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# The Safety Concerns of Night Shift Schedule: Implications for Family, Homes and Human Health

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## ABSTRACT

*Wealth does not correlate with health, neither does the ability to work longer hours and the night shift determine the level of one's wealth. It is important to consider health and safety first when accepting new job schedules or offers. This study investigates how night shift schedules have contributed to workers' poor well-being, quality of life and marriages. One-hundred ninety-one night shift workers voluntarily participated in the study. Respondents were grouped into three age categories: 18-34, 35-54, and 55-74. Responses were quantified and statistical analyses were run on the data. Results revealed that 24% of the respondents responded to be depressed and 57% indicated to have low energy after working a night shift schedule. The risk of divorce among the married respondents was found to be 1-person in every 5-workers. Poor appetite revealed 1 out of every 3-workers and 1 out of 2-workers have the risk of losing interest in their usual activities. Approximately seventeen percent reported having very bad quality of life, while 39% declared to have average quality of life. Thirty percent of the respondents revealed having concentration problems after working night shift. The paired t-test result revealed that a night shift schedule has a statistically significant effect on the workers' well-being who work on night shift ($t = 16.13$, $df = 190$, $p < 0.0001$). The level of divorce, poor quality of life, less interest in usual activities and health issues as a result of workers' schedule suggest the need for better work schedule structuring. The findings from this study highlight potential damages night shift schedule has done to human well-being and life style in general. Findings from this study could help families to better avert or handle health issues at home and with their spouses.*

**Keywords**

Circadian-rhythm, Health, Safety, Marriages, Work-schedule, Divorce.

## Introduction

Wealth does not correlate with health; neither does the ability to work longer hours and night shift determine the level of one's wealth. It is important to consider health and human safety first when accepting new job schedules or offers and to never let money be the first attraction. As one adage says, "health is wealth." a person with good and sound health produces better output in all activities. The need for more money is one thing that the employers and employees desire. Meanwhile, different safety specialists and ergonomists have advocated for technology improvement for human betterment. Technology advancement is the priority of all nations today. The question remains, is the society ready and willing to take the challenges so that workers safety, psychological, physical, moral, mental and emotional being are considered in all aspects of work activities? One of the biggest problems commonly believed to cause human health deterioration

is stress from work, family, bills and loans, as well as concerns of what the future holds for them.

Night shift is now common in the United States (US). The reasons for night shift and extended work hour schedule in the US are numerous. According to the 2006 conference report of the International Labor Office in Geneva, Switzerland, the urgent need to reduce poverty and inequality within and among nations, the immigration issue and the technological transformation have increased the working population in the US [1]. Thus, these have influenced the employment patterns and working conditions of US citizens to make ends meet. Thereby, many Americans have increased their working hours, and some have taken night shift schedules. Several studies have revealed the consistent increase in the number of American citizens involved in overtime and night shift schedules from 1970 through the 1990s [2,3]. Caruso et al. [4] reviewed twenty-two articles on the impacts of night shift, overtime and extended work hours on the workers' health. It was revealed in their findings that 16 of 22 studies concluded that night shift, overtime and extended work hours are associated with perceived poor general health, increase in blood pressure, injury rates, and more illnesses which consequently led to higher mortality among workers.

Variations in the physical, mental and behavioral activities of humans in 24-hour activity have been the major issues resulting from night shift, overtime, and extended work hours [5]. These variations are known as the circadian rhythms. Circadian rhythms describe the human biological clock at which humans achieve better performances in 24-hour activities. Disruption to the rhythms usually has a negative impact on human health. Circadian rhythms regulate the duration of nocturnal melatonin secretion and the nocturnal phase of rising drowsiness [6]. Workers with circadian rhythm disturbances are prone to clinical significant distress and impairments in social, occupational, or other important areas of functioning [7,8].

As reported by Zelinski, et al. [9], disruption to these rhythms in the longer term is believed to have significant adverse health consequences on peripheral organs outside the brain, especially in the development or exacerbation of cardiovascular disease. Lack of sleep causes opening of eyes for long period of time. Meanwhile, opening of eyes all night to an artificial light can lead to light pollution and health problems such as breast cancer, says George Brainard, a professor of neurology at Jefferson Medical College, Thomas Jefferson University in Philadelphia. A controlled laboratory study also showed that exposure to light during the night can disrupt circadian and neuroendocrine physiology, thereby accelerating tumor growth [10]. The same author revealed the damages artificial lights have on the eco-system. Humans experience the deepest sleep around 2 am and any disruption to this pattern, reverses the sleep-wake cycle and may be a sign or complication of uremia (kidney problems) [11]. Disruptions of the immune function have also been reported as a result of sleeping disturbance [12,13]. Several researchers have documented that in humans, sleeping deprivation clinically increases IL1, IL2 IL6 (these are cytokines that participate in the regulation of immune responses, inflammatory reactions and haematopoiesis in human blood) and tumor necrosis factor levels [14,15].

Although circadian rhythm disruption has been extensively discussed in different medical literature, the question remains, as to how many people actually have access to the medical literature and how many considered reading them, if they have access to them? Few studies have been done based on human perceptions and safety related articles [16-18]. People understand better when information is presented in layman's terms than in technical/ professional languages. If actually the statement "practice makes perfection" holds, workers involved in everyday night shift schedules should have their body system adjusted and feel no impact. On the contrary, some authors' findings revealed that everyday night shift and overtime schedules are associated with high blood pressure and various psychological problems including higher levels of stress, depression and anxiety [5,19-22]. As of today, only few researchers have contrary findings, Park, et al. [23] found no correlation between blood pressure and work hours among Korean engineers.

Socially, Dunifon, et al. [24] study revealed that night shift schedules negatively impact relationship stability, common among couples with children. Another important finding study showed that married men of five years or less with at least one child, working fixed night schedule, experience separation or divorce up to six times more than men working days. Mothers in the same category are three times more likely to experience separation or divorce than mothers working a day shift [24]. Dembe, et al. [16] studied how night shift and extended working hours cause occupational injuries and illnesses. The authors reported that approximately 61% of the survey respondents experienced higher injury rates working night shift and overtime compared to regular (day shift) work hours. Night shift can make one impatient and constantly snapping unnecessarily. An example of such situation can be explained by what happened between Dan Sutermeiser and his family, as published by "Psychology Today" in May 2014 [25]. Dan was an engineer who worked at NASA Goddard Space Flight Center in Maryland between the hours of 7 PM and 7 AM. Per the article, Dan was always impatient snapped easily at his two boys and made them nervous. The same article reported the impact of night shift on children's behavior. It was revealed by the study that most children with elevated levels of aggressive and anxious or depressed behavior had mothers who worked night shift. Others have documented that mothers who work nonstandard work schedules may influence child well-being and the entire family life style [26,27]. Therefore, more research is needed in this area of study (impacts of night shift on workers) to establish standards and regulations that will help control the situation.

## Purpose of Study

This study explores workers' perceptions to study primarily, the correlations between night shift schedule and workers' quality of life- physically, psychologically, morally, and emotionally. The following objectives were formulated as means of achieving the

primary goal of the study:

- Determine any consequences night shift might be causing to workers' health.
- Investigate workers' behavior toward their usual activities after working night shift.
- Investigate workers' eating pattern after working night shift.
- Investigate workers' quality of life after working night shift.
- Investigate which education level predominantly work the night shift.
- Determine the reported proportion of divorcees due to night shift schedule

## Method and Procedure

### Method

The study population included the employees that routinely work night shifts with processing, manufacturing, paper packaging customer service companies, healthcare facilities and courier services geographically located in Midwestern States and Central North Carolina in United States of America. A total number of 191 workers participated in the survey. This comprises of both males and females who had at least three years of experience working night shifts. Every respondent worked at least five hours per day and for at least three days per week. Respondents were recruited through the support of the facility management staff, along with the support letter from the Institutional Review Board (IRB) of the principal investigator's institution. Respondents were fully informed of any risk associated with the research before given their informed written consent to participate. The research protocol was approved by the University IRB. Respondents were grouped into three age group categories (18-34), (35-54), and (55-74). Racial composition of respondents included Caucasians, Native Americans or American Indians, Hispanics or Latinos, and Black or African Americans (being the predominant ethnicity in the study).

### Procedure

Data were collected using a self-developed questionnaire adapted from a standardized questionnaire retrieved from online resources. The self-developed portions of the questionnaire were based on the interview responses with six healthcare and safety professionals. The questionnaire was reviewed by a group of certified healthcare personnel and a psychologist to validate its contents. The questions were presented in the form of "yes/no" options and the Likert scale. The "yes/no" options reflected what several researchers have used to investigate the effects of work schedule on workers' well-being [5,16,24]. Prior to the distribution of the questionnaire to various organizations, each facility was visited to obtain permission. At each organization, the purpose of the research was explained to the management and an approval was obtained before the questionnaires were distributed to the workers.

A box taped with an opening at the top was made available at the reception desk for respondents to return completed questionnaires without fear of identification by any member of the management (i.e. ensured that every respondent's privacy was protected). Each organization was visited twice a week to check for the progress of the survey. Participation was voluntary, and all surveys were each attached with the consent form that explained the purpose of the research and a space to sign. At three months, both completed and uncompleted questionnaires were collected from each organization and were taken to the lab for data compilation. Data collection lasted for 2-years, 3-months. Data were compiled and analyzed using MS Excel [29] version 2010 (Microsoft, Redmond, WA, USA). Analysis included both descriptive and inferential statistics and risk and odds analyses.

## Data Analysis and Results

Data compilation was done using MS Excel [29]. Of the four hundred survey questionnaires sent out, only one hundred and ninety-one were fully completed and returned, yielding a 48% return rate. Of the 191, one respondent did not indicate the marital status. Data analysis revealed that 44% (n = 84) of the respondents were females while 56% (n = 107) were males. About fifty-seven percent identified as Black or African American, 24% as Caucasian, 13% as Hispanic or Latino, 3% as Native American or American Indian and only 3% identified as Asian or Pacific Islander and other. Demographic data of the respondents revealed that approximately 32% of the respondents fell in the age group of 18-34; 58% fell in age-group of 35-54; and only 10% of the respondents fell in age-group of 55-74. Table 1 shows respondents' ethnicity, age-group and gender frequency distributions.

Figure 1 shows the graphical representation of all respondents and frequency distribution of their educational status. Educational levels of all respondents follow a bell shaped curve distribution. This bell curve describes the standard normal distribution and respondents' education level with respect to the observed population working the night shift. It is revealed, from the graph, that the largest number of respondents had a high school diploma or GED, while only one respondent had a professional degree.

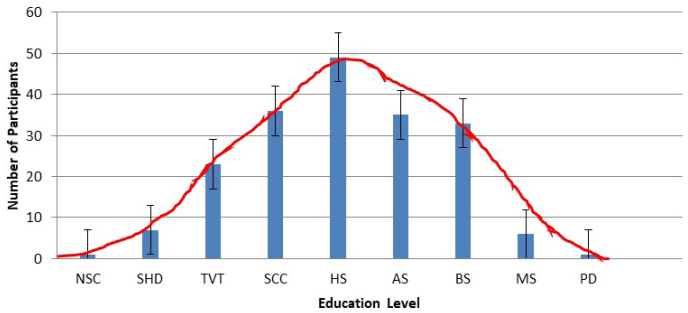


**Figure 1:** Frequency distribution of all participants' educational level (SHD = some high school, no diploma, TVT = Trade/technical vocational training, HS = High school, SCC = some college credit, no degree, AS = Associate degree, BS = Bachelor's degree, MS = Master's degree, PD = professional degree).

Respondents' population according to their age-group is represented in Figure 2. The results indicate that people between the age of 35 and 54 years old are the predominant age group of a night shift schedule. Figure 3 shows the marital status of the respondents. This

| | Ethnicity | | | | | | | | | | | | Age-Group | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Black | | Caucasian | | Hispanic | | Native American | | Pacific Islander | | Others | | 18-34 | | 35-54 | | 55-74 | |
| **Respondents** | 108 | | 46 | | 25 | | 5 | | 3 | | 4 | | 61 | | 111 | | 19 | |
| **Gender** | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M |
| | 48 | 60 | 22 | 24 | 7 | 18 | 3 | 2 | 1 | 2 | 1 | 3 | 24 | 37 | 52 | 59 | 8 | 11 |
| | *F = Female and M = Male | | | | | | | | | | | | | | | | | |

**Table 1:** Ethnicity and Age-Group Distributions.

graph indicates that fewer widows worked night shift, for reasons which are unknown. These individuals fell mainly in the second age-group category (ages 35-54). Additionally, more workers were married before accepting the night shift schedule than during the period of working night shift. Divorce rates increased among respondents after accepting a night shift schedule.

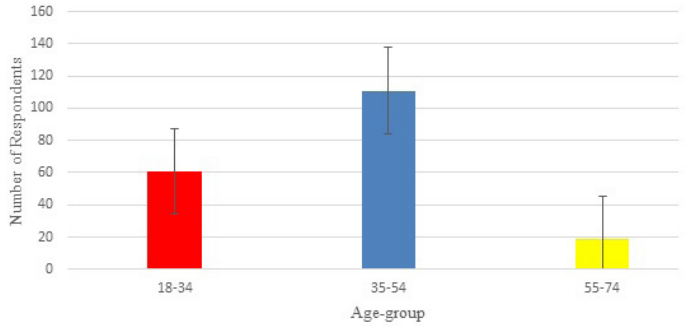


**Figure 2:** Frequency distribution of all participants according to age-group.

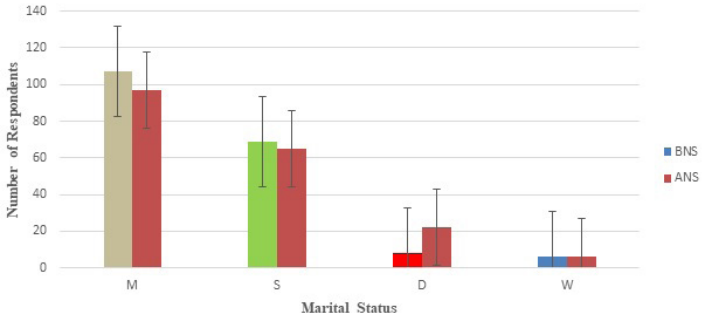


**Figure 3:** Frequency distribution of the participants based on marital status. (M = still married, S = Single, D = Divorced, W = Widows, BNS = Before Night Shift, ANS = After Night Shift).

Table 2 shows the frequency distribution of respondents to a specific question as it relates to the impacts of night shift on life style. Thirty-one percent of the respondents felt that interest in their usual activities decreased as a result of working the night shift schedule. Twenty-seven percent reported that they experienced a poor appetite after a night schedule, while approximately 20% of the respondents found it difficult to sit still after working a night shift. Twenty-four percent recounted being depressed after working night shift, while 47% declared to have low physical fitness. Further, 57% declared to have low energy and 31% reported to have concentration problems. Psychologically, 22% of the respondents felt guilty for working the night shift and 29% found it difficult to make decisions and 19% considered themselves a failure. An inferential statistic was also conducted on the overall data to investigate how the night shift schedule contributes to human health degradation. The paired t-test result revealed that night shift schedule in one way or another has a statistically significant impact on night shift workers' health ($t = 16.13$, $df = 190$, $p<0.0001$).

| Question types | Responses | # of Participants | Percentage (%) |
|---|---|---|---|
| Depression | Y | 46 | 24 |
| | N | 145 | 76 |
| Lack of interest in usual activities | Y | 72 | 38 |
| | N | 119 | 62 |
| Poor appetite | Y | 51 | 27 |
| | N | 140 | 73 |
| Sleeping problem | Y | 88 | 46 |
| | N | 103 | 54 |
| Difficulty to sit still after worked night shift | Y | 37 | 20 |
| | N | 154 | 80 |
| Low physical fitness | Y | 89 | 47 |
| | N | 102 | 53 |
| Low energy level | Y | 109 | 57 |
| | N | 82 | 53 |
| Feel guilty after worked night shift | Y | 41 | 22 |
| | N | 150 | 78 |
| Concentration problem | Y | 58 | 30 |
| | N | 133 | 70 |
| Difficulty to make decision | Y | 54 | 28 |
| | N | 137 | 72 |

**Table 2:** Frequency distribution of night shift impact on workers.

Of the total 191 respondents, 50% responded "Yes" to the questions that the night shift effected their mental health issue, future disappointment and attempt to commit suicide. Using the Likert scale, one question asked about the overall quality of life experience while working night shift schedule. Approximately, 39% reported to have an average quality of life, while 28% had a good quality of life. Sixteen percent of the respondents reported a very good quality of life and 17% a poor quality of life.

Risk and odds analysis were also conducted on workers' behavior toward usual activities, appetite, and divorces after working the night shift. The analyses helped to understand the proportion per specific population that falls into a particular category (e.g. interest in usual activities or lack of interest, still married or divorced, poor

eating habits or good eating habit). The analyses were performed based on the methods described by Higgins and Deeks [29].

### Marital status

In all, 107 respondents were married prior to starting a night shift schedule; but with time, 14 respondents reported being divorced. The risk of divorce analysis is 0.13 while the odds of divorce is 0.2. These indicate that the risk of divorce when working a night shift are one person in every five workers and the odds of having divorced are be 5 to 1 against.

### Eating habit

In all, 51 respondents responded to have poor appetite after working night shift. The risk and the odds analyses results are 0.3 and 0.4, respectively. These indicate that one out of three night shift workers will have the risk of poor appetite.

### Interest in usual activities

Overall, 54 respondents felt that interest in their usual activities dropped as they worked the night shift schedule. The risk and odds results from the analyses are 0.4 and 0.6, respectively. These indicate that one out of two night shift workers will be at risk of losing interest in their usual activities.

## Discussion

The primary objective of this study was to explore the connections between night shift work and workers' quality of life physically, morally, and emotionally. Additionally, the study explored the impacts of night shift on workers' usual activities and marital relationships. Several studies had confirmed how night shift, overtime and extended work hours have impacted family relationship and marriages [24,30,31], caused stress as a result of circadian rhythm disruption [5,8,32], and led to increased injury rates, illnesses, or mortality [4,33]. This study's findings support the previous findings; as 13% of the married respondents, reported to have divorced, which indicated that the risk of divorce among night shift workers was one person in every five married workers. Fifty-seven percent responded to be experiencing low energy after working the night shift schedule and approximately 22% responded to have some psychological problem after night shift schedules. Another important finding in this study was the percentage of people that experienced significant decrease in the interest in their usual activities.

This finding also agreed with [34] Mizoue, Reijula, and Andersson's findings, who found a significant decrease in the percentage of workers that have interest in their regular sports activity due to overtime and night shift work. Part of the findings revealed that one out of three workers night shift experienced poor appetite. Twenty-four percent of the respondents reported depression working night shifts. This finding also agreed with [35] Perry-Jenkins, et al. findings which revealed a significant number of people who developed higher levels of depression symptoms after working night shift. The findings from this study also buttress the story behind the death of Mr. Ranjan Das, CEO and MD of SAP for the Indian subcontinent region, a 42 years old man who died after a massive cardiac arrest due to lack of enough sleep at night, less than 5 hours a day [36]. The severity of night schedules and extended work hours may have varying impacts among individual workers. In other words, while some workers' bodies may prefer and their bodies tolerate night shift work, others are intolerant. The results from this study revealed that some respondents were comfortable with the night shifts and therefore, did not feel much of the effects in their body system.

## Limitations

This study was limited by the potential inaccuracy of self-reported data. The addition of physical and psychological evaluations could further validate the findings. Respondents were limited to manufacturing, processing, healthcare industry, paper packaging, customer support, and courier services companies. Night shift workers from other industries would further increase the reliability and generalizability of the study. Despite these limitations, the results indicate the extent and severity of night shift schedules on workers and the need to continue to address the issues of balancing work schedule for workers.

## Future Directions

This study can serve as a wake-up call for safety agencies and professional bodies such as Occupational Safety and Health Administration (OSHA), American Society of Safety Engineers (ASSE), National Sleep Foundation (NSF) etc., to consider workers' schedules as an important factor when designing worker safety policies. Due to worker poor health, family issues and possible home instability, can critically affect an organizations' revenue and profit margins. It is imperative to address these issues for all involved. Early attention to these issues can help reduce worker compensation claims, injuries at work and promote workers' productivity. Proper and adequate attention is required in this area of study. For example, differences in the effects as related to gender should be taken as priority when evaluating the impacts of the night shift on workers. Safety agencies should also endeavor to fund research in this area of study for better clarity and understanding of the impacts. Finally, besides the sampled industries, more industries should be considered, so that the results can be generalized globally. Additionally, a longer longitudinal study will be helpful to assess worker perception on night shift impacts.

## Practical Application

This study highlights the potential impacts of night shift on workers' home, health and family. Findings from this study suggest that night shift impacts vary among workers and have an impact on workers' health and marriages. Results will increase the awareness and knowledge of night shift impacts on workers' quality of life and well-being of the families. Married couples with children that still work night shift may find the results of the study useful, as it may help them to change their work schedule. The results also suggest that more attention is needed in workers' schedule design. Most importantly, the study shows that night shift is one of the main factors that could cause a disruption in human circadian rhythm.

## Conclusion

In order to satisfy the increasing needs of the contemporary society, the method of the industrial production has changed and more productions take place at night. Likewise, in an attempt to fulfill the family needs, some have decided to work overtime, night shift and extended hours. This trend increases every year, and as technology increases, there are needs by industries to increase overtime and night shifts for workers [36]. While, chief executive officers are working days and night to increase job opportunities in the nation, not enough attention is given to the workers' well-being, the families and their safety. This study revealed some potential health hazards associated with night shift schedules among the surveyed workers in Midwest States and central North Carolina.

It is revealed that no matter how the body might have adjusted to the night shift schedule, it will one way or another cause circadian rhythm disruptions, poor well-being (such as marriage, usual activities, etc.). The findings from this study could be of help to the policy makers on how workers' safety should be ensured by industrial engineers, company schedule planners and operation research specialists to plan the best time schedule for their workers. Likewise, based on these findings, it is recommended that company schedule planners consider to minimize night shifts and to accommodate employees when possible by adjusting to a flexible work schedule. The impacts of night shifts on married couples should be studied further. This could help protect marriages and ensure better worker productivity. Additional research is also recommended to further ascertain the extent to which night shift schedule impacts the well-being of all workers.


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## Author Contributions

BK is the PI of the study, he developed the questionnaire, prepared IRB document, wrote the manuscript, participated in data collection, compilation and analyzed the data. MS helped review the questionnaire, participated in the writing of the introduction and editing of the entire manuscript after completion. OO helped with data analysis and the result. RPF helped with data collection, compilation and editing of the entire document.


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