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The effects of sleep duration and sleep quality on health outcomes in the Marshallese population in Northwest Arkansas

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THE EFFECTS OF SLEEP DURATION AND SLEEP QUALITY ON HEALTH OUTCOMES IN THE MARSHALLESE POPULATION IN NORTHWEST ARKANSAS

by

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ABSTRACT

The objective of this study was to examine possible correlations between sleep duration and sleep quality on health outcomes in the Marshallese community members in Northwest Arkansas. Little research has been conducted on the association between sleep health and health outcomes in Native Hawaiian Pacific Islanders, and even less so in the Marshallese populations. Using cross sectional date from a cluster randomized controlled trial study (n=374), I will examine whether sleep duration and sleep quality are associated with hypertension, type 2 diabetes, body mass index, and overall self-reported health rating in the Marshallese. Systolic and diastolic blood pressure, HbA1c levels, and height and weight were all measured for hypertension, type II diabetes, and BMI, respectively. General health status was determined by self-reported measures from the National Health and Nutritional Examination survey-derived questions. Sleep duration was categorized as very short sleep (0-4 hours), short sleep (4-7 hours), normal sleep (7-9 hours), and long sleep (9 or more hours). Sleep quality was determined by answers to the question: "Over the last two weeks, how many days have you had trouble sleeping or staying asleep?" For the continuous dependent variables (BMI, blood pressure, and HbA1c), median and interquartile range values were examined. For non-continuous variable (general health outcomes), the Spearman Correlation Coefficient was examined to determine association.

Statistically significant associations were found between sleep duration and diastolic blood pressure and HbA1c, and sleep quality and general health. These associations among the Marshallese provide foundation for further longitudinal and intervention research on health disparities in Marshallese residents of the United States.

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LIST OF ABBREVIATIONS

BMI..Body Mass Index

COFA...Compact of Free Association

CVD..Cardiovascular Disease

DPP... Diabetes Prevention Program

HbA1c.. Hemoglobin A1c

HTN .... Hypertension

IQR ....Interquartile Range

NHANES ....National Health and Nutritional Examination Survey

NHPI... Native Hawaiian Pacific Islanders

PET ....Positron Emission Topography

PILI..Pacific Culturally Adapted Diabetes Program

REDCap...Research Electronic Data Capture

RMI...Republic of the Marshall Islands

SES ....Socioeconomic Status

T2DM .... Type II Diabetes

UAMS..University of Arkansas for Medical Sciences

US .... United States

INTRODUCTION

Sleep Overview

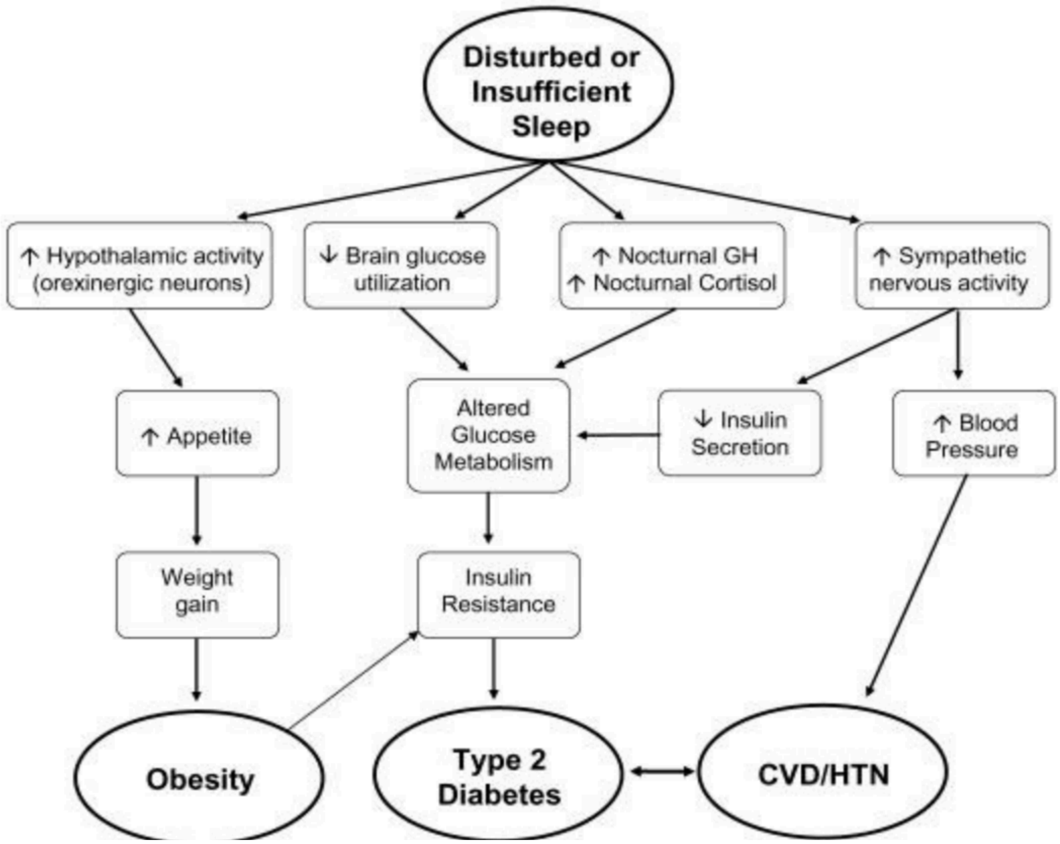
Sleep duration and quantity have been consistently recognized as an important lifestyle contributor to health. Healthy sleep is generally comprised of adequate duration and quality, appropriate timing, and the absence of sleep disorders (Chaput 2018). Guidelines on recommended amount of sleep varies for each person and across one's lifespan, making it difficult to create strict requirements for healthy sleep. Nevertheless, chronic insufficient sleep has become an increasing concern in most countries, with 50 to 70 million US adults reporting insufficient sleep or suffering from a sleep disorder (St-Onge 2016). Adequate sleep is necessary to support one's immune system, perform daily activities effectively and safely, and support the metabolism of sugar to prevent diabetes. If left untreated, chronic short sleep is associated with a higher risk of cardiovascular disease, high blood pressure, obesity, and diabetes. Sleep loss and untreated sleep disorders can negatively affect not only one's physical health, but also family health and interpersonal relationships.

Past meta-analysis studies confirm that both short and long duration of sleep are predictors of cardiovascular outcomes: short sleep is significantly associated with a higher mortality rate. Similar results found significant association between short sleep and type 2 diabetes mellitus (T2DM), hypertension, cardiovascular diseases, coronary heart diseases, and obesity (St-Onge 2016). One key finding revealed that over the course of 6 years, habitual short sleepers (less than or equal to 5 or 6 hours) were more likely to gain weight and have an increased weight circumference and percent body-fat compared with normal-duration sleepers (St-Onge 2016). Reviews of experimental and observational studies have confirmed that restricted sleep duration or impaired sleep quality is associated with impaired glucose metabolism, insulin sensitivity, appetite regulation and immune function (Rangaraj 2016).

Mechanisms of Sleep

It is important to understand the mechanisms between insufficient sleep and its link to obesity, type 2 diabetes, hypertension and cardiovascular disease. While no specific pathway is responsible, the combination of different mechanistic pathways leads to the increased risk of cardiometabolic diseases. One pathway specified by laboratory studies is the increased appetite resulting from short sleep: Decreased inhibition of hypothalamic activity in appetite centers from insufficient sleep leads to increased hunger (Knutson 2010). Increased hunger evidently leads to increased food intake, resulting in weight gain if the subject does not compensate with physical activity (Knutson 2010). Laboratory studies using positron emission tomography (PET) scans observed decreased brain glucose utilization after sleep deprivation, indicating a pathway leading to type 2 diabetes due to insulin resistance from the altered glucose metabolism (Knutson 2010). Another important pathway is the increase in sympathetic nervous activity from insufficient sleep leading to increased blood pressure. A sustained increase in blood pressure may predispose individuals to a development of hypertension and eventual cardiovascular disease (Knutson 2010). Ultimately, understanding these mechanistic pathways is important to understanding the importance of sleep and interventions to treat unhealthy sleep habits.

Figure 1: Schematic representation of possible mechanistic pathways linking disturbed or insufficient sleep to obesity, diabetes, cardiovascular (CVD) and hypertension (HTN). Figure taken from Best Practice and Research: Clinical Endocrinology and Metabolism, "Sleep duration and cardiometabolic risk: a review of the epidemiologic evidence."



Effects of Long Sleep

Contrary to popular belief, habitually long sleep duration (greater than 9 hours) can also negatively impact health. Past epidemiologic studies have confirmed a U-shaped relationship between sleep duration and mortality, leading to an assertion that there may be an optimal amount of sleep necessary to maintain good health (Stamatakis 2007). One epidemiologic cohort found that depressive symptoms are the strongest predictor of long sleep, and most likely the main confounder between long sleep and mortality risk (Patel 2006). Other possible confounders include sleep apnea, fatigue, and poor sleep quality. Nevertheless, few to no studies have investigated the mechanism for long sleep causing a higher risk of mortality and morbidity, and therefore must be explored further to understand its effect on health outcomes.

Sleep in Minority Populations in the United States

This sleep crisis appears to further affect minority populations, such as African Americans and Hispanics, and low SES groups (Rangaraj 2016). Minority groups, specifically African Americans, tend to have shorter sleep duration and poorer sleep quality, and may even be treated less effectively for sleep disorders compared to their non-Hispanic white counterparts (Rangaraj 2016). One study aiming to assess the role of sleep disparities in the incidence of T2DM, hypertension, and cardiovascular disease found significant differences in the prevalence of sleep-related problems by both race and SES as well as significant disparities in the incidence of T2DM, high blood pressure and cardiovascular disease in follow up exams (Rangaraj 2016). However, the results of this study did not confirm an association between sleep, race, and health disparities. Another study examining sleep duration in Native Hawaiian Pacific Islanders (NHPI) found that NHPI are more likely to report shorter sleep compared to Whites and less long sleep (>8 hours) than Blacks (Matthews EE 2018). NHPI were also more likely to report poor sleep quality and use fewer sleep medications. Furthermore, very short sleep (less than 5 hours) was associated with a higher prevalence of hypertension and diabetes in NHPI (Matthews

EE 2018).

Health Outcomes in Native Hawaiian and Pacific Islanders

The rapidly growing Native Hawaiian and Pacific Islanders (NHPI) population in the US often have worse health outcomes than their Asians and Whites counterparts. The 2010 National Health Interview Survey found the obesity prevalence to be 42% among NHPI compared to 26% among Whites and 27% among non-Hispanic blacks (Bacong 2016). The 2012 Pacific Islander Health Study found that more than 95% of NHPI were above normal BMI ranges and 90% of participants were classified as overweight or obese. Overall, studies have further revealed that "NHPI experience disparities in obesity, cardiovascular disease, type II diabetes, physical activity and dietary behaviors" (Bacong 2016). Healthy sleep must be considered as a major predictor for these health disparities (Bacong 2016). Significant gaps remain in the reasoning for the cardiometabolic health disparities among NHPI in the United States. However, several possible factors must be considered including environmental determinants of health relating to food sufficiency, self-perception of one's health, and sleep duration and quality.

The Republic of the Marshall Islands (RMI) was a United States (US) territory which gave the US strategic control of the Pacific before and after World War II. Between 1946 and 1958, the US military conducted multiple nuclear weapon tests on the Marshall Islands, exposing islanders, who were not relocated away from the test sites, to significant levels of nuclear radiation (McElfish 2016). After the nuclear tests, US scientists set up Project 4.1 to study the effects of nuclear radiation on the Marshallese and found extreme health problems: Many miscarriages and birth defects were reported after the US nuclear testing and radical diet and lifestyle changes occurred among the Marshallese, ultimately resulting in a major surge of chronic diseases such as obesity, cardiovascular disease, diabetes, infectious diseases, and cancer.

Marshallese Migrants in the United States

Northwest Arkansas has become the home of one of the largest populations of Marshallese in the world. It is estimated that approximately 10,000 to 12,000 Marshallese live in Arkansas, a number that is predicted to rapidly grow as they likely become the world's first climate refugees. Under the Compact of Free Association (COFA), the Marshall Islands became a sovereign nation in 1986, allowing citizens covered by COFA to lawfully reside and work in the US (McElfish 2016). However, COFA migrants differ from other immigrants, as they do not have the right to vote and are excluded from federal Medicaid, leaving most Marshallese in the US uninsured, thereby furthering the disparities between themselves and their US counterparts. Furthermore, more studies must identify the ethno-cultural and socioeconomic barriers in existing health services as perceived by immigrant Marshallese (Willliams 2005). With little to no access to health care and generational health disparities from the US nuclear testing, the Marshallese population face deeper inequalities that must be addressed in order to improve their health outcomes.

Specific Aims

The first aim of this study looks to examine whether shorter sleep duration (as measured by four categories of normal, long, short, and very short) is associated with a risk of hypertension (as measured by diastolic and systolic blood pressure), T2DM (as measured by HbA1c levels), higher body mass index (BMI) (as measured by height and weight), and worse perceived general health (Poor, Fair, Good, or Excellent) in the Marshallese population (DPP).

The second aim looks to examine whether sleep quality (determined by the question: “Do you have trouble sleeping?”) is associated with a risk of hypertension, T2DM, BMI, and general health outcomes in the Marshallese population.

We hypothesize that shorter sleep duration will be associated with a higher risk of hypertension, higher HbA1c levels, higher BMI, food insufficiency, and worse perceived health in the Marshallese population. We also hypothesize that worse sleep quality is associated with a higher risk of hypertension, higher HbA1c levels, higher BMI, and worse perceived health in the Marshallese population.

METHODS

Consent

Participants who agreed to participate in the study were required to provide informed consent to join the study. Bilingual study staff reviewed consent information orally, provided a written study information to potential participants, and were given the opportunity to answer any questions about the study. This study is approved by the University of Arkansas for Medical Sciences (UAMS) Institutional Research Board.

Study Setting

The study was conducted in 30 Marshallese churches in Northwest Arkansas. The study taking place in Marshallese churches with bilingual study staff was determined to be the most culturally appropriate method. Past studies have shown that 96.51% of Marshallese attend church regularly, making churches an essential aspect of their day-to-day lives. For the Marshallese, churches represent not only a religious affiliation, but also strong social network ties with one another. The churches were not randomly selected to participate, but instead were approached and asked by Marshallese-speaking staff to participate. If the church agreed, our study staff screen people within the congregation to ensure that at least 12 people in the church were eligible to participate in the study.

Research Method and Approach

This study used observational cross-sectional study design, in which the investigator measures the outcome and the exposures in the study participants concurrently. Cross-sectional designs are used for population-based surveys, to assess the prevalence of diseases in clinic-based samples. Investigators measure the outcome and exposures in the population, and study their association (Setia 2016).

The study design is a cluster randomized controlled trial: the churches were randomized to one of two DPP interventions—the Word DPP or the PILI DPP. The WORD curriculum, originally designed for rural African American faith communities was adapted to maintain cultural relevance in Marshallese churches. The WORD DPP includes 16 lessons delivered by trained community members over a 24-week period, with each lesson approximately 90 minutes long. The curriculum emphasized reduced caloric intake, increased physical activity and behavioral strategies for weight loss. Participants are also taught to recognize the connection between one's faith and its importance in making healthy lifestyle changes.

The PILI DPP is a two-phase family and community focused DPP curriculum, which teaches participants to be involved in their family and community members' lifestyle changes to achieve a healthier weight. Participants are asked to elicit support from their friends and family, effectively communicate healthy lifestyle goals and encourage each other to utilize community resources to reach their health goals.

The study was a church-level intervention, in which classes were taught in churches to large groups of people and church-level health policies were made. In this case, we could not randomize people within the same churches to different interventions because this would cause issues with contamination between arms.

This study utilized the mixed-methods design of concurrent triangulation to explore health outcomes in Marshallese immigrants in Northwest Arkansas. A mixed-method concurrent triangulation design collects qualitative and quantitative data in one simultaneous phase, allowing researchers to use both types of data to corroborate findings from the other (McElfish 2016). This approach allows cross-validation of study findings to encompass a broader sense of the research question at hand, while a quantitative versus qualitative method alone may have inherent weaknesses. Using the mixed-method design, we were able to assess quantitative data such as participants' HbA1c levels, blood pressure, and height and weight measurements, and qualitative data such as self-perceived health status, perceived friends, family and church support in healthy lifestyle choices, quality and duration of sleep, healthcare access, previous diagnoses, self-control in eating, physical activity levels, and food security. With both types of data collected, we are able to cross-examine and compare perceived health habits from the qualitative subsection of the survey with measured blood glucose levels, BMI's, and blood pressure.

Diabetes Prevention Program Survey

This study utilized the data from the baseline surveys from the Diabetes Prevention Program, created and implemented online using Research Electronic Data Capture (REDCap). The baseline survey included several subsections that collected both quantitative and qualitative data from the participants. In this study specifically, questions from the DPP focused on were: "On average, how many hours of sleep do you get in a 24-hour period?" Sleep was categorized into very short sleep, less than or equal to 4 hours, short sleep, 4 to less than 7 hours, normal sleep, 7 to less than 9 hours, and long sleep, at least 9 hours or more. This question allowed us to determine the quantity of sleep of each participant. The survey also recorded answer to the following question for sleep health: “Over the last two weeks, how many days have you had trouble sleeping or staying asleep?”, which allowed us to determine the quality of sleep of the participants. These sleep quality and quantity items were taken from the Behavioral Risk Factor Surveillance System, from Koenig and Bussing (Koenig 2010).

The DPP survey also recorded information on several different biometrics to assess physical health of the participants. Biometric measures included: measured weight, measured height, hemoglobin A1c (HbA1c), waist circumference, and blood pressure. Participants were asked to remove their shoes and step on a calibrated scale to measure their weight to the nearest 0.5 lb. Height (without shoes) was measured to the nearest 0.25 inch, using a stadiometer. With the height and weight measurements, the participant’s BMI was calculated using the Quetelet Index (kg/m^2). Systolic and diastolic blood pressure was measured using a digital blood pressure device, with the participant seated upright and arm elevated. To measure HbA1c, study staff used a finger stick blood collection and received results using the Rapid A1c test kit and Siemens DCA Vantage Analyzer. All biometric data collection was completed by trained research staff. Bilingual staff were present to clarify doubts for participants.

Psychosocial variables such as perceived social support, self-efficacy for participant’s body weight, diet and exercise habits were assessed using different self-efficacy scales. Weight locus of control was measured using the Weight Locus of Control scale. Family support for exercise and healthy diet was measured by items from Gruber

(Gruber 2008). Exercise and self-efficacy was measured using the self-efficacy for exercise and outcome expectations scale by Resnick et al (Dustin 2017). Finally, self-efficacy scales for health-related diet and exercise behaviors were assessed using Clark et al's measurement. (Ames 2015)

All data collection was inputted into REDCap platform, to monitor any missing data during field collection. REDCap flags missing data fields for researchers to recollect the data immediately, and allows for accessible retrieval of participants data for later analysis.

Participants

Participants were recruited from Marshallese churches in Northwest Arkansas, Kansas, Missouri and Oklahoma. Individuals were eligible for the study if they were at least 18 years of age, self-reported Marshallese, and had a Body Mass Index of 25 kg/m^2 (official classification of overweight or obese) or higher at the time of the study. Individuals who were pregnant, breastfeeding an infant, or had a clinically significant medical condition likely to affect weight (i.e. cancer, HIV/AIDS etc.) at the time of data collection were excluded from the study. Bilingual Marshallese staff were provided with study specific training, including consent procedures, interview facilitation skills, quality control procedures, interview facilitation skills, quality control procedures, confidentiality, data security, and human subjects' protection, in order to collect data in the most culturally appropriate way. All members of the research team were trained and certified in the participant consent procedures, the study protocol, and human subjects' protection.

RESULTS

TABLE 1: Sample Size and Statistical Values for Continuous Dependent Variables by Classification of Sleep Duration

Dependent Variable	Very Short Sleep		Short Sleep		Normal Sleep		Long Sleep		Statistical Values	
	N	Median (IQR)	N	Median (IQR)	N	Median (IQR)	N	Median (IQR)	Kruskal Wallis Chi Square Value	P-Value
Systolic Blood Pressure	20	129.0 mmHg (19 mmHg)	138	129.5 mmHg (17 mmHg)	172	128.5 mmHg (18.5 mmHg)	44	123 mmHg (21.5 mmHg)	5.85	0.119
Diastolic Blood Pressure	20	77 mmHg (12.5 mmHg)	138	81 mmHg (13 mmHg)	172	79 mmHg (12.5 mmHg)	44	74.5 mmHg (18 mmHg)	9.54	0.0229
BMI	20	33.31 kg/m2 (5.39 kg/m2)	138	32.5 kg/m2 (6.99 kg/m2)	172	32.93 kg/m2 (6.93 kg/m2)	44	34.95 kg/m2 (6.04 kg/m2)	2.6163	0.4546
HbA1C	20	7.6 mmol/mol (4.1 mmol/mol)	138	7 mmol/mol (4.4 mmol/mol)	172	6.1 mmol/mol (2.9 mmol/mol)	44	5.90 mmol/mol (1.25 mmol/mol)	19.9	0.0002

TABLE 2: Correlation Coefficient for Significant Non-Continuous Dependent Variables for Trouble Sleeping

	Spearman Correlation Coefficient	P-Value
General Health	-0.19702	0.001

Table 1 shows the sample size (N), median and interquartile range values for the continuous dependent variables of systolic and diastolic blood pressure, body mass index, and hemoglobin A1C levels. None of the dependent variables are normally distributed across all categories of sleep. As a result, non-parametric tests were used in each case. In non-parametric tests, median and interquartile range values were recorded instead of mean values. These values were only recorded for continuous dependent variables; in the case of non-continuous variables (general health outcomes and food security), the Spearman Correlation Coefficient was reported, as shown in Table 2.

20 of the total 374 participants recorded sleeping 4 hours or less in the past 24 hours (short sleep). The 20 participants who reported very short sleep (4 hours or less in the past 24 hours) had a median systolic blood pressure of 129 mmHg with an interquartile range (IQR) of 19 mmHg, and a median diastolic blood pressure of 77 mmHg with an IQR of 12.5 mmHg. The very short sleep participants had a median BMI of 33.31 kg/m^2, with an IQR of 5.39 kg/m^2. These participants also had a median HbA1c value of 7.6 mmol/mol, with an IQR of 4.1 mmol/mol.

The 138 participants who reported short sleep (4 to 7 hours of sleep in the past 24 hours) had a median systolic blood pressure of 129.5 mmHg with an IQR of 17 mmHg and a median diastolic blood pressure of 81 mmHg with an IQR of 13 mmHg. These participants had a median BMI of 32.5 kg/m^2 with a range of 6.99 kg/m^2. They also had a median HbA1c of 7 mmol/mol, with a corresponding range of 4.4 mmol/mol.

172 participants reported normal sleep (7 to 9 hours in the past 24 hours). These participants had a median systolic BP of 128.5 mmHg with an IQR of 18.5 mmHg, and a

median diastolic BP of 79 mmHg with an IQR of 12.5 mmHg. They reported a median BMI of 32.93 kg/m^2, with an IQR of 6.93 kg/m^2. They reported a median HbA1c of 6.1 mmol/mol with a corresponding IQR of 2.9 mmol/mol.

44 participants reported long sleep (greater than 9 hours in the past 24 hours). Their median systolic blood pressure was 123 mmHg, with an IQR of 21.5 mmHg. Their median diastolic blood pressure was 74.5 mmHg, with an IQR of 18 mmHg. Their Median BMI was 34.95 kg/m^2 with an IQR of 6.04 kg/m^2. Their HbA1c was 5.90 mmol/mol with an IQR of 1.25 mmol/mol.

For non-parametric tests, the Kruskal Wallis Chi Square Value and its corresponding p-value were used to determine significance for each continuous dependent variable. A P-value less than 0.05 confirms significance in each dependent variable. We found that diastolic blood pressure (p-value of 0.0229) and HbA1c (P-value of 0.0002) were the statistically significant dependent variables. In figures 2 and 3, box plot distributions of Wilcoxon scores among sleep duration were created. Figure 3 indicates a significantly higher Hemoglobin A1C in participants with very short sleep, compared to other participants. Figure 2 indicates a significantly higher Wilcoxon score in diastolic BP for short sleep participants compared to other sleep duration categories, leading to the assumption that there is a significant association between short sleep and higher diastolic blood pressure.

FIGURE 2: Box Plot Distribution of Wilcoxon Scores for Diastolic Blood Pressure among Categories of Sleep Duration

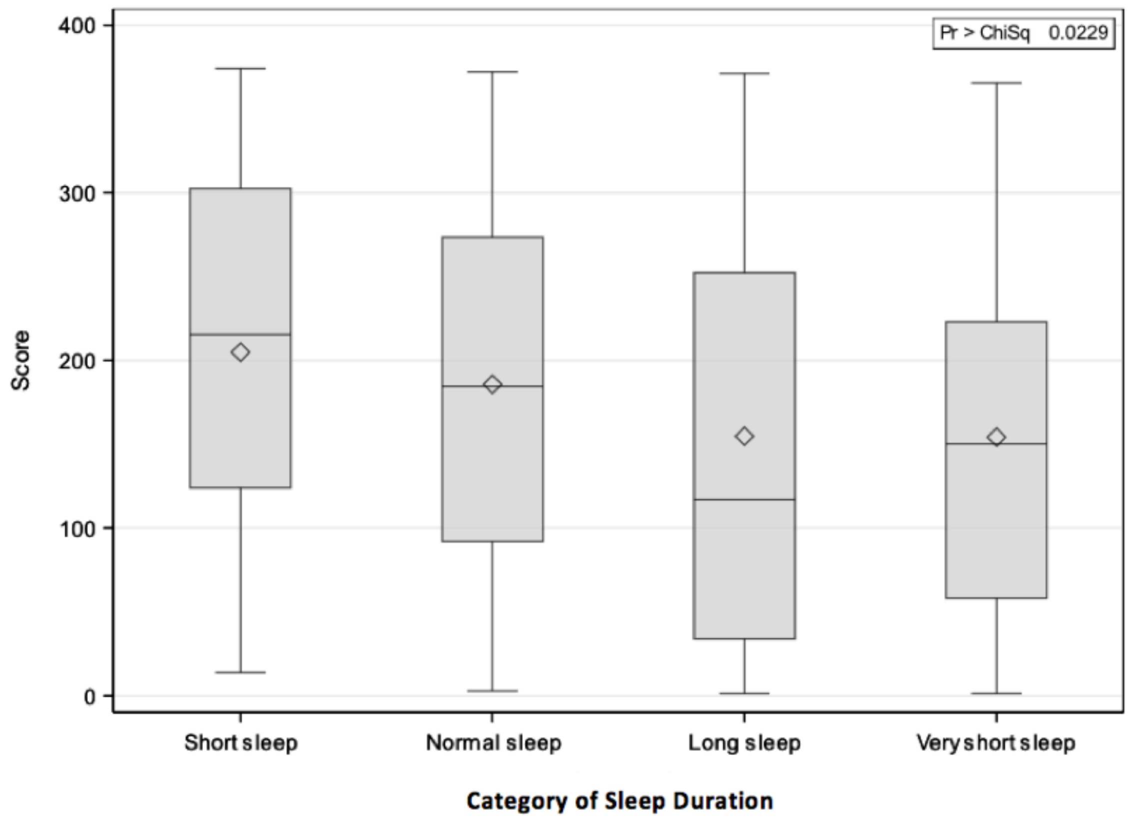
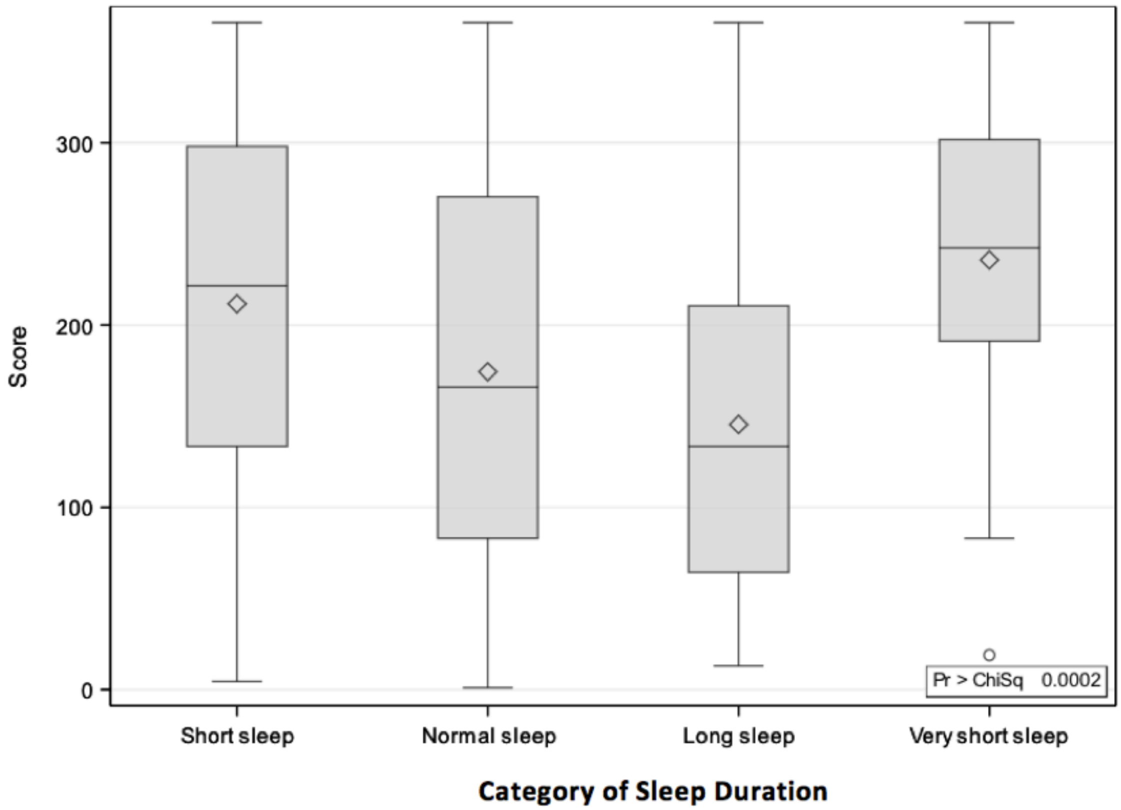


FIGURE 3: Box Plot Distribution of Wilcoxon Scores for Hemoglobin A1C among Categories of Sleep Duration



DISCUSSION

This study is one of the first in exploring associations between sleep duration and sleep quality with health outcomes in the Marshallese community. Northwest Arkansas remains one of the largest homes for the Marshallese and their health remains a critical area of improvement. As the Marshallese suffer from diabetes at rates greater than 400% (McElfish 2016), researchers, healthcare providers, and fellow community members have a duty to reduce these prevalent health disparities.

Our study sample consisted of self-reported Marshallese over the age of 18, living in Northwest Arkansas, who had a BMI of 25 kg/m^2 at the time of the study. We excluded those with a BMI under the official classification of overweight in order eliminate variable body weights as a potential confounding variable. We found statistically significant associations between sleep duration and the continuous dependent variables of diastolic blood pressure and HbA1c. The results indicate that short sleep is significantly associated with higher diastolic blood pressure and very short sleep is significantly associated with a higher HbA1c. We found no significant associations with the other continuous dependent variables, systolic blood pressure and BMI. For the non-continuous dependent variables, general health outcomes and food sufficiency, we found a statistically significant association between general health outcomes and trouble sleeping. There was no significant association between food sufficiency and trouble sleeping.

Ultimately, the association between short sleep and higher blood pressure and HbA1c levels is consistent with past studies. Universal guidelines on healthy sleep have confirmed that chronic short sleepers are at risk for cardiometabolic diseases, such as hypertension and type 2 diabetes. However, several other determinants of health also play an impactful role in the outcome of high blood pressure and HbA1c, including social and environmental determinants of health. As past studies have shown, the impact of living in neighborhoods with minimal access to healthy foods can have a strong impact on health conditions that would not exist in other neighborhoods. Furthermore, support from friends and family within one's social network can have a significant influence on one's diet and exercise habits, and therefore health outcomes. While the social determinants of health were not studied in this research question, they remain an important aspect of health that must be investigated further in the Marshallese.

There were several limitations to this study. First, because the study was designed as a cross-sectional survey, we were unable to establish causality. The study was also susceptible to bias, as we relied on participants' self-reported answers to questions related to sleep health. Additionally, due to complications in statistical analysis, certain associations in sleep health and health outcomes were not studied, limiting the conclusions to be drawn. Despite these limitations, this study provides insight into health behaviors that may be potential barriers to diabetes and cardiovascular disease in the Marshallese, providing an area of improvement to address their stark health disparities.

In conclusion, we found that short sleep had significant positive associations with diastolic blood pressure and HbA1c. We also found that trouble sleeping had a significant association with poorer general health outcomes. These findings assert the fact that sleep duration and sleep health can have a strong impact on chronic diseases, such as type 2 diabetes and cardiovascular disease, both of which are disproportionately higher in the Marshallese. With this in mind, interventions that engage the Marshallese community to improve their sleep health (as well as other health behaviors) may have an impact on rates of blood pressure and HbA1c. Ultimately, bringing awareness to the importance of sleep and its effects on health outcomes can help address the stark health disparities that exist in the Marshallese community, and is a foundational aspect of public health.

LIST OF JOURNAL ABBREVIATIONS

Best Pract Res Clin Endocrinol Metab	Best Practice & Research. Clinical Endocrinology & Metabolism
Contemp Clin Trials Commun	Contemporary Clinical Trials Communications
Eat Behav	Eating Behaviors
Hawaii J Med Public Health	Hawai‘i Journal of Medicine & Public Health
Hawaii Med J	Hawaii Medical Journal
Health Res Policy Syst	Health Research Policy and Systems
Indian J Dermatol	Indian Journal of Dermatology
J Ark Med Soc	The Journal of the Arkansas Medical Society
J Fam Med Dis Prev	Journal of Family Medicine and Disease Prevention
J Immigr Health	Journal of Immigrant Health
J Nurs Meas	Journal of Nursing Measurement
J Pharm Technol	Journal of Pharmacy Technology
Nat Sci Sleep	Nature and Science of Sleep
Sleep Med Rev	Sleep Medicine Reviews

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