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Review of Nighttime Temperature Effects on Long-Term Health Condition Through Sleep Studies

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ABSTRACT

Over the past 40 years, there has been increasing interest in human sleep quality and duration. This nonsystematic review looked at over 80 peer-reviewed papers on the association among sleep, temperature, and long-term health conditions. Generally, warmer temperatures lend to poorer sleep quality, and poor sleep quality lend to mental illness and a higher risk of coronary heart disease and mortality. Future research should be to conduct a study that relies more on health records rather than questionnaires to accurately map current and future health quality.

Keywords: sleep quality, sleep duration, thermal environment, mental health, long-term health conditions

INTRODUCTION

Previous literature documents that extreme temperature exposure can accelerate illness and mortality in humans, Kalkstain and Green (1997). For example, extreme heat can lead to occurrences of heat stroke, dehydration, and cardiovascular diseases in a relatively short period, Kalkstain and Green (1997). The following review will detail the effects of temperature on long-term health conditions through the lens of sleep studies due to the body's unique sensitive thermoregulation during sleep, specifically during the rapid eye movement (REM) stage.

MATERIALS AND METHODS

Over 80 peer-reviewed journal articles on the background of sleep stages, the long-term effects of sleep quality and duration, and the environmental effects on sleep quality and duration were reviewed. The articles were retrieved using George Mason University's and Old Dominion University's respective online library systems using search terms including but not limited to "sleep and long-term health," "sleep and thermoregulation," and "temperature and sleep quality."

RESULTS AND DISCUSSION

As a person falls asleep, their core body temperature decreases, and, conversely, temperature increases during wakefulness, Barrett et al. (1993). However, when the ambient temperature gets too extreme, a person cannot sustain sleep in the REM cycle and starts to experience wakefulness. Today, people have behavioral sleep thermoregulation (i.e., blankets/bedding for cold ambient temperature and air conditioning for warm). Regulation to cold ambient temperature is more readily available, but Sandberg et al. (2014) found that the most important factor dictating better sleep quality was the use of air conditioning, which led to better work conditions and lower levels of anxiety and depression. However, in Fujii et al. (2015), air conditioning did not have an effect on sleep quality and had a positive effect on fatigue. Further work is needed to confirm the effects of air conditionig usage and investigate if these finding are related to socioeconomic status.

Unfortunately, temperature effects on sleep quality are not trivial as sleep has an effect on long-term health. An increased risk of coronary heart disease and mortality are seen in people that do not sleep the recommended 6-7 hours nightly, Ayas et al. (2003) and Patel et al. (2004). In Kripke et al. (2002), patients with insomnia only showed higher mortality risk when they slept more than 8 hours, showing a possible interaction between duration and quality. Insomnia, and poor sleep quality in general, has been linked to the perpetuation of depression and other major mental health

illnesses, Pigeon et al. (2008) and Scott et al. (2016). In addition, Mokhlesi et al. (2014) found that disordered breathing (sleep apnea) has an association with hypertension in older individuals.

CONCLUSION

Extreme fluctuations in temperature at night have a negative relationship with sleep quality. People with poor sleep quality tend to be exposed to long-term health effects. Future studies should investigate the multicollinearity of poor sleep, exposure to unideal temperatures, and socioeconomic status. It is also important to keep in mind that sleep questionnaires are based off subjective answers, and when they are not the truth, they may lead to incorrect results.

One project I assist with at Virginia Modeling, Analysis, and Simulation Center is on local childhood asthma, for which the team will acquire comprehensive health records. To eliminate subjectivity, we could conduct an experiment where we monitor participants' sleep in a controlled environment and link the results to the health records and to public weather records. We would also be able to control for confounding variables (i.e., ambient noise and shift workers).

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