriptions.....	45
Table 4.4	Distribution of Participants by Sleep Quality Elements.....	46
Table 4.5	Pittsburgh Sleep Quality Index score for shift worker and non-shift worker.....	47
Table 4.6	Association between Shift Work and Level of Sleep Quality Among Critical Care Nurses in HUSM.....	48
Table 4.7	Association between selected sociodemographic characteristics (age, gender, marital status, years or working experience with shift work and monthly household income) with level of sleep quality.....	49

LIST OF FIGURES

Figure 2.1	Visualization of Total Effect Model and Basic Mediation Model (Nielsen et al., 2016).....	19
Figure 2.2	Modified Model According to Mediation Model to Test the Sociodemographic Characteristics and the Use of Shift Work on Sleep Quality.....	21
Figure 3.1	Overall Flow of the Data Collection Process.....	38

LIST OF ABBREVIATIONS

AASM	American Academy of Sleep Medicine
HREC	Human Research Ethics Committee
HUSM	Hospital Universiti Sains Malaysia
ICU	Intensive Care Units
NIOSH	National Institute for Occupational Safety and Health
PSQI	Pittsburgh Sleep Quality Index
REM	Rapid Eye Movement
SES	Socioeconomic Status
SPSS	Statistical Package Social Sciences
SRS	Sleep Research Society
SSI	Standard Shiftwork Index
USM	Universiti Sains Malaysia
WASO	Wake After Sleep Onset
WHO	World Health Organization

**KERJA SYIF: KESAN TERHADAP KUALITI TIDUR DALAM KALANGAN
JURURAWAT PENJAGAAN KRITIKAL DI HOSPITAL UNIVERSITI SAINS
MALAYSIA**

ABSTRAK

Kajian telah menunjukkan bahawa kualiti tidur yang buruk boleh mengakibatkan kesan buruk yang tidak menyenangkan dan lazimnya berlaku dalam kalangan jururawat. Memandangkan hakikat bahawa jururawat perlu bekerja mengikut jam syif (pagi, petang dan malam), kajian ini bertujuan untuk menilai status semasa kualiti tidur jururawat penjagaan kritikal di Hospital Universiti Sains Malaysia (HUSM) dan meneroka kesannya. Kajian keratan rentas telah dijalankan untuk menilai kesan kerja syif terhadap tahap kualiti tidur dalam kalangan jururawat penjagaan kritikal di HUSM. Data dikumpul menggunakan soal selidik yang ditadbir sendiri yang menggabungkan Indeks Kualiti Tidur Pittsburgh (PSQI). Seramai 69 orang jururawat penjagaan kritikal dari wad jagaan kritikal, HUSM yang memenuhi kriteria inklusi telah terlibat dalam kajian ini. Mereka dipilih melalui kaedah pensampelan mudah. Data yang dikumpul dianalisis secara statistik menggunakan perisian Statistical Package Social Science (SPSS) versi 26. Kajian ini menunjukkan 82.6% responden mempunyai tahap kualiti tidur yang kurang baik. Perkaitan antara kerja syif, ciri sosiodemografi terpilih dan tahap kualiti tidur dianalisis dengan menggunakan ujian Chi-Square Pearson. 69.57% responden yang bekerja mengikut syif menunjukkan mereka mempunyai tahap kualiti tidur yang lemah. Jumlah min skor PSQI bagi 69 jururawat jagaan kritikal di HUSM ialah 0.83 (0.382), termasuk 12 (17.4%) subjek $PSQI \leq 5$ dan 57 (82.6%) dengan $PSQI > 5$. Hasil kajian ini mendedahkan bahawa tidak terdapat hubungan yang signifikan antara ciri sosiodemografi terpilih (umur, jantina, status perkahwinan, tahun pengalaman bekerja dengan kerja syif dan pendapatan isi rumah bulanan) dengan tahap kualiti tidur dalam kalangan jururawat penjagaan kritikal di HUSM ($p > 0.05$). Kesimpulannya, tahap kualiti tidur dalam kalangan jururawat rawatan kritikal di HUSM adalah lemah.

SHIFT WORK: THE IMPACT ON SLEEP QUALITY AMONG CRITICAL CARE NURSES IN HOSPITAL UNIVERSITI SAINS MALAYSIA

ABSTRACT

Studies have shown that poor sleep quality could result in many unpleasant consequences and is prevalent in nurses. Considering the fact that nurses need to work in shifts hour (morning, evening and night), this study aimed to evaluate the current status of critical care nurses' sleep quality in Hospital Universiti Sains Malaysia (HUSM) and explored its impacts. A cross-sectional study was carried out to assess the impact of shift work on level of sleep quality among critical care nurses in HUSM. Data was collected using a self-administered questionnaire incorporating the Pittsburgh Sleep Quality Index (PSQI). A total number of 69 critical care nurses from the critical care wards, HUSM who fulfilled the inclusion criteria were involved in this study. They were selected through a convenience sampling method. Data collected were statistically analyzed using the Statistical Package Social Science (SPSS) software version of 26. This study showed that 82.6% of respondents have a poor level of sleep quality. The association between shift work, selected sociodemographic characteristics and level of sleep quality was analyzed by using Pearson's Chi-Square test. 69.57% respondents who work in shift show that they have poor level of sleep quality. The total mean of PSQI score of 69 critical care nurses in HUSM was 0.83 (0.382), including 12 (17.4%) subjects with $PSQI \leq 5$ and 57 (82.6%) with $PSQI > 5$. The result of this study revealed that there is no significant relationship between selected sociodemographic characteristics (age, gender, marital status, years of working experiences with shift work and monthly household incomes) with level of sleep quality among critical care nurses in HUSM ($p > 0.05$). As a conclude, the level of sleep quality among critical care nurses in HUSM was poor.

CHAPTER 1 : INTRODUCTION

1.1 Introduction

This research aims to investigate the impact of shift work on sleep quality among critical care nurses in Hospital Universiti Sains Malaysia (HUSM). The first section of this final year project started with the background of the study, problem statement, research question, objectives hypothesis. Finally, the significance of the study and the operational definition of key terms used in this study are described.

1.2 Background of Study

According to National Institute for Occupational Safety and Health (NIOSH), shift work was explained as a working hour outside the normal daylight hours. (Fong, 2022). While, in health care professionals, shift work is defined as a repetitive, rotating periods in which one person (worker) or more individuals work at different times to cover a 24-hour. In healthcare industries, shift work usually encompasses either a three-shift system, with day, evening, and night shifts each lasting 8 h, or a rotating shift system (Awosoga et al., 2020). In general, the term "shift work" refers to a variety of work schedules, including night shifts, overtime, longer shifts, irregular work patterns (a system that required staff to work a combination of day, evening, and night shifts), and non-shift schedules (day work), which refers to the working hours during which an office is typically open for business, or in other words, following a standard working days/office hours (8.00 a.m. to 5.00 p.m.) (S. Foundation, 2022).

Nowadays, shift work systems are increasingly common characteristic expected in many occupations (Korompeli et al., 2014). A number of workers doing shift as part of their work contract are growing. Several reasons for shift work are the business needs, continuous production and the need to provide 24-hour services. The occupations affected include the military defense, transportation, manufacturing, food services, security personnel, police, firefighter and health care personnel particularly nurses. In the health care services, nursing is the biggest sector in terms of employees and changes in the work patterns result in a major impact to the nursing profession. They blend principles of health services with the art of caring to provide patients with comfort and recovery. In addition, nurses also work as patient advocates, health educators and coordinators of different health care services (McManus, 2019). Thus, rotating shift work is common and necessary for nurses considering patients in the hospital need 24-hour care. To provide 24-hour healthcare, the majority of critical care nurses working in shift work that characterized as having a schedule that fluctuates between working days, evenings, or nights. They work in a high-pressured environment, as they care for patients with life-threatening conditions (Pryce, 2016). However, rotating shift work has been associated with various health problems that not only led to the negative effect of nurses' health status and well-being but also affect the quality of health care for patients (Gong et al., 2015).

Other than that, rotating shift work is the main cause of disruption to the well-being of nurses because rotating shift interferes with the body's natural circadian rhythms. Working nights or early morning shifts means that an individual must be awake when the circadian drive for alertness is low and asleep when it is high, in opposition to the natural biological rhythm. This leads to shortened and disrupted sleep, and excessive sleepiness while awake

(James et al., 2017). In addition, rotating shift work have been related with various health problems such as sleep disturbances, increased risk of cardiovascular and psychological disorders, and may negatively impact work–life balance (Shiffer et al., 2018).

In various studies, shift work systems, especially night shift has been shown to impact the nurses' sleep quality. In addition, shift work is known to be a workplace hazard, as it often causes poor sleep quality that can impact patients' and nurses' safety, leading to adverse consequences in healthcare provision (McDowall et al., 2017). National Sleep Foundation 2020 defined sleep quality as measuring of how well you sleep. Typically, good sleep quality can be categorize as followed; fall asleep soon after getting into bed, within 30 minutes or less, wake up not more than once per night, if you do wake up, you do so within 20 minutes and fall back asleep and, feel rested, restored, and energized upon waking up in the morning. Meanwhile, poor sleep quality can be described by falling asleep within more than 30 minutes after getting from bed, wake up more than once per night and feel tired after waking up from sleep.

The American Academy of Sleep Medicine (AASM) and Sleep Research Society (SRS) recommend that all adults need to get at least 7 hours of sleep each night (Watson et al., 2015). As an important biological function, sleep plays a role in various physiological processes of organisms. Furthermore, good sleep quality guarantees well-being and mental health as it has positive effects including decrease the risk for serious health problems, like diabetes and heart disease, reduce stress and improve your mood, can think more clearly and do better in work performance.

1.3 Problem Statement

Sleep is increasingly becoming an important and growing global public health issue influencing millions of people all around the world. Poor sleep quality is a significant public health concern in the United States (US) with an estimated 50–70 million Americans suffering from sleep or wakefulness disorders. According to the previous study, nurses are more likely to have poor sleep quality than the general population, with more than 50% of nurses, especially those who work night shifts, experiencing really poor sleep quality. Worldwide, 61.0% of nurses were reported for having trouble sleeping (Segon et al., 2022).

Besides that, the nursing shortage is also a major problem in the health care industry and becomes a world-wide phenomenon (Suhaimi et al., 2021). In Malaysia, this phenomenon was proven through a report by the American Society of Registered Nurses (2007) which stated that Malaysia needs 20,000 registered nurses in all specialization. About 1,000 Malaysian nurses leave the nursing field each year further exacerbates the shortage. Additionally, local nurses mentioned that their early departure from the field was due to the tough work and long hours (Tang & Ghani, 2012). It will increase nurses' workload. When workload increases, it will affect nurse's physical and mental health including sleep disturbance, decreased sleep quality, disturbed the circadian rhythm, stress, depression, social relationship and many more.

Many studies have measured sleep disturbances among nurses globally, but just a few studies have addressed this issue in Malaysia. The study of impact of shift work on the quality of sleep among nurses is not widely done. Still, most of them are done in a particular hospital. For an example, the effect of shift work systems on nurses' physical and psychological well-being was studied among nurses in Hospital Sultanah Aminah (Anita et al., 2016) and the

research about sleep disturbance and its associations with work characteristics among nurses was done in Hospital Melaka (Nazatul et al., 2008). Therefore, this study aimed to determine the impact of shift work on sleep quality among nurses in Hospital Universiti Sains Malaysia.

Next, shift work is identified as one of the job stressors that makes nurses vulnerable to stress. According to World Health Organization (WHO) stress has been considered as a global epidemic, which has recently been observed to be associated with 90% of visits to physicians (Baye et al., 2020). Shift work typically attracts pay enhancement but can significantly affect personal and social life. Nurses who have prolonged shift work, especially night shift, face a higher stress level due to the irregular working schedules compared to the day working nurses. The effect of prolonged stress can negatively affect the quality of sleep and distract the nurses' focus on work, thus affecting nurses' performance on patient care, putting the patient at risk of medical error and at the same time harming patients.

Thus, this study can contribute to the limited research conducted on the effect of shift work systems among nurses in Malaysia. Therefore, the investigation of the effect of shift work systems either on workers' physical, psychological and physiological well-being including towards quality of sleep especially among the nurses is necessary to be done in order to find alternative working arrangements in the organization of healthcare setting. Last but not least, by understanding the consequences of these problems, it will help and protect nurses from experiencing adverse health effects such as sleepiness and fatigue in the future. If not, the nurses may experience health problems and poor work performance and further threaten the patients' safety.

1.4 Research Questions

- i. What is the level of sleep quality among nurses in Hospital Universiti Sains Malaysia?
- ii. Is there any association between shift work with sleep quality among nurses in Hospital Universiti Sains Malaysia?
- iii. Is there any association between selected sociodemographic characteristic (age, gender, marital status, years of working experience and monthly household income) with sleep quality among nurses in Hospital Universiti Sains Malaysia?

1.5 Research Objectives

Research objectives describe what researchers expect to achieve at the end of a research project or study.

1.5.1 General Objectives

To determine the impact of shift work and the association between selected sociodemographic characteristics with sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.

1.5.2 Specific Objectives

- i. To identify the level of sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.
- ii. To determine the association between shift work with sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.
- iii. To determine the association between selected sociodemographic characteristics (age, gender, marital status, years of working experience, and monthly household

income) with sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.

1.6 Research Hypothesis

Hypothesis 1

Null Hypothesis (H_0): There is no significant association between shift work with sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.

Alternative Hypothesis (H_1): There is significant association between shift work with sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.

Hypothesis 2

Null Hypothesis (H_0): There is no significant association between selected sociodemographic characteristics (age, gender, marital status, years of working experiences and monthly household income) with sleep quality among critical care nurses in Hospital Universiti Sains Malaysia.

Alternative Hypothesis (H_1): There is significant association between selected sociodemographic characteristics (age, gender, marital status, years of working experience and monthly household income) with sleep quality among critical nurses in Hospital Universiti Sains Malaysia.

1.7 Significance of the Study

This study is aimed to investigate the impact of shift work on sleep quality among critical care nurses in Hospital Universiti Sains Malaysia. As we know, sleep is a basic human need, and it is a universal biological process that is common to all people. Most healthy adults need at least 7 to 9 hours of sleep a night in order to achieve a status of getting a good quality of sleep (National Sleep Foundation). However, there are some situations where an individual needs to carry out their responsibility in work that causes disruption of the sleep pattern. The National Sleep Foundation reported that shift workers including nurses are one of the groups that are particularly vulnerable for not getting enough sleep.

The reasons for choosing this topic because is that there is now less known about the study on impact of shift work on nurses' sleep quality in Malaysia. Many studies have measured sleep disturbances among nurses globally, but just a few studies have addressed this issue in Malaysia. The study of impact of shift work on the quality of sleep among nurses is found to be not widely done. Still, most of them are done in a particular hospital. For an example, the effect of shift work systems on nurses' physical and psychological well-being was studied among nurses in Hospital Sultanah Aminah and the research about sleep disturbance and its associations with work characteristics among nurses was done in Hospital Melaka. Even though there has been research conducted on shift work systems and sleep quality, most of the studies are more specific to other industries and situation such as manufacturing industry, not in healthcare setting. Therefore, this study aimed to determine the impact of shift work on sleep quality among staff nurses in Hospital Universiti Sains Malaysia.

The finding from the study will determine the association between shift work and the level of sleep quality among nurses in Hospital Universiti Sains Malaysia. The results from this study will redound to the benefits of nurses in Hospital Universiti Sains Malaysia in terms of their health and well-being. It is because, the deprive sleep quality will affect one's physical and mental health (Mental Health Foundation, 2016). Thus, the finding is useful to determine the actual level of influence of shift work towards nurses' sleep quality.

Then, the published study can raise the public's awareness on this issue, eventually carrying out various interventions to help nurses increase their sleep quality in daily life by help them in how to adapt with shift work system. The community will further realize promoting the importance of good sleep quality, especially for the nurse, as a preventive measure against various diseases. As a result, the overall health of nurses' population in Hospital Universiti Sains Malaysia will increase. The rate of developing health complications and sleep disorder in their future life will decrease, indirectly rising the performance on patient care. Thus, patients' and nurses' safety are unsure. Lastly, the analysis that is presented in this study will convey valuable information for future research that will explore the various benefits of sleep and good management of shift work system.

1.8 Conceptual and Operational Definitions

Table 1.1 Conceptual and Operational Definitions (Shift work, Sleep quality, Critical care, Nurse)

	Conceptual	Operational
Shift Work	The term shift work is defined as an arrangement of working hours that includes working outside daytime hours (a system in which staff are required to work a combination of day, afternoon and night shifts) in order to extend the hours of operation of the work environment beyond that of the conventional office hours. It also defined as a diversity of working hour's arrangements, including night shifts, overtime work, and irregular or rotational work patterns (Awosoga et al., 2020).	Shift work at Hospital Universiti Sains Malaysia divided into three shifts; Morning shift (0700h–1400h), evening shift (1400h – 2100), and night shift (2100h – 0700h). Total hours of shift work are 7 hours per shift for morning and evening shift and 10 hours for night shift. In this study, shift work will be measured using Standard Shiftwork Index (SSI) (Barton J, Folkard S, Smith L, Spelten E, 2007).
Sleep Quality	An individual's self-satisfaction with all aspects of the sleep experience consists of	In this study, the sleep quality of the nurses will be measured using Pittsburgh Sleep Quality

	four attributes which is sleep efficiency, sleep latency, sleep duration and wake after sleep onset (Nelson et al., 2022)	Index (PSQI) (Buysse et al., 1989).
Critical Care Nurses	Critical care is medical care for people who have life-threatening injuries and illnesses. It usually takes place in an intensive care unit (ICU). Critical care nurses are a team of specially-trained health care providers that provide 24-hour care for patients who are critically ill. They are responsible in all aspects of the patient's care, including administering medications, caring for tracheotomies and other ventilators care, and constant monitoring of the patients for any alterations in status (Franjić, 2020).	In this study, critical care nurses are registered nurses with grade U29 and U32 that provide holistic nursing care for patients in Hospital Universiti Sains Malaysia. It involves types of care which is essential for patients with life threatening condition. A nurses must be efficient and highly skilled in providing comprehensive care for the patients.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

This chapter presented the literature review of the impact of shift work on sleep quality and the other factors that might contribute to the effect of sleep quality. This chapter is divided into five sections. The first section focused on shift work. The next section focused on sleep and quality of sleep, revealed the impact of sleep quality. In addition, we briefly explained on shift including the categories of shift work while the following section explains the shift and sleep quality, other factors associated with sleep quality, and theoretical and conceptual framework of the study.

2.2 Critical Care Nurse

Critical care nurses bear a great responsibility for patients who are critically ill as they are responsible for constantly monitoring the patient's condition, as well as recognizing any subtle changes. They have a great deal of one-on-one contact with the patients and are often the main source of information, especially for the patients' family members. Critical care nurses use a great amount of technology within their practice, and function as integral members of the multidisciplinary health care team.

Other than that, critical care nurses must possess the ability to collaborate with other members of the health care team such as physicians, case managers, therapists, and, especially, other nurses. They are responsible for all care given to the patient, from medication administration to tracheotomy and other ventilator care, as well as constant monitoring of the patient for any alterations in health status (Franjić, 2020).

2.3 Shift Work

Shift work is defined as a working time arrangement that uses teams (shifts) of workers to extend the operating hours of a working environment beyond the the normal daylight hours (Fong, 2022). While, in health care professionals, shift work is defined as a repetitive, rotating periods (shifts) in which one person (worker) or more individuals (workers) work at different times to cover a 24-hour period. Shift workers might work in the evening, in the middle of the night, overtime or extra working hours, and rotating shifts. Other shift workers might have permanent shift and only work at night or in the evening (Awosoga et al., 2020).

Shift work disrupts circadian rhythms that help to maintain body temperature, hormone levels, blood pressure, and sleep patterns. In the long term, altering familiar biological processes worsens health and increases an individual's risk of developing chronic diseases. As example, insomnia and the resulting drowsiness lead to increased fatigue and decreased ability to concentrate and altering work performance (Rhéaume & Mullen, 2018). Thus, shift workers are more prone to struggle with insomnia than they are with excessive daytime sleepiness since they are battling their internal clock. They frequently attempt to sleep while it is daytime and the rest of the world is awake, which makes it difficult for them to fall asleep. Drowsiness is frequent at night since the body's clock is telling you it's time to go to bed.

According to a recent report released by the Bureau of Labor Statistics, about 25% of Americans work shifts and the report states that some of the main effects of night shifts are reduced physiological and psychosocial health of individuals, and reduced work productivity and performance. Due to the nature of their job, the nurses must work around the clock (24

hours) to care for patients effectively. As a result, they are vulnerable to declining personal health and increased medical errors caused by shift work. (Eldevik et al., 2013).

2.4 Overview of Sleep

Sleep is one of the important parts of the human daily routine. We need to sleep for a variety of reasons. It includes managing daily stress, preventing exhaustion, conserving energy, restoring the mind and body, and getting the most out of life. A better level of physical, cognitive, and psychological well-being is significantly correlated with restorative sleep. Poor or irregular sleep may impair cognitive and psychological functioning and damage general physical health (Crivello et al., 2019). Table 2.1 shows the sleep recommendations by age group.

Table 2.1 Sleep Recommendations by Age Group (S. Foundation, 2022)

Categories	Age	Sleep Recommendation (Hours)
Newborns	0 – 3 months	14 – 17
Infants	4 – 11 months	12 – 15
Toddlers	1 – 2 years	11 – 14
Preschoolers	3 – 5 years	10 – 13
School-Age Children	6 – 13 years	9 – 11
Adolescents	14 – 17 years	8 – 10
Young Adults	18 – 25 years	7 – 9
Adults	26 – 64 years	7 – 9
Older Adults	65 years and above	7 – 8

2.4.1 Stages of sleep

When sleeping, a person goes through a five stages of sleep cycle. It including wake, N1, N2, N3, and REM. Non-rapid eye movement (NREM) sleep is categorized into stages

N1 to N3, with each stage corresponding to a deeper state of sleep. Approximately 75% of sleep is spent in the NREM stages, with the majority spent in the N2 stage. A typical night's sleep consists of 4 to 5 sleep cycles, with the progression of sleep stages in the following order: N1, N2, N3, N2, REM. A complete sleep cycle takes roughly 90 to 110 minutes in adults (Patel & Araujo, 2018).

The first stage of sleep is wake stage. It is the stage of time spent in bed before and after falling asleep. It is also the stage where individuals briefly awaken during sleep. Stage 1 (N1) of sleep is the stage of light sleep, accounting for about 5% of total sleep and lasts only a few minutes or around 5 minutes to 10 minutes. During this stage, the individual feels drowsy and relaxed, the eyes roll from side to side, heart rate and respiratory rates drop slightly. For stage 2 of sleep (N2), called deeper sleep which body processes continue to slow down. The heart rate and respiratory rate decrease slightly plus the body temperature drop. Stage 2 of sleep lasts for about 25 minutes for the first cycles and lengthens with each subsequent cycle, eventually accounting for about 45% of total sleep (Kozier et. al, 2021).

Next, stage 3 of sleep (N3) is the stage of deepest sleep which is characterized by much lower frequency and higher amplitude signals known as delta waves. Stage 3 eventually accounts for about 25% of total sleep. Individual's heart rate and respiratory rate will decrease. The body repairs and regrows tissues, restoring energy, builds bone and muscle and strengthens the immune system. In addition, sleepers in this stage are the most difficult to awaken, and some people are not awakened by loud sounds.

Lastly, the stage of sleep is rapid eye movement (REM). REM sleep usually begins about every 90 minutes after you fall asleep, with longer REM cycles as the night progresses. The first period usually lasts 10 minutes and the last period lasts up to 1 hour. In this stage,

sleeper's brain is highly active and brain metabolism may increase. Sleeping may be difficult to arouse or wake spontaneously and heart rate and respiratory rates often irregular. Stage REM eventually accounting for about 25% of total sleep (Patel & Araujo, 2018).

2.5 Sleep Quality

Sleep quality refers to how well you sleep, or if your sleep is restful and rejuvenating. It also can be defined as a measure of the feeling that person would have of being energetic, active, and ready for a new day. Nursing tasks are frequently set for nurses to complete during the day, evening, and night. This causes sudden changes in the time of their sleep, which frequently throw off their internal biological clock and result in poor sleep quality that affects how they operate during the day. This condition has detrimental effects on social, psychological, and physiological elements that could be a precursor to more serious health issues. This effect impairs learning, concentration, safe functioning, and decision-making abilities and raises the risk of medical errors, occupational accidents or injuries, and time away from work (Segon et al., 2022).

Sleep quality can be divided into four parts which is sleep efficiency, sleep latency, sleep duration and wake after sleep onset. Sleep efficiency is the ratio of the amount total time asleep versus the total time in bed and tends to decline with age (Nelson et al., 2021). Sleep latency or sleep onset latency is the amount of time it takes from state of wakefulness to sleep (Biggers, 2019). It can be different from person to person. Sleep duration is the total time of a person to sleep. It can be measure over a single sleep period or over a 24-hour day (Suni & Rehman, 2022). While wake after sleep onset (WASO) is periods of wakefulness

occurring after defined sleep onset. It was measured by person's wakefulness, excluding the wakefulness occurring before sleep onset (Shrivastava et al., 2014).

Good sleep quality guarantees well-being and mental health as it has positive effects including decrease the risk for serious health problems, like diabetes and heart disease, reduce stress and improve your mood, can think more clearly and do better in work performance. Poor sleep quality contributes to disease and poor health outcomes. So, it is very important to get good sleep quality in order to prevent the negative effect from occurring (Nelson et al., 2021).

2.6 Shift Work and Sleep Quality

It is commonly known that shift work can have a negative influence on sleep quality among nurses. In addition, shift work also gives adverse effect on nurses' health. Some of the health implications include stress, cardiovascular disease, gastrointestinal symptoms, and mental health illnesses. Furthermore, shift work affects a nurse's social life and could jeopardise patients (Pryce, 2016). It is because shift work disturbs a worker's circadian rhythm and induce physiological malfunction which night shift workers may have more difficulty in falling asleep than day shift workers. They may experience a shortage of sleeping hours and poor quality of sleep, and could develop obesity and various health problems due to chronic fatigue (James et al., 2017).

2.7 Factors Associated with Sleep Quality

The other factor that might be able to influence sleep quality is sociodemographic characteristics. The previous studies have shown that sex, age, marital status, educational status, monthly income, working unit, and year of experience affected the level of sleep

quality. Research has proven that compared to the male participants; female nurses were almost two times as likely to have poor sleep quality. According to various research, female nurses experienced poorer sleep quality more frequently than male nurses. This discovery may be connected to the physiological and psychological traits of women. Female nurses need to work and take care of their families at the same time, such that their life pressure is higher than that of male nurses (Segon et al., 2022).

On the other hand, people with anxiety symptoms were 2 times more likely to have poor sleep quality than participants who had no anxiety symptoms. The probable reason might be nurses often need to deal with patients with critical and severe diseases or with complex diseases, which may lead to rapid working rhythms and high mental tension and anxiety symptoms that are associated with sleep quality. Based on the result, nurses may be easier to suffer from a lack of sleep (Segon et al., 2022).

Next, sleep disorders are substantially correlated with income. The presence of sleeplessness was linked to lower income. Insomnia was more prevalent among those with lower incomes. greater yearly income was linked to less sleep disruptions, however there wasn't enough money at the end of the month increased risk of excessive daytime sleepiness. One research discovered that there was no significant correlation between income and sleep length. The presence of sleeplessness was linked to the workforce. Among older adults, full-time employment was significantly associated with short sleep, while unemployed older adults were more likely to sleep longer (Etindele Sosso et al., 2022). Therefore, income level has an impact on someone's sleep. A study mentioned low socioeconomic status (SES) is associated with poor sleep compared to high SES as people with low SES tend to work longer and harder (Jehan et al., 2018)

Last but not least, working experiences also can be one of the factors associated with sleep quality. The previous study proved that nurses with working experience of more than eighteen years had more sleep problems than those who had worked less than ten years. And the number of nurses 19 who could not sleep well in rest days was found greater in the group of \geq eighteen years working experience than in the group of ten to eighteen years of working experience (Korompeli et al., 2013). However, at the same time, a long experience of shift work was significantly associated with better sleep quality. The reason was said to be developed coping strategies of shift work. After years of working rotating shifts, nurses had increased their adaptation and learned better coping skills (Peiqing, 2018).

2.8 Theoretical Framework of Study

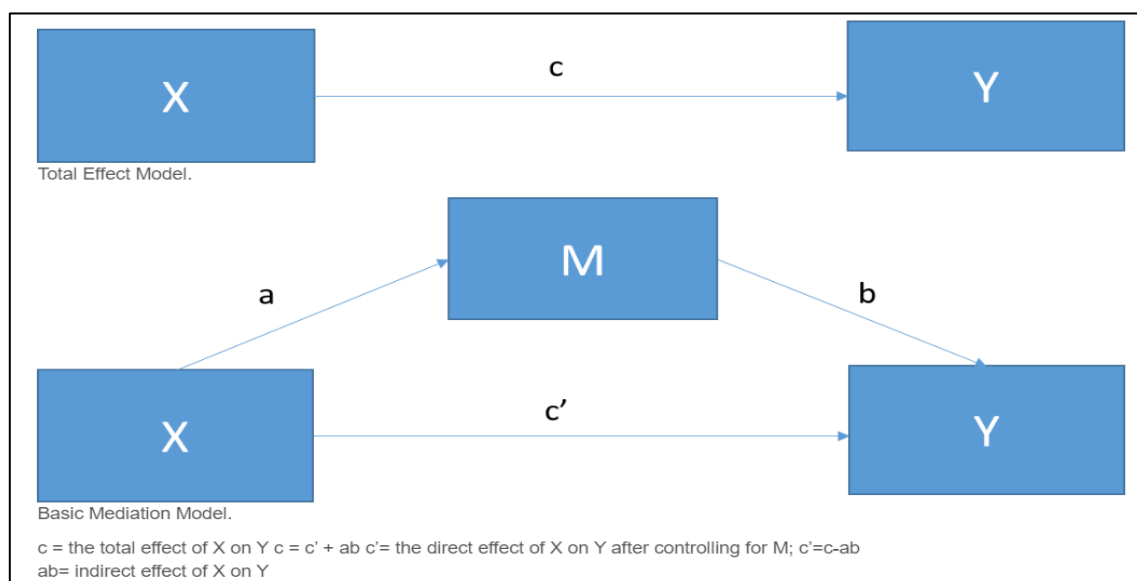


Figure 2.1 Visualization of Total Effect Model and Basic Mediation Model
(Nielsen et al., 2016)

M = Mediator Variable

X = Independent Variable

Y = Dependent Variable

2.8.1 Description of Multiple Mediation Model

Mediation Model is used as a base for theoretical framework of this study. These models are suitable for analysis the current association in the study by using mediation analysis. Mediation Analysis is a subset of path analysis in which the main purpose is to allow researcher checks whether the causal effect of the independent variable X on the dependent variable Y is caused by the mediator M (Caron & Valois, 2018). Hence, the part or all of the relationships between the independent variable and dependent variable should be described after the mediator has been added. If the proportion of the indirect effect against the total effect is greater, it indicates a higher mediating effect (Chen & Hung, 2016).

The upper part of picture in Figure 2.1 (Total Effect Model) shows the impact path of independent variable (X) on the dependent variable (Y), path coefficient c' is also known as the total effect of the independent variable (X) on the dependent variable (Y). Generally, the total effect c' is expected to be significantly different from zero. The lower part of picture in Figure 2.1 (Basic Mediation Model) shows the typical mediation model; path coefficient c is termed as the direct effect of the independent variable (X) on the dependent variable (Y), also known as the effect of the control mediator variable (M) of independent variable (X) on dependent variable (Y), or the residual effect. Path coefficient a is the effect of independent variable (X) on mediator variable (M), also known as the first stage effect. Path coefficient b is the effect of the mediator variable (M) on the dependent variable (Y), also known as the second stage effect. The multiplication of the first stage effect and second stage effect ab is known as the indirect effect. If the direct effect of independent variable (X) on the dependent variable (Y) after the addition of the mediator variable (M) is insignificant (namely, path coefficient c is significantly), it is known as the full mediation.

The three regression equations of the mediation model proposed by Barron & Kenny (1986) are as follows:

$$Y = c + c' X + e$$

$$M = a + aX + e$$

$$Y = b + cX + bM + e$$

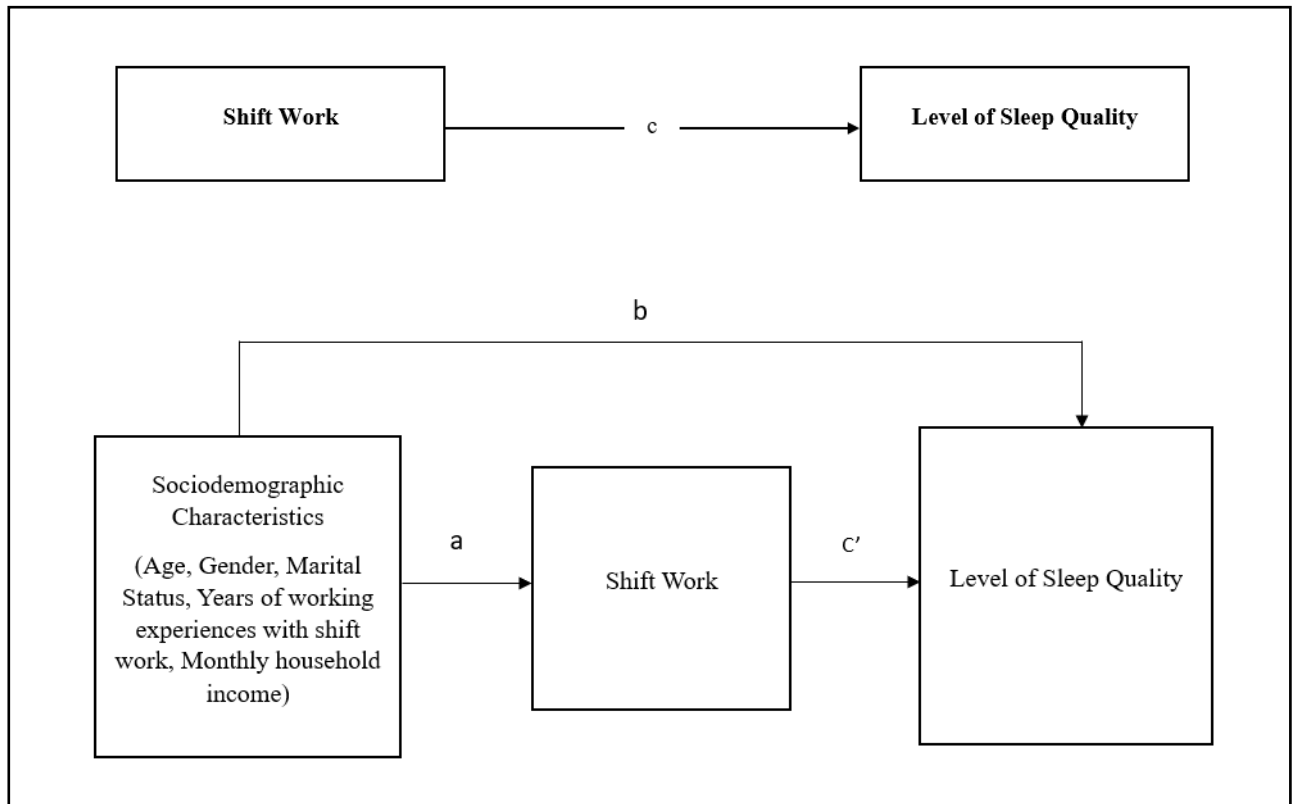


Figure 2.2 The study model according to Mediation Model to test the sociodemographic characteristics and the use of shift work on sleep quality.

Figure 2.2 illustrates a Mediation Model modified to be applied in this study. These models are suitable for analysis of the association between shift work and sociodemographic characteristics with level of sleep quality in this research study. The upper part of picture in Figure 2.2 (Total Effect Model) showed the impact path of shift work on the level of sleep

quality, on path coefficient c' . The lower part of picture in Figure 2.2 (Basic Mediation Model) shows the typical mediation model; path coefficient c is termed as the direct effect of the shift work on the level of sleep quality, also known as the effect of the control sociodemographic characteristics of shift work on sleep quality, or the residual effect. Path coefficient a is the effect of shift work on sociodemographic characteristics, also known as the first stage effect. Path coefficient b is the effect of the sociodemographic characteristics on the level of sleep quality, also known as the second stage effect.

In summary, by using the Mediation Model, this study explores modifying factors which are sociodemographic characteristics that include age, gender, years of working experience, as well as household income. Additionally, the Mediation Model can examine if it moderates the relationship between the mentioned variables and level of sleep quality. This exploratory study will be conducted to identify the impact of shift work and the association between sociodemographic characteristics with level of sleep quality. For the outcome, the participants will give either good or poor level of sleep quality. Overall, this concept is available to determine sleep quality level related with shift work among critical nurses in HUSM.

CHAPTER 3 : METHODOLOGY AND METHODS

3.1 Introduction

This chapter explained the approach and rationale used to support the chosen research methodology. Determining and understanding an appropriate research design was crucial for achieving the aims of the study. The chapter begins with a description of a cross-sectional design and justification for using this approach. The section is followed by a description of the study setting, population, participant selection criteria, sampling plan, sample size determination, and instrumentation, including ethical consideration through data collection methods. The final section also explained the expected research outcome.

3.2 Research Design

The research design selected for this study was a cross-sectional study. This approach was considered appropriate to give a detailed description of the participants' impact of shift work on level of sleep quality, as well as the association sociodemographic characteristics with the participants' sleep quality. The advantages of cross-sectional study include that it was not costly to perform, generally quick which does not require a lot of time, can be carried out at a one-time point or over a short period, and was easy to perform. They are often based on a questionnaire survey. There were no loss to follow-up because participants were interviewed only once.

3.3 Research Location and Population

The study was conducted at Critical Care Ward (1 Mutiara, ICU Surgical, ICU Trauma, 2 Delima, Kristal 1, Kristal 2, 4 Timur Belakang, 1 Fairuz, 8 Selatan, 1 Intan) in

HUSM situated in Kubang Kerian, Kelantan. The study's population was nurses who are currently working in critical care ward in Hospital Universiti Sains Malaysia. The total number of critical care nurses was 69 nurses as the sampling size.

3.4 Research Duration

For this study, the duration of data collection was from January to March 2023. The study was conducted for about six to eight months between October 2022 and June 2023 after obtaining approval from the Human Ethics Committee, USM. (APPENDIX F)

3.5 Sampling Plan

The sampling plan is the process of selecting individuals or sampling units from the sample frame. In this step, the specifications and decisions regarding the implementation of the research process are outlined (Muhammad & Kabir, 2016). The Hospital Universiti Sains Malaysia was selected as a setting of this study. The critical care wards were chosen as the research area. Sampling plan ensures that the research validity and reliability representative of the population of interest. An effective sampling method enables researchers to achieve research goal.

3.5.1 Sample Criteria

To achieve the research's objective, several criteria are set to ensure the subject's data were suitable for the research purposes and hence able to reach the targeted goals at the end of the study.