# Thermoregulation in Nocturnal Workers: The Impact of Sleep Temperature on various health risks among night Shift Workers

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## Abstract

This study explores the thermoregulation impact on various health risks among night shift workers. Specifically, the study focuses on Sleep Temperature and how it can potentially lead to health conditions such as Obesity, Diabetes, Cardiovascular diseases, Digestive issues, etc. Through the usage of a cross-sectional survey with 167 participants, this study aims to find out what type of sleep temperature participants sleep in and how it affects their overall health. The results of this study illustrate a relation between high sleep temperature and higher amounts of health complaints such as weight gain, sleep disorders, heart diseases, etc. Through maintaining thermoregulation during sleep these dangerous health risks among night shift workers can be prevented. This research brings a new perspective on occupational health on how maintaining optimal temperature during sleep can minimize health conditions among night shift workers. Further study should be conducted on this topic to find other factors that can be optimized to reduce health risks among night shift workers.

Keywords: Thermoregulation, Sleep temperature, night shift workers, Obesity & cardiovascular diseases.

## INTRODUCTION

In the modern world, the demand for night shift work has increased substantially. Different industries run 24/7 because continuous operation in these industries is a must to keep society running. According to the Bureau of Labor Statistics, More than 15 million Americans work a night shift (Lindner, 2023). The type of work could be varied such as healthcare worker, Emergency services, security, Public safety, etc. This nocturnal pattern of workstyle is linked with the disruption of the circadian rhythm and sleep patterns. Which ultimately makes night shift workers more prone to diseases such as obesity and diabetes. While 7-9 hours of sleep is crucial for an individual to live a healthy life, On Average nightshift workers get 2-4 hours of less sleep than normal which is the origin of various diseases (UCLA HEALTH, n.d.). The disruption of the circadian rhythm is also fueled by Unhealthy eating habits or wrong choice of diet and also reduced physical activity due to the nocturnal pattern of workstyle. Night shift workers have a 40% higher chance of getting heart disease and they are also likely to build up habits that may contribute to various cardiovascular diseases - smoking, Unhealthy snacking during work, less physical activity, weight gain, etc (Lindner, 2023). Another 2021 research review shows that Night shift worker has a higher chance of developing heart diseases, obesity, and diabetes. Shift workers are also likely to develop metabolic syndrome (Wu et al., 2021, #). Metabolic syndrome is a collection of various health conditions that significantly increase the risk of being diagnosed with heart disease, diabetes, certain types of cancer, and stroke. If an individual has at least 3 of these signs - Obesity, Elevated blood triglycerides, Low HDL, High Blood pressure, and elevated blood sugar, the individual likely has metabolic syndrome (Shmerling MD, 2020). Metabolic Syndrome can contribute to the health risks of heart attacks, stroke, diabetes, liver or kidney diseases, and sleep apnea. Additionally, each of those signs can be the reason for a certain health condition given respect to the signs. Also, the fact that shift workers' circadian rhythm is heavily disrupted means they likely have “Shift work disorder” - preventing them from

sleeping according to their natural circadian Rhythm. If an individual's circadian rhythm is disrupted or completely shut off, they will have sleep problems (Sleep deprivation, insomnia), memory problems, health problems, Fatigue, etc. Circadian Rhythm's main functions are sleeping and waking up, cognitive functions, Core body temperature, Immune system, Hormones, Metabolism, stress, etc. So an individual Circadian Rhythm must stay uninterrupted so these functions can be done swiftly. Circadian Rhythm essentially makes our body respond to the environment around us for example daytime or Temperature, so it's crucial that the responder is not malfunctioning.

**GAPS IN RESEARCH**

While there is a large amount of research, studies, articles, Journals, books, literature & documentaries on diet, physical activity, Circadian Rhythm's impact on sleep quality, and the development of Metabolic syndrome, a certain part of these affectors received less attention. Which is called Thermoregulation. Thermoregulation is essentially our body remaining at its core temperature to keep our body in Homeostasis. Thermoregulation helps our body to stay within equilibrium during sleep so, factors affecting thermoregulation will also impact our sleep quality which will also have various health impacts (Stephens, 2017).

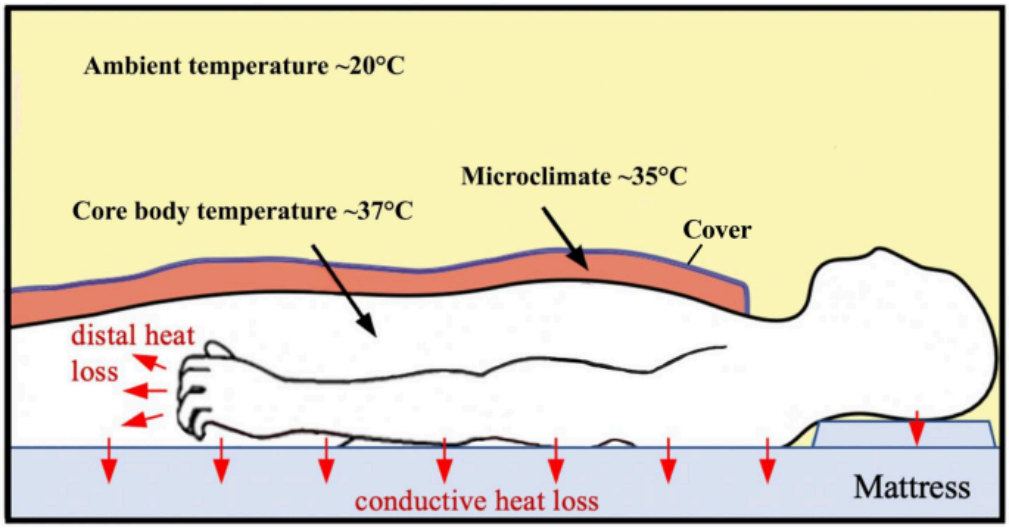



**Figure 1:** The thermoregulation process is essential for sleep. As the image shows, the figure uses bedding to form warm temperatures during sleep. Which will ultimately initiate sleep and maintain it for the rest of the sleep process (Harding et al. #).

Thermoregulation is essential for initiating sleep and maintaining a restful sleep for the rest of the time an individual is sleeping. However, Due to the nocturnal pattern of working it can be hard for shift workers to maintain this thermal equilibrium since they are already disrupting their circadian rhythm by sleeping during the daytime when temperatures tend to be higher. Poor thermoregulation with interrupted circadian rhythm will increase the risk of metabolic disorders due to poor sleep quality. Thermoregulation is an important factor that should be considered for better sleep quality & maintenance of circadian rhythm. This study will focus on the relationship between sleep temperature preferences, sleep quality & amount of participants and how not

maintaining thermoregulation can impact health risks among night shift workers. This study will consist of research on circadian interruption & health risks with night shift work, with a specific focus on thermoregulators or sleep temperature during sleep of the nightshift workers. The methodology used then gathered data from night shift workers participants and their environment during sleep and health outcomes. During the analysis step, the study will discuss how sleep temperature is important for quality sleep and indications of various health diseases such as Diabetes, and myocardial infarction. Lastly, recommendations will be implemented in order to decrease the risk of these diseases among the night shift worker populations.

## LITERATURE REVIEW

Night shift work is significant in our 24-hour society, but night shift work poses various health risks among night shift workers. Night shift work can disrupt an individual's sleep pattern which can lead to dangerous health conditions such as type 2 diabetes, cancer, and obesity (Lauren et al. #). Night shift workers also receive shorter durations of sleep, worse sleep quality, and bad dietary habits and all of these contribute to night shift workers gaining weight which ultimately results in developing metabolic syndrome.

### General Impact of Night Shift Work

Research conducted by David Ray shows specific diseases that can be caused due to night shift work. Night shift work can result in mental issues such as mood and sleep disorders, metabolic diseases such as diabetes and obesity, asthma, and even cancer such as breast and prostate (Ray). These health effects are mainly caused due to the disruption of sleep patterns and circadian rhythm. In addition to those, night-shift workers are at a high risk of abdominal obesity and jetlag (Burm et al.) Supporting this research Wu et al. conducted an umbrella review which gathered data from other systematic reviews and analyses. This review states that night shift workers have a 23% higher risk of obesity, 28% higher diabetes risk, 24% higher risk of coronary artery diseases, 32% higher ischemic stroke, 32% of breast cancer, and 26% increased risk of prostate cancer. Night shift work is also linked with Alzheimer's disease, anxiety, depression, and other sleep disorders (Wu et al. #)

### *Circadian Dysfunction and Health Impact*

In addition to these general health impacts, there is also Circadian dysfunction and its health implications. Circadian dysfunction is a circadian disorder in which the internal clock of an individual’s body is not in sync with the environment that they are in. Circadian dysfunction which is very common among night shift workers can initiate various cardio-metabolic disorders. Circadian dysfunction will interrupt the normal metabolic process of a human being and increase the risk of heart disease, obesity, Type 2 diabetes, and cardiovascular diseases (Marhefkova et al. #). Likewise, Another review by Baidoo and Knutson illustrates how circadian disruptions are related to increased risk of metabolic diseases such as type 2 diabetes, etc. Factors such as night shift work, short sleep, lack of physical activity, and wrong choices while eating are directly related to circadian dysfunction. Which also leads to metabolic syndrome - obesity, high blood pressure, cardiac diseases, etc. The circadian rhythm can be interrupted by the timing of sleep, quality, Chronotype, meal time, activity time, etc. All of these contribute to the metabolic health of an individual as well (Baidoo and Knutson #).

**Specific consequences on Night workers' health and lifestyle.** Some of the most popular night shift workers are part of health care. For example, paramedics, Nurses, Certified Nursing Aids, doctors, etc. In this case, Al-hrinat, jebril, et al. specifically show the quality of life among night nurses. The study was focused on the quality of life of the nurse with the sleep disturbance that was present due to the style of work. An inverse relationship between night shift work stress and quality of sleep was found in this study. The increase in night shift work stress would decrease the quality of sleep of the nurses. As usual, both sleep patterns and Circadian rhythm were disrupted due to the type of work. This also led to sleep disorders like insomnia, fatigue, and many physical and mental health issues among the nurses. An unhealthy work-life balance was shown through the research, the risk of cardiovascular disease was high, and cognitive impairments were also part of it (hrinat et al. #). Other than nurses there are also other professions such as Paramedics, bartender and they also go through this same process where they also face negative impacts in their personal lives in addition to a higher risk of dangerous health conditions.

***The Gaps in Research and Avenue.*** Various research and studies exist that establish a strong link between night shift workers and how they're prone to dangerous health conditions due to their disrupted sleep patterns and dysfunctional circadian rhythm. Also, with these certain health issues, there are also personal life problems that could potentially be there due to this nocturnal type of work. Activities during shifts such as Napping can potentially improve cognitive performance during the night shift and minimize the negative impact of disrupted sleep and circadian rhythm (Dutheli et al. #). Despite all these extensive searches, the impact and importance of the sleep environment and its contribution to maintaining circadian rhythm are still overlooked. Thermoregulation in general hasn’t been explored much in terms of night shift workers and their health implications. This gap suggests that the study of Thermoregulation and implicating optimal sleep temperature for night shift workers during sleep can potentially provide them with quality sleep. As research shows, Thermoregulation is necessary to induce sleep and maintain comfortable sleep throughout the phase (Harding et al. #). Ultimately, this comfortable sleep can minimize the health risks that are endangering night shift workers such as Diabetes, obesity, metabolic syndrome, etc. Controlling sleep temperature during sleep can potentially enhance health outcomes for night-shift workers and lead to significant innovation in healthcare and better well-being of night-shift workers in general.

## Methodology

The goal of this research is to investigate the influence of Sleep environment temperature among night shift workers. As shown before Shift work is linked with dangerous diseases such as diabetes, metabolic diseases, cardiovascular diseases, and Obesity. This study implemented a cross-sectional survey to understand the environment that participants are sleeping in and how it’s impacting their sleep quality, amount, diet choices, and overall health and well-being.

### Study Designs And Research Questions

The study uses a cross-sectional survey to interpret the relationship between sleep environment temperature and various health conditions and symptoms of night shift workers. Those health issues include - Weight gain, Fatigue, Tiredness, Digestive issues, Sleep disorders including sleep deprivation and insomnia, Mental Health Issues such as depression or anxiety,

Heart Diseases, High blood pressure, stroke, Diabetes, Vitamin D deficiency, etc. The main questions I had throughout the survey which I needed to answer by interpreting the data are

- ☐ How does the Temperature affect the overall sleep and health situation of the night shift worker?'
- ☐ Does having night shift work impact the participant's dietary habits which ultimately leads to various heart, and metabolic diseases and obesity?
- ☐ What is the optimal sleep temperature range that gives the night shift workers the most comfortable & quality sleep?

***Participants***

Participants for this survey were aged between 20 years old to all the way to 60 years old and are currently employed as night-shift workers. Participants were from various industries such as EMS, healthcare, retail, warehouse, paramedic, Janitor, mining, Bartender, Nursing, manufacturing, Custodial, Distributor, Education, Law Enforcement, etc. In order to get more broad and diverse results there was no restriction on Gender, ethnicity, age, or the type of work someone is associated with. Any Individual who works during the night shift was eligible to participate in the survey. Participants were recruited through the use of social media. Particularly Instagram and Reddit were most used where the majority of participants mainly came from. The survey was posted in the "nightshift subreddit" and also on my personal Instagram with the link to the survey in order to receive responses. A total of 167 responses were received after keeping the survey open for 2 weeks.

**Data Collection Method.** The survey had both quantitative measures - the number of hours slept & Temperature- and Qualitative assessment - comfort level of sleep and rating of overall health. The survey consisted of 3 separate sections which are as follows: Work and Sleep patterns, Sleep Environment, and Health Outcomes. The survey was conducted through the usage of Google form and all submissions to the form were anonymous to maintain the privacy of the participants.

***PROCEDURE.*** After participants gave consent to fill out the survey a 5-10 minutes long direct question survey was sent out to the participants. The questions were clear and straightforward. The survey was open for 2 weeks meaning Data was collected for 2 weeks in order to reach a substantial amount of participants. The data will be analyzed through the usage of Google Spreadsheets to evaluate the results. The data were collected and stored safely to save the privacy of the readers.

Data Analysis.

This study will conduct descriptive statistics which will provide a summary of key variables such as sleep patterns and room temperature - calculation of average and median will also be done through using this method. For example, Most average and most common sleep temperature preferences among night shift workers are the percentage of people reporting specific health issues such as weight gain, digestive issues, heart diseases, etc. Inferential Statistics were also implemented in order to identify the correlation between sleep temperature and reported specific health problems. Specifically, the Chi-square test was conducted in order to find a correlation between sleep temperature and report of health concerns like weight gain for example. Additionally, Another simple statistic test called T-test would be conducted as well.

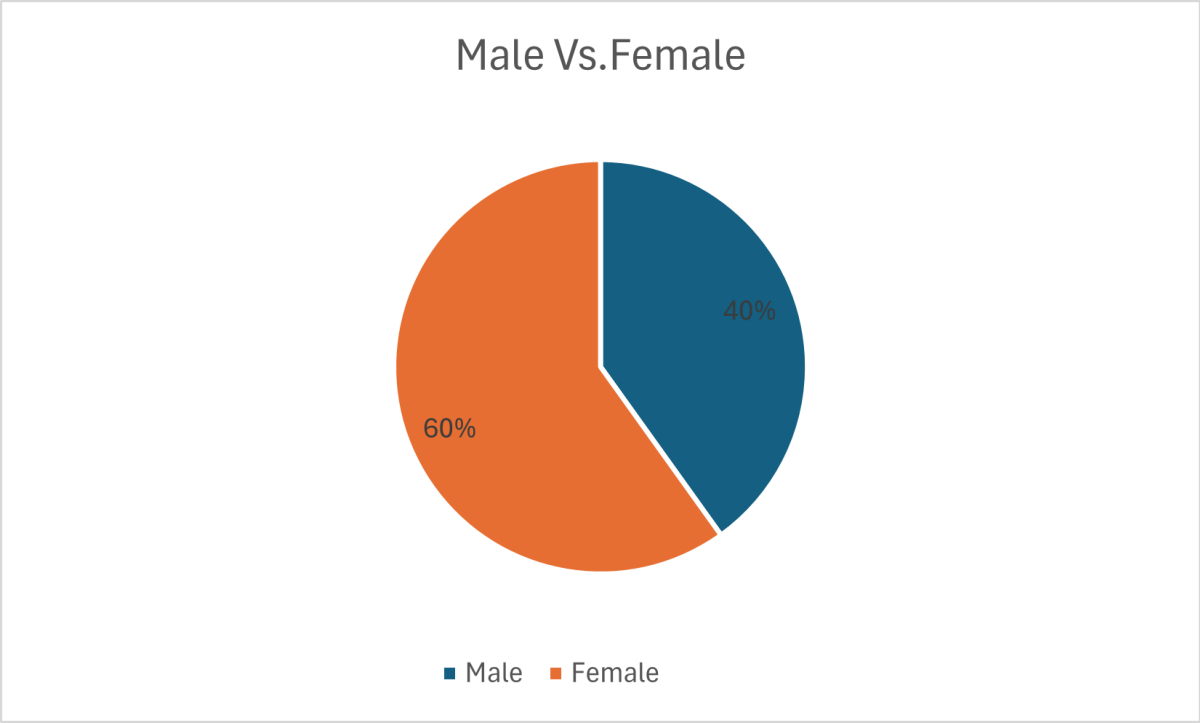
The purpose of the T-test is to compare Higher sleep temperature and lower sleep temperature and compare those with health concerns that participants report. The test will look for a corelation between those. A simple regression analysis was also conducted to find the specific effect of sleep temperature on health outcomes. This mixed approach allowed for a more complex and comprehensive understanding of the survey responses by night shift workers. This also helped us understand the relationship between thermoregulation, sleep quality, and health risks among various night shift workers. The qualitative data gathered through the response gave context to the Quantitative data. For example, Participants had the option to write out how they felt in terms of health, sleep, and dietary habits, which corresponded with their report on specific health concerns and sleep duration/quality.

*Limitation.*

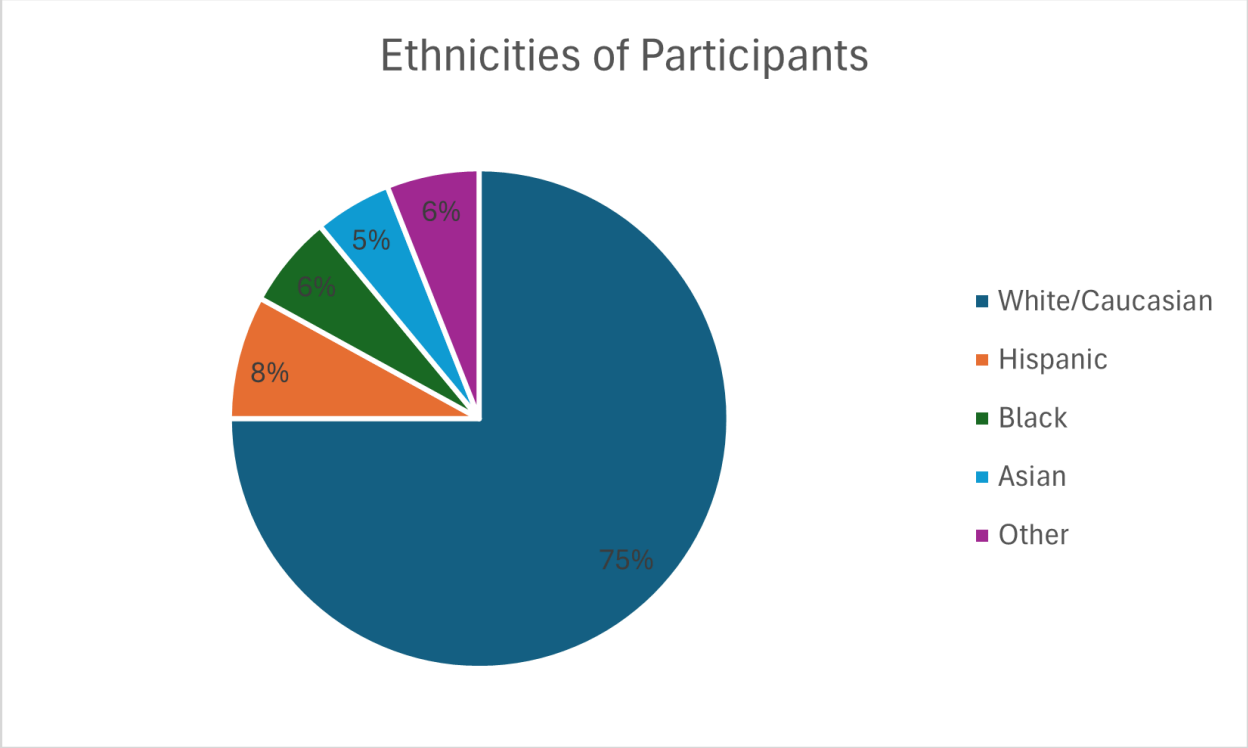
Even though the data was very diverse among various professions, genders, and ethnicities, the data was self-reported limiting the scope of the study. Also, the survey was run completely online so there wasn't a proctor to observe the participants to verify whether reported data was truthful or not. However, the diverse nature of the study provides a rich perspective on the topic which can be studied in the future to build more development on the topic of Thermoregulation and health risks among night shift workers.

## RESULTS

Our survey collected responses from around 167 nightshift workers from various Job industries. It was predominantly the Healthcare industry for this particular research. Participants were aged from 18-60 years old with a mean of 33.5 years old. The same Consisted of 100 females (59.9%) and 67 males (40%)



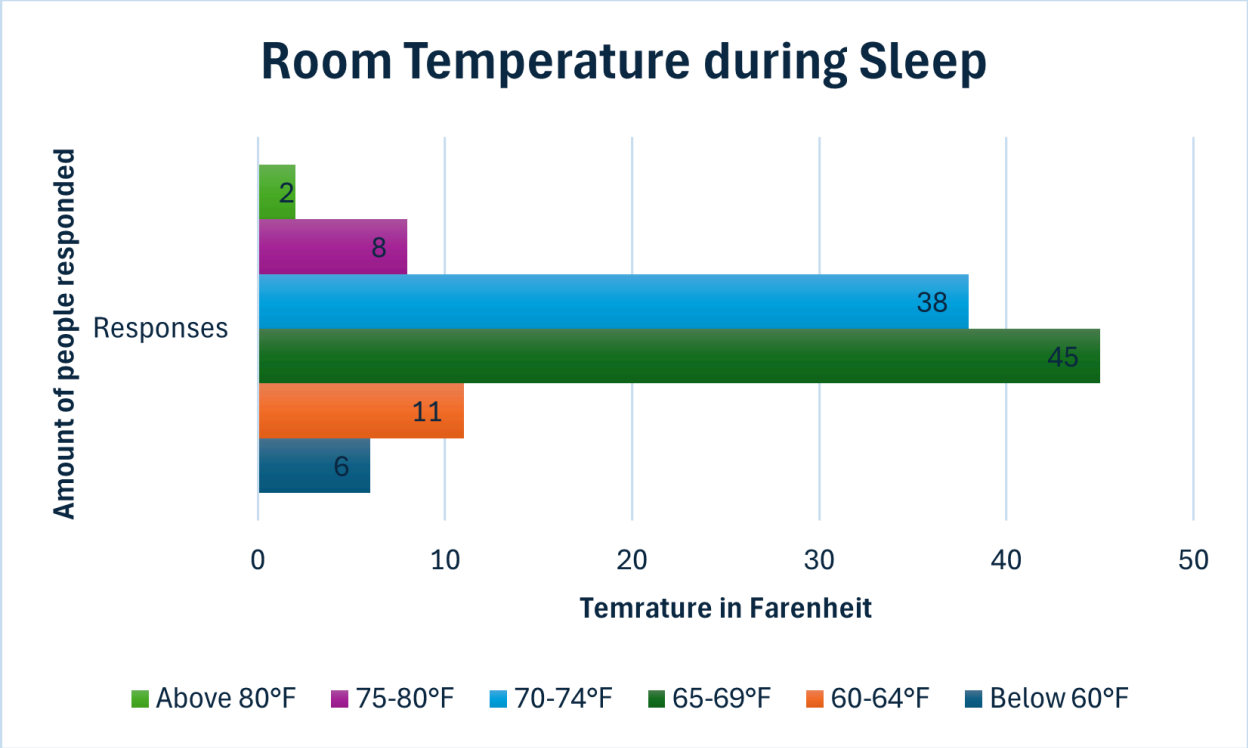

In terms of Ethnicities, 75% of the participants were White/caucasian, 8% Hispanic/Latino, 6% Black, 5% Asian and 6% are other ethnicities.



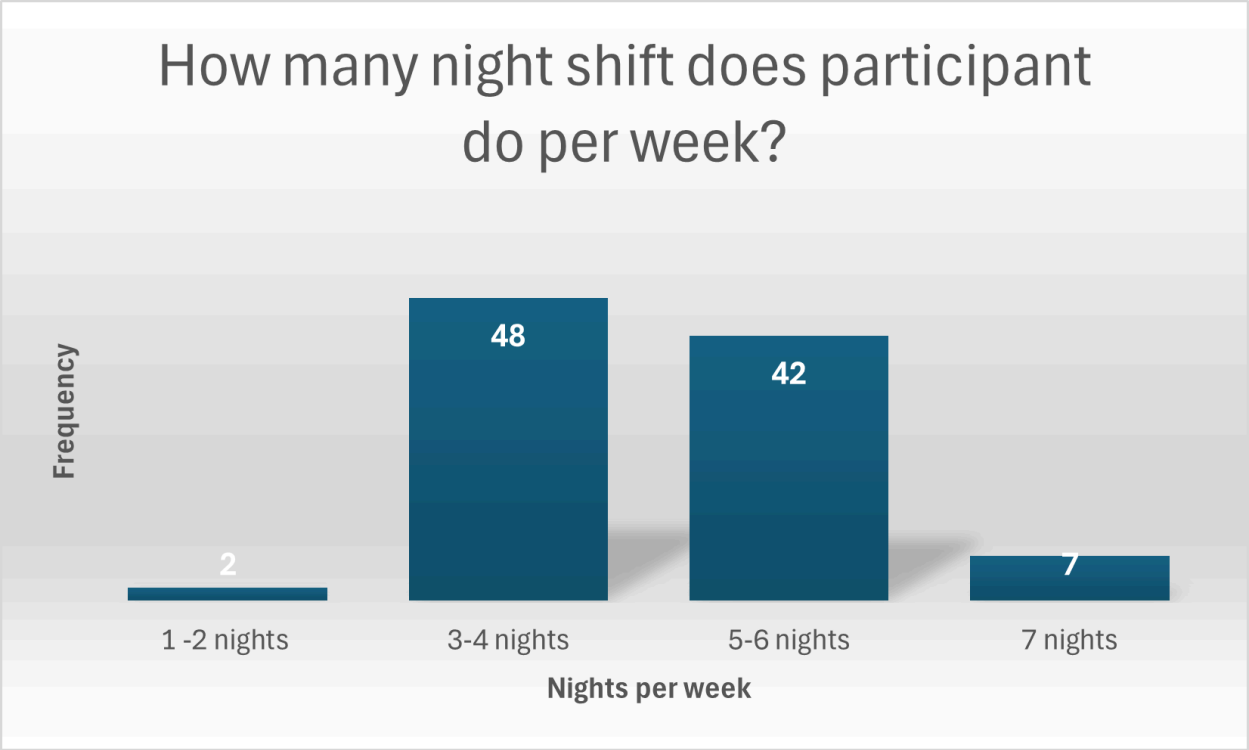

Responders also diverged from various industries where Healthcare was 35%, Manufacturing 20%, and Retail was 15%  out of all participants.

**Work and Sleep Pattern**

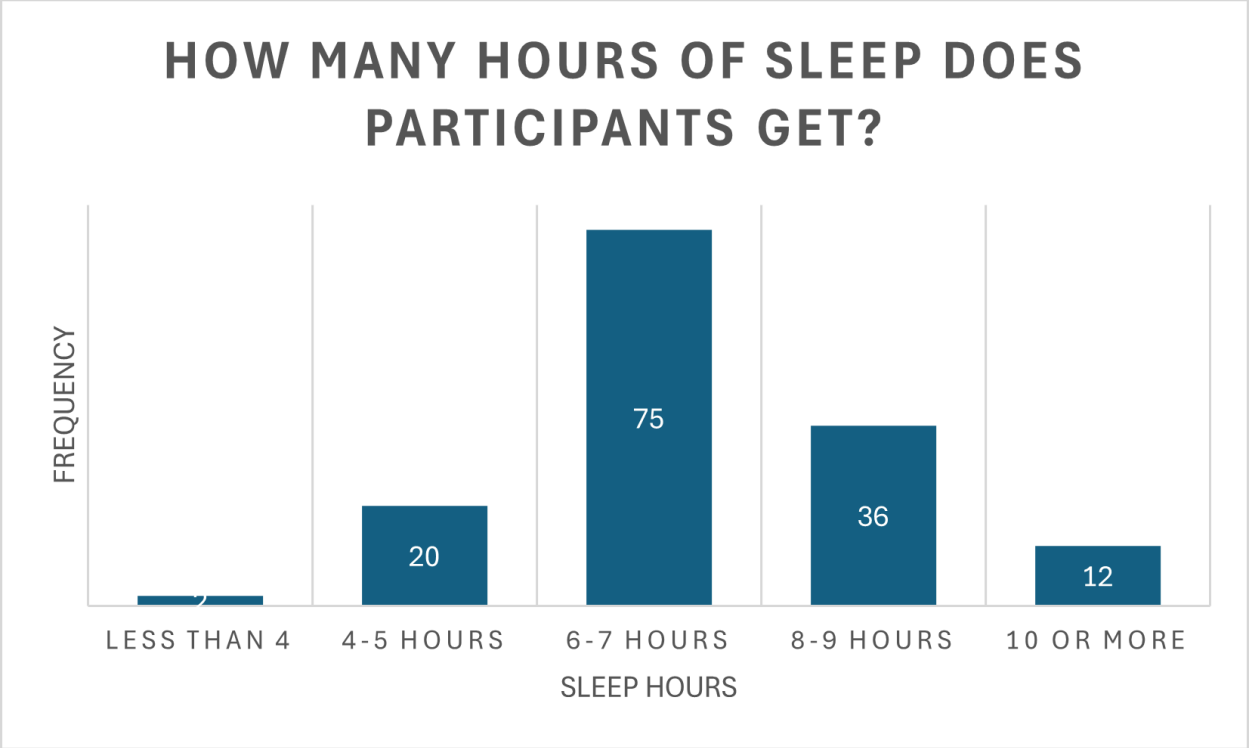
Participants in the survey reported an average of 4-night shifts per week and an average sleep duration of 6.5 hours. The most common or preferred sleep temperature was between 65 degrees Fahrenheit and 69 Degrees Fahrenheit. Around 60% of the participants have found their sleep environment comfortable.




Description:- Preference for Room temperature of participants in Fahrenheit.

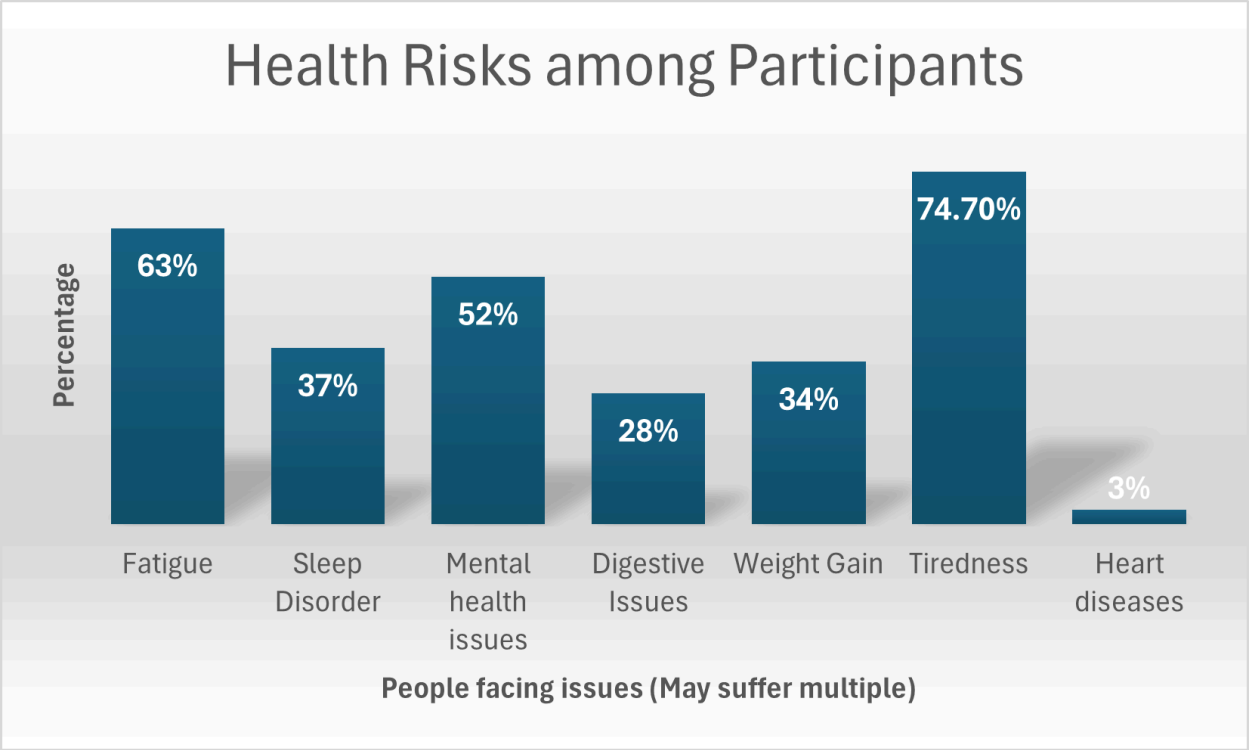



Description:- How many shifts/weeks Participants worked (some also mentioned their total hours)



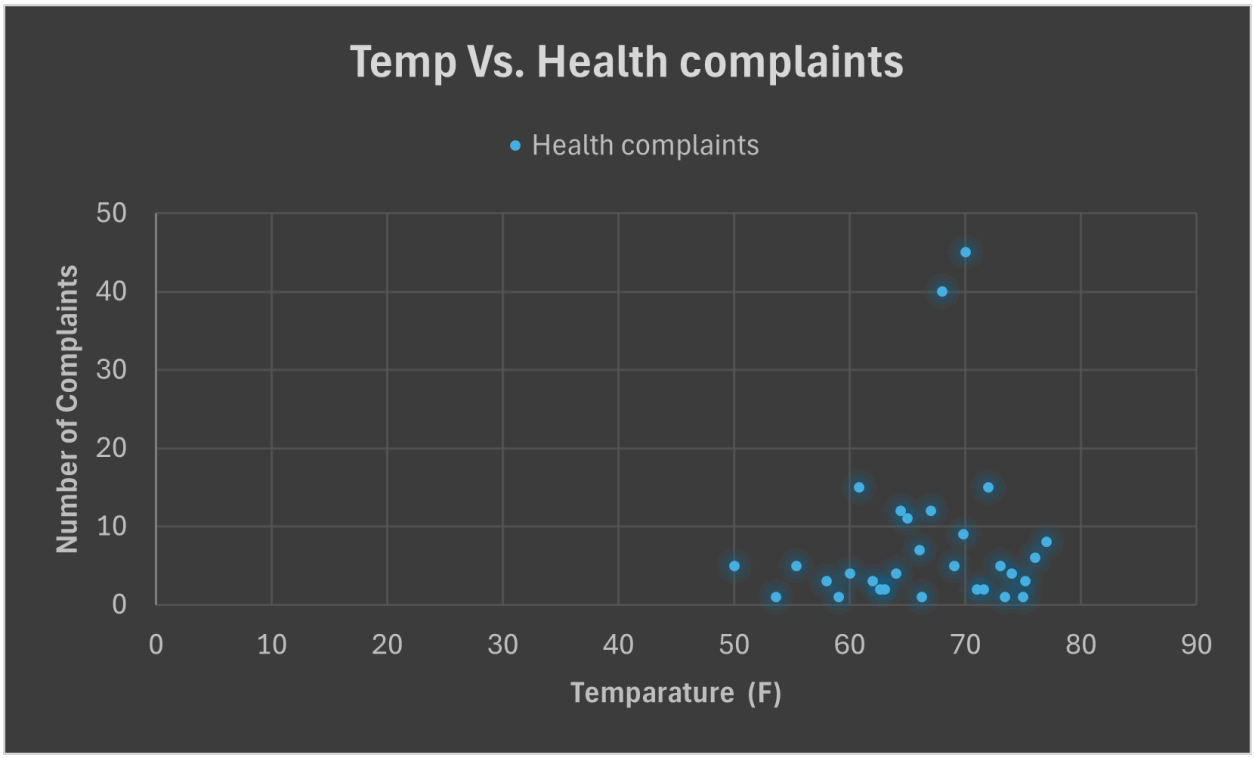

Description:- Amount of Hours Participants Slept ( Some participants slept differently when out of shift)

***Health Issues Among Participants***



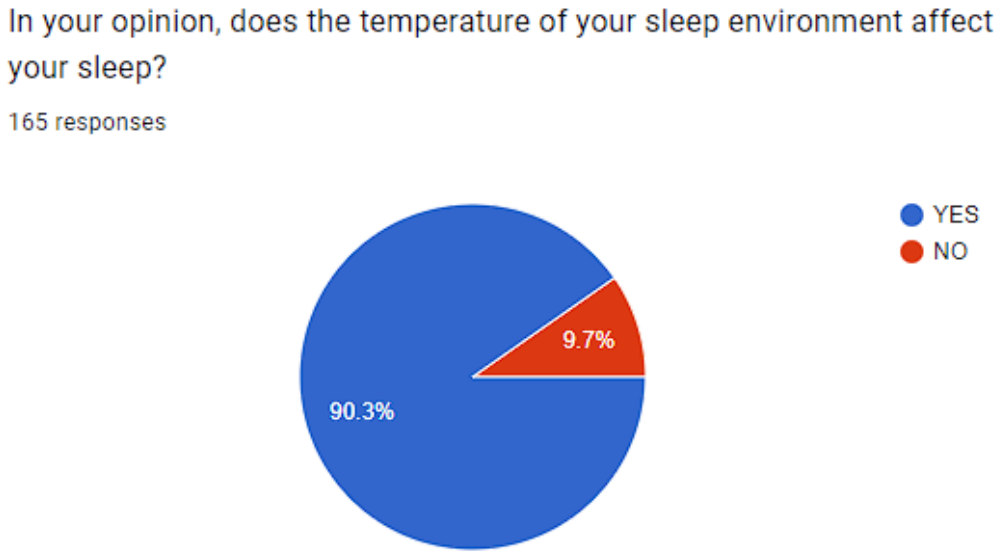

Out of 166 responses, Participants mentioned various health issues due to their nocturnal pattern of work. In total 21 diseases and symptoms combined were mentioned in the survey response however, Only the dominant ones have been mentioned in the chart above. Significant health issues that are generally known among night-shift workers have been mentioned. For example, 63% of the participants had fatigue, 37% of the participants had some sort of sleep disorder such as insomnia, or sleep deprivation, and 52% had Mental health issues such as depression, Anxiety, etc. Also, 28% of the participants had digestive issues, 34% of participants reported gaining weight due to dietary choices while most people of 74.7% reported Tiredness. Also, around 3% of people reported having some sort of heart disease. The percentage would not add up to 100% because people were able to choose multiple options and also write their own diseases or health issues if none of the above were applied to them.

**Sleep Temperature and Health Outcomes.**



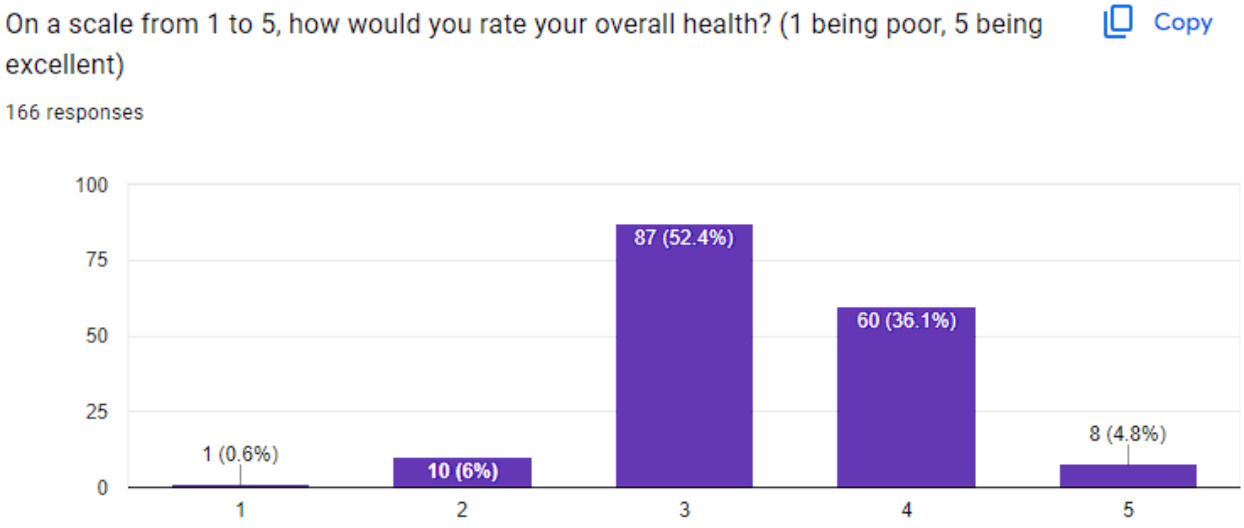

As the scatter plot shows above, the Majority of the time if the temperature during sleep is too high there is a significant amount of complaints of various health issues. People who had high-temperature sleep environments found it difficult to maintain stable Thermoregulation during sleep. While some data fluctuate, statistical analysis shows a positive correlation to where the higher the temperature the higher amount of disease complaints there was.

***Impact of Temperature.*** A vast majority (90%) of the people in the survey response stated that the temperature that they live in has a significant impact on the quality of their sleep.

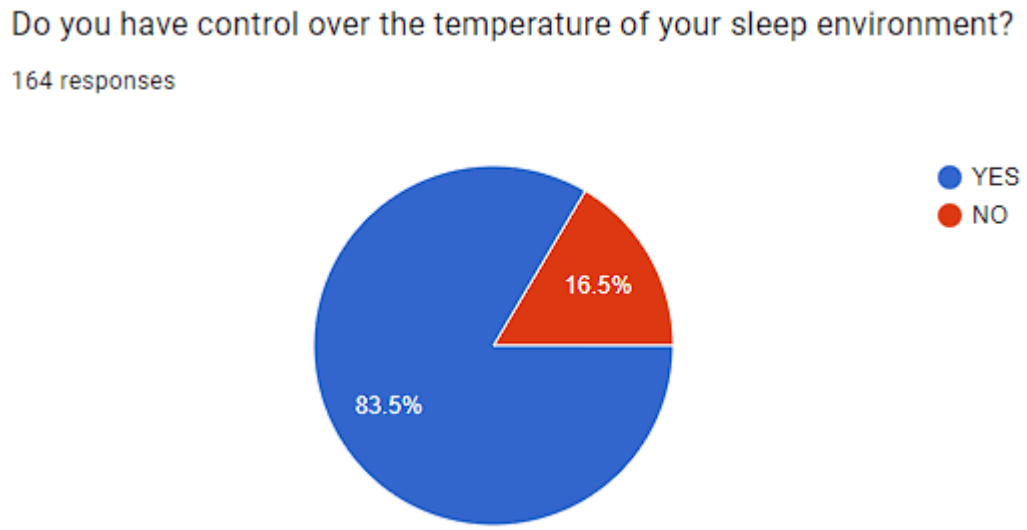


**Qualitative insights.** The question was more leaned toward dietary habit and their impact on health risks. “In what way do you believe your work schedule affects your dietary habits?” - this question was asked as part of the survey to get a more in-depth view of how much their diet is impacted by night shift work and how that impacts their health. This also had a positive corelation. The majority of participants reported having bad dieting habits such as irregular meals, snacking during shifts, etc. All of these caused them to gain weight as mentioned on a previous chart. Most people tend to drink too much caffeine than recommended in the survey. Overall, a bad diet during night shift work also impacts the health and well-being of these night shift workers.

### *OVERALL HEALTH VS. SLEEP TEMPERATURE.*



While the majority of participants were neutral state in terms of their overall health the 6.6% or 11 people who reported less than 3 all have similar traits. 8 out of those 11 people reported a temperature higher than 70 degrees Fahrenheit while the rest 3 were very close to 70. The ideal sleep temperature is around 60-67 degrees Fahrenheit (Brennan and McMillen #). Some of the responses of the participants were “Needs to be cold”, “Cold room= better sleep” Now this may be caused by the fact that a significant portion of people don't have control over their sleep temperature. They might be part of that 16.5% and want a cold temperature room.




**Inferential Statistics.** A chi-square test - comparing observed results with results that are already expected- was conducted with the survey. The Chi-square test reveals that there is a significant correlation between sleep temperature and the quality of sleep which is a determining factor for various health diseases like obesity and diabetes. Participants who reported discomfort during sleep and High temperature during sleep also reported their overall health situation as less or equal to 3 out of 5. Those participants also reported weight gain, fatigue, Mental Health issues, and heart diseases in the survey. The T-test compared those with higher temperatures of 70 and above and those with lower sleep environment temperatures of 69 or below with health complaints of the participants. Those with higher temperatures demonstrated a higher amount of complaints than the other group for the majority of the time.

## DISCUSSION

### Going Beyond Existing Literature

While previous studies have shown us that night shift work can create a misalignment in our body's circadian rhythm and the light-dark cycle. This misalignment can lead to metabolic syndrome, Obesity, and other life-threatening diseases. The studies also say that shift work can create permanent sleep disorders, increased risk of mental and physical diseases, cardiovascular diseases, etc (Bolvin et al., 2021, #). However, My study goes beyond just circadian rhythm disruption, Diet choice, and lack of Physical activities and creates a specific focus on Thermoregulation. Thermoregulation is necessary for initiating sleep and also maintaining quality sleep throughout the various sleep cycles. By illustrates the fact that

temperature has a significant impact on the sleep quality of night-shift workers, which is a less paid attention site of Health Risks for night-shift workers. Having an Optimal temperature for sleep can initiate sleep quicker and give a better quality of sleep to night-shift workers.

The results of this study show the significance of thermoregulation in minimizing the risks of dangerous diseases associated with Night shift work. This study highlights the importance of Environmental Factors specifically temperature and How maintaining temperature can result in better sleep quality and in the well-being of the individual. Having control and authority over the environment that surrounds someone can directly impact the well-being of an individual. It's necessary to maintain thermoregulation, which is basically an equilibrium state of our body temperature that gives us comfort. The reason we wear blankets and use bedding is so we can reach that equilibrium state internally in our body maximizing our sleep. Other than physical, and dietary factors, Temperature during sleep is as important as those other factors. While it doesn't mean that just maintaining optimal sleep temperature would give an individual the perfect sleep. Only when all factors contribute together which is making the right choice of food, Getting enough rest, maintaining thermoregulation, Exercising, etc. If all of those factors operate together at their optimal level then the health risks such as Obesity, Diabetes, and Cardiovascular diseases for Night shift workers would decrease at a significant rate.

***Practical implication***

The findings throughout this research or study suggest that in order to promote quality sleep, the environment while sleeping must be customized at optimal sleep temperature for the best results, which is around 60° Fahrenheit to 67° Fahrenheit. According to the results, Participants have shown a clear preference for cooler temperatures during sleep and made fewer complaints in terms of healthcare risks or conditions. Night shift workers must make sure to change the temperature to a slightly cooler side before going to sleep. Which is not only going to be more comfortable rather it will be more healthy and will decrease the risk of various healthcare diseases. However, Almost 16.5% of the participants have reported that they don't have control over their environment (temperature) when sleeping. In that case, finding alternative ways to reduce the temperature is a must to decrease the chance of being diagnosed with diseases. Also during shifts, organizations can also implement adaptive climate control technology specific to maintain optimal thermoregulation.

**Future Research implication.** Future research can take various directions in order to create more innovative solutions in order to minimize the health risks among night shift workers. Night shift workers fill out a significant portion of the labor force and we must make sure to prevent them from being exposed to cardiovascular diseases, obesity, metabolic disorders, etc. In the future running a longitudinal study with observation can really show the true impact of thermoregulation in sleep. My study was significantly limited due to the self-report nature of the study and also the fact this whole research was conducted through various online platforms, there might be biased or inaccurate information while filling out the survey. In addition to running a longitudinal study, this study can take into another way which is finding other environmental factors that didn't get much attention in other studies that can impact circadian rhythm or sleep quality among night shift workers. Light exposure and noise levels could be other factors that might impact the sleep quality of an individual - especially a nocturnal worker- which might've not received as significant attention as they should. Overall, this study can take multiple approaches for future implications whether it's developing this current study to a more in-depth

level or finding similar factors like thermoregulation for sleep. No matter what, those findings can be crucial for the health and well-being of society and particular groups like the nightshift workers covering almost 11 Million people in the United States of America.

## Conclusion

This study focuses on thermoregulation and its impact on health outcomes among night shift workers. Night shift workers cover a significant portion of the labor force in various industries such as security, healthcare, manufacturing, etc. Night shift workers are more prone to dangerous diseases such as cardiovascular diseases, metabolic syndrome, obesity, diabetes, etc. The study on thermoregulation correlates with sleep temperatures and how it can affect previously mentioned health conditions, weight gain, fatigue, and other mental health issues. With almost 167 participants in this research project, the result showed that a cooler temperature between 65° Fahrenheit to 69° Fahrenheit was the most optimal. People who slept at this temperature showed less health conditions compared to people who slept over 70° Fahrenheit. This ultimately illustrates the relationship between higher sleep temperature and with higher number of health outcomes such as obesity or diabetes.

The findings of this study or research would be extremely beneficial toward occupational health and just an innovation to healthcare in general. With the known effect of not having proper quality sleep, not being able to sleep the recommended hours can be extremely dangerous for people. Thermoregulation is responsible for initiating sleep and maintaining sleep throughout all the other phases of sleep. After the findings of this study, Night shift workers would now implicate a customized environment with a bit colder temperature to maximize sleep quality. With their disrupted circadian rhythm, it's crucial to receive quality sleep. With these new findings, organizations will also promote policies for the well-being of nightshift workers such as recognizing the crucial role of temperature for sleeping. For example, Companies can implement adjustable temperature controllers for employees in their sleeping rooms/places if applicable.

In the future, This study can go further whether that's through conducting longitudinal research on Thermoregulation among night shift workers and the long-term effect of it or Finding other environmental factors that can affect the quality of sleep. For example, Noise levels or Light exposure, etc. No matter what the continuous studies on this topic of decreasing health risks among night shift workers would be extremely beneficial as they are needed for our 24/7 society and their work has so much impact on our society. Unfortunately, Night shift work has a higher chance of health diseases, and being able to reduce that would have a long-lasting effect on society.

In conclusion, This study illustrates the importance of thermoregulation in sleep among nmight shift workers. Thermoregulation is often overlooked as other factors such as diet, circadian rhythm, Lack of physical activity, etc are the main factors that most research put more emphasis on for health risks for night shift workers. However, addressing thermoregulation and temperature during sleep can significantly reduce various health diseases that night shift workers are prone to such as Diabetes, Obesity, or cardiovascular diseases. Through maintaining optimal sleep temperature chronic health diseases among night shift workers can be reduced as their impact is significant and crucial in our society.

## Bibliography

Baidoo, V. A., & Knutson, K. L. (2019). Associations between circadian disruption and cardiometabolic disease risk: A review. *Associations between circadian disruption and cardiometabolic disease risk: A review*, *31*(3), 615-624. https://onlinelibrary.wiley.com/doi/full/10.1002/oby.23666

Bolvin, D. B., Boudreau, P., & Kosmadopoulos, A. (2021). Disturbance of the Circadian System in Shift Work and Its Health Impact. *Disturbance of the Circadian System in Shift Work and Its Health Impact*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8832572/#bibr72-07487304211064218

Brennan, D., & McMillen, M. (n.d.). What's the Best Temperature for Sleep? *What's the Best Temperature for Sleep?* https://www.webmd.com/sleep-disorders/features/cant-sleep-adjust-the-temperature

Burm, M. C. B., Dantas Filho, F. F., Schnorr, C. C., Borchardt, G., & Rodriguez, T. C. (2015). *Shift work and its association with metabolic disorders*. Diabetology & Metabolic Syndrome. Retrieved 02 03, 2024, from https://dmsjournal.biomedcentral.com/articles/10.1186/s13098-015-0041-4

Dutheli, F., Bassonnat, B., Pereira, B., Baker, J. S., Moustafa, F., Fantini, M. L., Mermillod, M., & Navel, V. (2020). Napping and cognitive performance during night shifts: a systematic review and meta-analysis. *Napping and cognitive performance during night shifts: a systematic review and meta-analysis*, *43*, 1-15. https://watermark.silverchair.com/zsaa109.pdf?token=AQECAHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAA1YwggNSBgkqhkiG9w0BBwagggNDMIIDPwIB ADCCAzgGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQMwqQy52neEIJ7lr0aAgEQ gIIDCXJAmH75W-T2h6GHjBI0F4hu901ZJg81ms7g6nTpCHHotIow

Harding, E. C., Franks, N. P., & Wisden, W. (2019). The Temperature Dependence of Sleep. *The Temperature Dependence of Sleep*, *13*. https://www.frontiersin.org/journals/neuroscience/articles/10.3389/fnins.2019.00336/full

hrinat, J. A.-., Al-Ansi, A. M., handi, A., Adwan, G., & Hazaimeh, M. (2024). The impact of night shift stress and sleep disturbance on nurses quality of life: case in Palestine Red Crescent and Al-Ahli Hospital. *"The Impact of Night Shift Stress and Sleep Disturbance on Nurses Quality of Life: Case in Palestine Red Crescent and Al-Ahli Hospital.*, *23*. file:///C:/Users/abidk/Downloads/s12912-023-01673-3.pdf

Lauren, S., Chen, Y., Chang, B., & Shechter, A. (2019). Free-Living Sleep, Food Intake, and Physical Activity in Night and Morning Shift Workers. *39*(5), 450-456. Retrieved 01 6, 2024, from https://www.tandfonline.com/doi/full/10.1080/07315724.2019.1691954?scroll=top&needAccess=true

Lindner, J. (2023, 12 16). *Must-Know Night Shift Statistics [Recent Analysis]*. Work and Employment Statistics. Retrieved 3 4, 2024, from https://gitnux.org/night-shift-statistics/#:~:text=According%20to%20the%20Bureau%20of,million%20Americans%20work%20night%20shifts

Marhefkova, N., Sladek, M., Sumova, A., & Dubsky, M. (2024). interdisciplinary Research in Diabetology. *Circadian dysfunction and cardio-metabolic disorders in humans*, *15*. https://www.frontiersin.org/journals/endocrinology/articles/10.3389/fendo.2024.1328139/full

Ray, D. (2020). *Addressing the health impacts of night shift work*. Manchester 1824. Retrieved 02 03, 2024, from https://blog.policy.manchester.ac.uk/posts/2020/07/addressing-the-health-impacts-of-night-shift-work/

Shmerling MD, R. H. (2020, 10 2). *Metabolic syndrome is on the rise: What it is and why it matters*. Harvard health Publishing. Retrieved 2 2, 2024, from https://www.health.harvard.edu/blog/metabolic-syndrome-is-on-the-rise-what-it-is-and-why-it-matters-2020071720621

Stephens, C. (2017, June 7). *Thermoregulation | Definition and Patient Education*. Healthline. Retrieved April 30, 2024, from https://www.healthline.com/health/thermoregulation#takeaway

UCLA HEALTH. (n.d.). *Overcoming sleep problems caused by a non-traditional work schedule*. UCLA Health. https://www.uclahealth.org/medical-services/sleep-disorders/patient-resources/patient-education/coping-with-shift-work#top

Wu, Q.-. J., Sun, H., Wen, Z. Y., Zhang, M., Wang, H. Y., He, X. H., Jiang, Y. T., & Zhao, Y. H. (2021). Shift work and health outcomes: an umbrella review of systematic reviews and meta-analyses of epidemiological studies. *Shift Work and health Outcomes*, *18*(2), 653-662. Retrieved 2024, from https://jcsm.aasm.org/doi/epdf/10.5664/jcsm.9642

## APPENDIX A

### The Impact of Sleep Temperature on Health Outcomes for Night Shift Workers

Thank you for participating in this survey! We are conducting research on the sleep habits o night shift workers and how their sleep environment, specifically temperature, might relate to health outcomes such as obesity. This survey is anonymous and should take about 5-10 minutes to complete. Your insights are invaluable to our understanding of these issues.

By selecting YES, I consent to my anonymous data being used for the purpose of this study.

- ☐ YES
- ☐ NO

**Demographics:**
Age:-
Gender:-
Ethnicity:-
Job Industry:-
*

Short answer text

**Section 1: Work and Sleep Patterns**

Description (optional)

1. How many nights per week do you work on average?
   Short answer text

2. On average, how many hours do you sleep per day?
   Short answer text

Do you have a regular sleep routine?

- ☐ YES
- ☐ NO

Do you often find it difficult to maintain a regular sleep schedule due to night shift work?

- ☐ YES

- [ ] NO

**Section 2: Sleep Environment**

Description (optional)

What is the usual temperature of the room where you sleep? (Please specify in Fahrenheit or Celsius.)

Short answer text

Do you have control over the temperature of your sleep environment?
How comfortable do you find your sleep environment?

- [ ] YES
- [ ] NO

In your opinion, does the temperature of your sleep environment affect the quality of your sleep?

- [ ] YES
- [ ] NO

If yes, could you describe how temperature impacts your sleep quality?

Long answer text

**Section 3: Health Outcomes**

Description (optional)

Have you experienced any of the following health issues? (Check all that apply)

- [ ] Weight Gain
- [ ] Fatigue
- [ ] Tiredness
- [ ] Digestive Issues
- [ ] Sleep Disorder (Insomnia, Deprivation)
- [ ] Mental Health Issues (Depression, Anxiety)
- [ ] Heart Diseases
- [ ] None of the Above

☐ Other (Please Clarify below)
Other…

On a scale from 1 to 5, how would you rate your overall health? (1 being poor, 5 being excellent)

Poor

1

2

3

4

5

Excellent

Do you feel that your work schedule has an impact on your dietary habits?
(If Yes to the above) In what way do you believe your work schedule affects your dietary habits?
Long answer text

THE END
Thank you for completing the survey. Your responses are crucial for our understanding of night shift work and sleep environment's effects on health.  led Title