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# Sleep Quality among Midwesterners, Metro vs. Nonmetro

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## Abstract

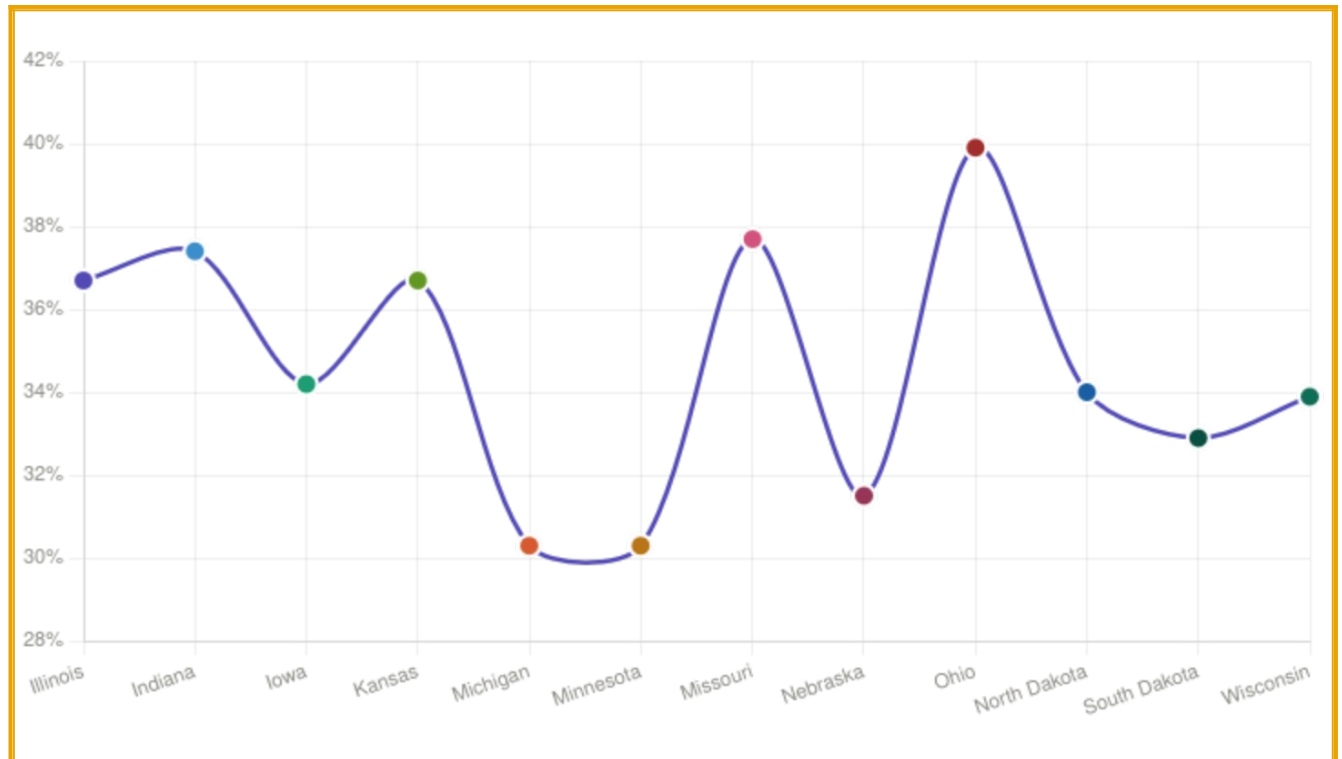
This paper provides epidemiological data on sleep quality of Midwesterners. Data are from the AARP's healthy living survey conducted by NORC at the University of Chicago. The online and telephone survey, fielded during April 3 thru April 18, 2024, polled 1,610 US adults age 40 and above. Data analysis reveals that to overcome sleep issues, respondents in the metro spend \$117 per month, on average, on sleep aids such as medicine and therapy. The same number for the nonmetro is \$22. Other tactics that people use to get quality sleep include using the bed only for sleep, avoiding caffeine and alcohol.

## Introduction

More than 50% of adults in the nation experience sleep disturbance and only 30% report sufficient amount of sleep<sup>3</sup>. Most adults need 7 to 9 hours of sleep per night for optimal health; the requirements vary by age with people greater than 70 years of age sleeping on average an hour less than young adults<sup>4</sup>. Figure 1 shows median sleep insufficiency by US states in the Midwest; Ohio tops the list with almost 2 in 5 reporting insufficient sleep.<sup>5</sup> The National Academy of Medicine classifies sleep deficiency as an unmet public health problem<sup>6</sup>, highlighting the need for epidemiological studies on sleep health. How do Midwesterners rate their sleep quality? How much do they spend in a month to help address any sleep-related difficulties? What tactics do Midwesterners employ to fall asleep, for example, avoiding caffeinated drinks in the evening? This paper addresses these and other related questions using survey data from the Midwest geography<sup>7</sup>.

- 1 Midwest geography Includes residents of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
- 2 Professor, Illinois Institute for Rural Affairs, Western Illinois University.
- 3 <https://www.nhlbi.nih.gov/health-topics/education-and-awareness/sleep-health>.
- 4 Kasper, D. L., Fauci, M. A. S., Hauser, M. S. L., Longo, M. D. L., Jameson, M. J. L., Loscalzo, P. J., & Langford, P. C. H. C. (2026). Harrison's Principles of Internal Medicine 22E. Nélio Correia da Silva Filho.
- 5 <https://www.cdc.gov/sleep/data-research/facts-stats/adults-sleep-facts-and-stats.html>
- 6 <https://www.ncbi.nlm.nih.gov/books/NBK19957/>.
- 7 <https://www.bls.gov/regions/midwest/midwest.htm>.

**Figure 1: Sleep Insufficiency in the Midwest States, Age-Adjusted Prevalence (Unit = %)**



### **Theory, Concepts that Aid in Understanding One’s Knowledge about Sleep**

Cognitive psychology explains how organisms gain knowledge about their world and how they apply that knowledge, or act on the knowledge. The theory is that in the brain there are sensory receptors to receive inputs from the environment, effectors to produce responses, a memory store to hold data which are action programs, and a central processor to execute thinking, judging, and making decisions<sup>8</sup>. Figure 2 is a summary of the theory with arrows between concepts indicating the flow of information and control.

To illustrate, an environmental stimulus event is matched with sensory patterns stored in memory and classified in terms

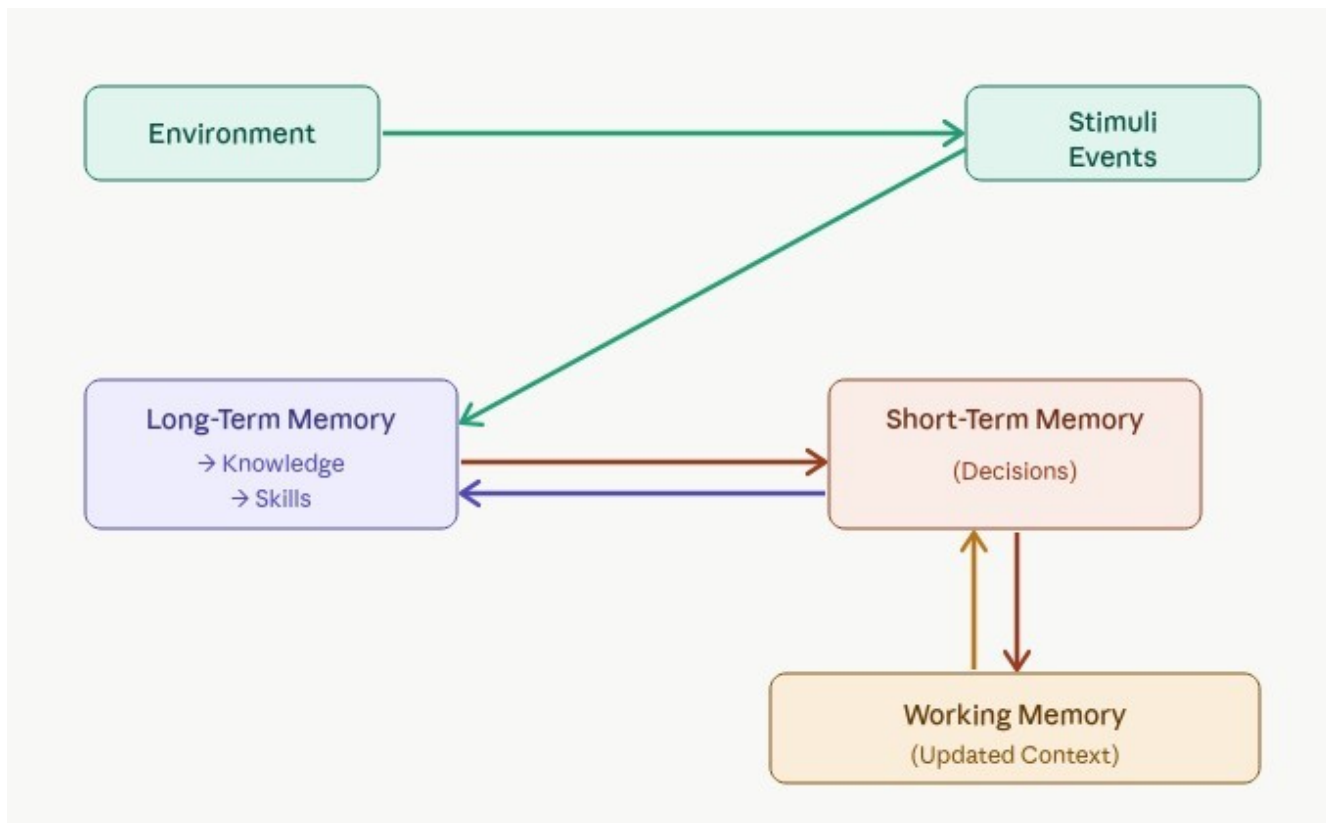
of elementary concepts, for example, “treadmill reminds me to exercise”. As the stimulus description enters short-term memory (STM), an active “program” acts on it or ignores it, for example, “should not exercise before bedtime”.

The working memory maintains an internal model of changes happening in the perceptual world; it updates our current model of the world around us.

The long-term memory contains everything we know: perceptual knowledge, procedural (action) knowledge, and propositional knowledge or beliefs. A belief contains a subjective truth value, for example, “going to bed at the same time every night helps one sleep”.

8 Lachman, R., Lachman, J. L., & Butterfield, E. C. (2015). *Cognitive psychology and information processing: An introduction*. Psychology Press.

**Figure 2: Principal Concepts of Information Processing Theory**



### Methodology

Data are from the AARP’s healthy living survey conducted by NORC at the University of Chicago<sup>9</sup>. The online and telephone survey, fielded during April 3 thru April 18, 2024, polled 1,610 US adults age 40 and above. Table 1 lists the variables extracted from the survey. Data analysis involved computation of descriptive statistics and calibration of multivariate models to predict sleep quality. Specifically, the four health status questions, “Q1\_Health” in Table 1, were subjected to a principal component analysis and results used as

independent variables in an econometric model to predict sleep quality, “Q9\_sleep quality”, Table1. Knowledge about sleep, “Q7\_Knowledge”, were summed with “1” to denote the correct response for the item, see Appendix 1 for “Q7\_Knowledge” measures by item. Similarly, the affirmative responses to the 14-item sleep-facilitators question, “Q21\_sleep\_facilitators”, Table 1, were summed to obtain a total score for the variable.

<sup>9</sup> <https://www.norc.org/>.

**Table 1: Variables and their Definitions**

Variable	Operational Definition
Gender	Male = 1; Female = 2
Age3	40 – 49 = 1; 50 – 64 = 2; GTE 65 = 3
Race	White = 1; Black = 2; Hispanic = 3; Asian = 4; Other = 5
Edu5	LT High School = 1; High School Graduate = 2; Some College = 3; Bachelor's Degree = 4; Post graduate = 5
HH Income	LT \$30k = 1; \$30k – LT \$60k = 2; \$60 – LT \$100k = 3; GTE \$100k = 4
Region	Northeast = 1; Midwest = 2; South = 3; West = 4
Metro	Metro = 1; Nonmetro = 2
Weight	Person weight
Q1_Health	How would you rate your physical, brain, mental, and emotional health: Poor = 1; ... ; Excellent = 5; individual scales for each item.
Q3_Stress	How would you rate your level of stress? No stress = 1; Highest level of stress = 10
Q6Health_Impacts	Chronic health condition impacts sleep quality. Disagree = 1; Strongly Agree = 4
Q7_Knowledge (13 items)	If you don't fall asleep after 20 minutes: 1) you should get out of bed and do a quiet activity without a lot of light exposure (i.e., no electronics).; 2) Your body gets used to lack of sleep; 3) If you are having trouble falling asleep, stay in bed until you can; 4) Alcohol before bed improves sleep; 5) Poor sleep is a normal part of aging; 6) A warm bedroom temperature is best for sleeping; 7) Sleeping with a light on is harmless; 8) You eat spiders in your sleep; 9) Napping makes up for a lack of nighttime sleep; 10) Snoring is harmless; 11) Adults ages 65 and older need less sleep than younger adults; 12) Poor sleep quality and lack of sleep can negatively affect your physical health such as increasing the risk for stroke, heart disease, and high blood pressure; 13) Poor sleep quality and lack of sleep can negatively affect your mental health such as an increased irritability or development of anxiety or depression.  4-point completely disagree to completely agree scale; Disagree = 1; Strongly Agree = 4
Q8_hrs of sleep	How many hours of sleep do you get on a typical day? 10-point scale; 1 hour to 10+ hours, ratio scale
Q9_sleep quality	How would you rate your sleep quality? 10-point scale; 1 = very poor to 10 = very best quality sleep
Q16_Cost	In the past year, on average, about how much would you say you spent in a month (i.e., medicine, equipment, teas, head gear, noise machine, special curtains, therapy, apps, etc.) to try to help address any sleep-related difficulties? Interval measure, \$0 to actual spend.
Q21_sleep_facilitators	1) Going to bed at the same time every night (within 15 minutes), even on weekends or

**Table 1: Variables and their Definitions (Continued)**

Variable	Operational Definition
(14 Items)	during vacations; 2) Getting up at the same time every morning (within 15 minutes), even on weekends or during vacations; 3) Setting a bedtime that is early enough to get at least 7-8 hours of sleep; 4) Using the bed only for sleep and sex; 5) Limiting exposure to bright light in the evenings; 6) Turning off electronic devices at least 30 minutes before bedtime; 7) Exercising regularly; 8) Maintaining a healthy diet; 9) Maintaining a cool bedroom temperature; 10) Avoiding consuming caffeine in the afternoon or evening; 11) Avoiding consuming alcohol before bedtime; 12) Reducing your fluid intake before bedtime; 13) Practicing meditation, deep breathing, or yoga; 14) Ensuring the bedroom is completely dark.
	Yes = 1; No = 0

**Findings**

The Midwest had responses from 33.38million residents of age 40 or more, weighted numbers. Of these slightly more than one-in-four respondents were from the nonmetro geography (Table 2). A typical respondent is a White male,

age 50+, lives in the metro, has some college education or a vocational degree, has a household income of \$100,000 or more, and rates his sleep quality as 7 on a 1-10 scale.

**Table 2: Profile of the Respondents**

Variable	Midwest (N = 33.38 mil)	Other Regions (N = 126.91 mil)	Chi-square, p
Geography:			
➤ Metro	74%	90%	44.36, p<.05
➤ Nonmetro	26%	10%	
Gender:			
➤ Male	52%	47%	.07, NS
➤ Female	48%	53%	
Age:			
➤ 40 – LT 50	28%	25%	2.24, NS
➤ 50 – LT 65	36%	39%	
➤ GTE 65	36%	36%	

**Table 2: Profile of the Respondents (Continued)**

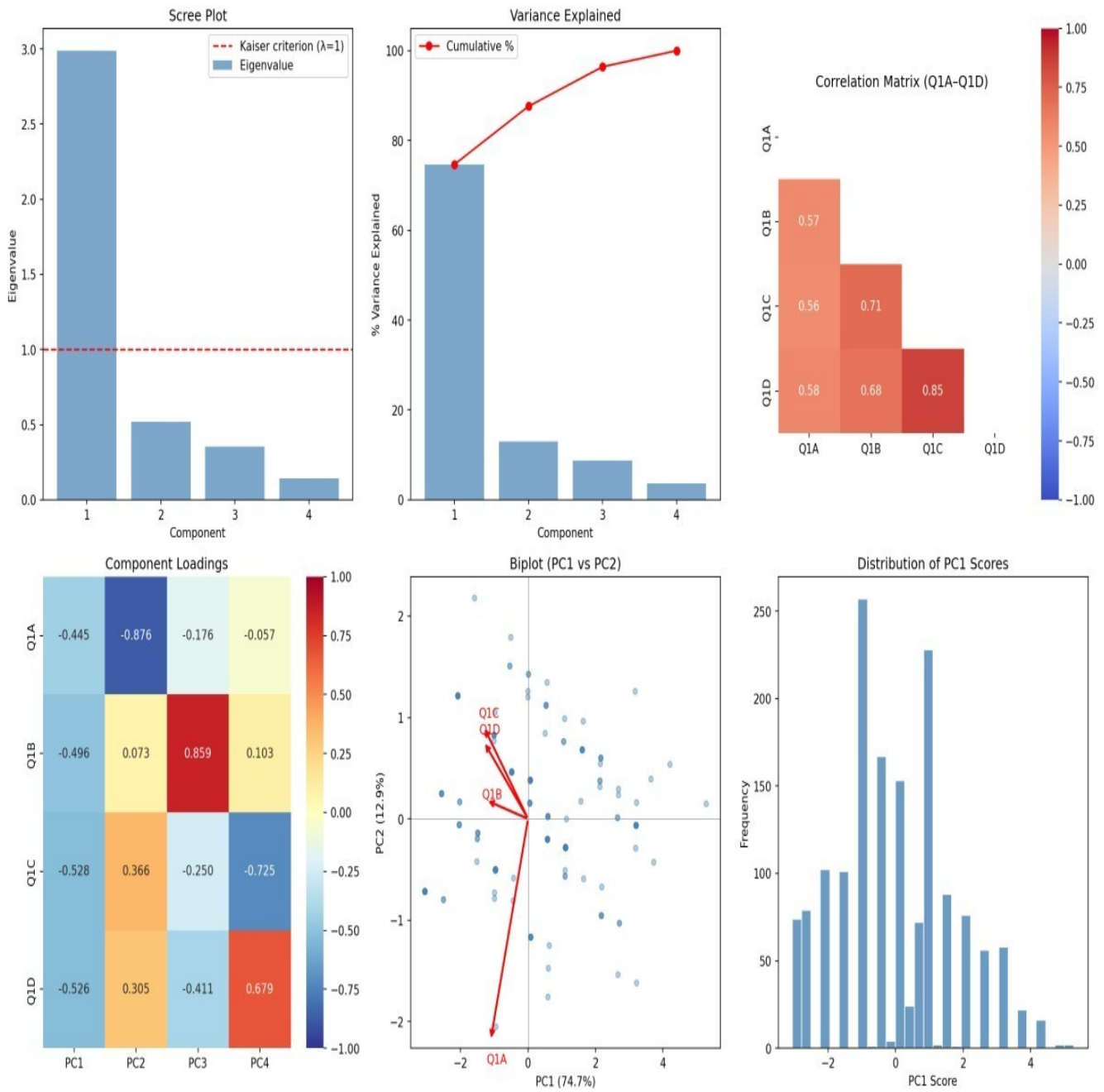
Variable	Midwest (N = 33.38 mil)	Other Regions (N = 126.91 mil)	Chi-square, p
Race:			
➤ White	83%	65%	57.01, p < .01
➤ Black	9%	12%	
➤ Hispanic	6%	17%	
➤ Asian	2%	5%	
➤ Other	LT 1%	2%	
Education:			
➤ LT High School	2%	3%	4.78, NS
➤ High School Graduate	28%	28%	
➤ Some College	29%	34%	
➤ Bachelor's Degree	20%	21%	
➤ Master's Qualification	21%	15%	
Household Income:			
➤ LT \$30k	19%	19%	.45, NS
➤ \$30k – LT \$60k	23%	25%	
➤ \$60k – LT \$100k	26%	24%	
➤ GTE \$100k	33%	32%	
Sleep Quality, Median Score		7, above average	

**Physical and Mental Health Impacts on Sleep**

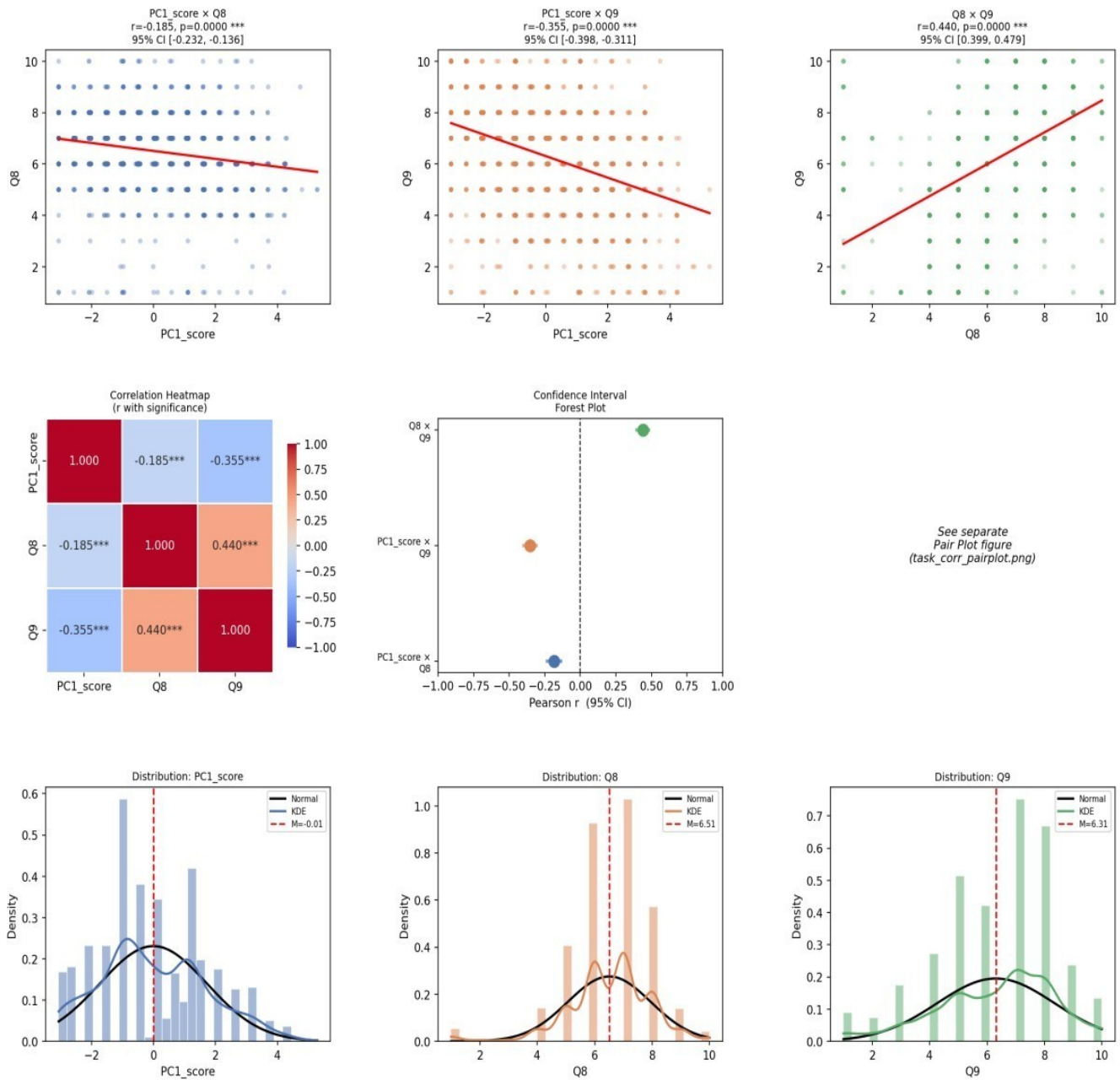
A principal component analysis of health ratings, see “Q1\_Health” in Table 1, yielded one principal component which explained 75% of the variability in the data (Figure 3, panels 1, 2, and 5). The component score for this principal component, PC1: “ill health”, had a

median value of 0.003 indicating that at least 50% of the respondents had health issues, physical and / or mental (Figure 3). The validity of this assertion can be gleaned from a correlational analysis of the component variable, PC1, and the variables “hours of sleep” and “sleep quality”, all negative (Figure 4).

**Figure 3: Results of Principal Component Analysis**



**Figure 4: Construct Validity of the First Principal Component (PC1), Correlations with Sleep Quality and Sleep Duration**



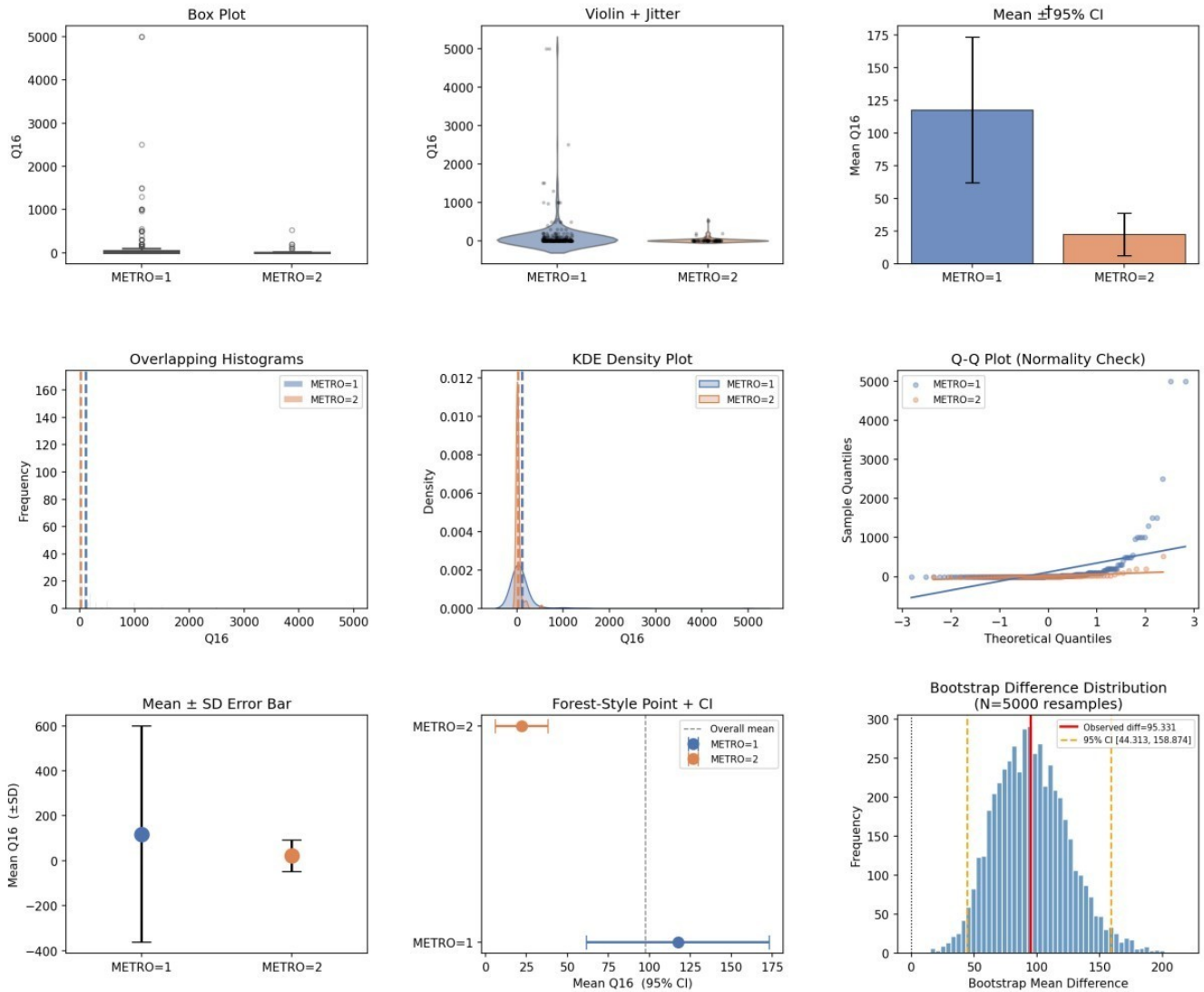
See separate  
Pair Plot figure  
(task\_corr\_pairplot.png)

Spending to Address Sleep Issues

On average, metro residents spend five times more than nonmetro residents per month to address sleep difficulties, \$117 for metro compared to \$22 for nonmetro

(Figure 5). The mean difference in spending between the metro / nonmetro geographies is statistically significant at the conventional  $p < .05$  level (Table 3).

**Figure 5: Expenditures on Sleep Remedies Per Month, Metro vs. Nonmetro**



**Table 3: Metro / Nonmetro Differences in Spending on Sleep Issues**

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SUMMARY

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Subset : midw == 1 (N = 364)  
METRO=1 : n=288, M=117.542, SD=480.717  
METRO=2 : n=76, M=22.211, SD=70.280  
Levene p=0.0861 → Equal variances assumed  
t(362.0) = 1.7223, p = 0.0859 †  
Mean diff = 95.3311, 95% CI [37.4139, 153.2484]  
Cohen's d = 0.2221  
Bootstrap 95% CI of diff: [44.3129, 158.8741]  
Mann-Whitney U = 13177.5, p = 0.0034 \*\*

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### Predictors of Sleep Quality

A linear model of the form:

Sleep quality = f(demographic predictors, stress, health impacts, knowledge, hrs of sleep, sleep facilitators) was calibrated.

A stepwise procedure was implemented to choose predictors of the criterion, sleep quality. The 'p-to-remove' decision rule was set at  $p > .05^{10}$ .

Table 4 shows the results of the regression run. The categorical predictors should be interpreted as follows:

For Blacks, the intercept coefficient is constant (4.21) + .53; for Hispanics, it is constant + .43. Similarly, for the age category GTE 65, the intercept coefficient is 4.21 + .28.

The slope coefficients (hrs of sleep, health impacts, PC1 scores, and stress) remain the same for all variables.

Table 4 shows that sleep quality is compromised for one experiencing stress and ill-health including chronic illness. More sleep contributes to sleep quality. Regression diagnostics indicate that the linear regression model is valid, it doesn't violate assumptions such as correlated predictors and residuals (Figure 6).

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10 Greene, W. H. (2012). *Econometric analysis* (seventh). New York University.

**Table 4: Results of Regression Run, Sleep Quality is the Dependent Variable**

	Coefficient	SE	t	p	CI_low	CI_high
Constant	4.21	0.31	13.46	0.00	3.60	4.82
Hrs of Sleep, Q8	0.46	0.03	13.38	0.00	0.39	0.53
Health Impacts, Q6	-0.42	0.05	-8.86	0.00	-0.51	-0.32
PC1_score	-0.24	0.03	-7.57	0.00	-0.30	-0.18
Stress, Q3	-0.07	0.02	-2.89	0.00	-0.12	-0.02
Black	0.53	0.12	4.62	0.00	0.31	0.76
Hispanic	0.43	0.12	3.59	0.00	0.19	0.66
Age, GTE 65	0.28	0.10	2.75	0.01	0.08	0.48

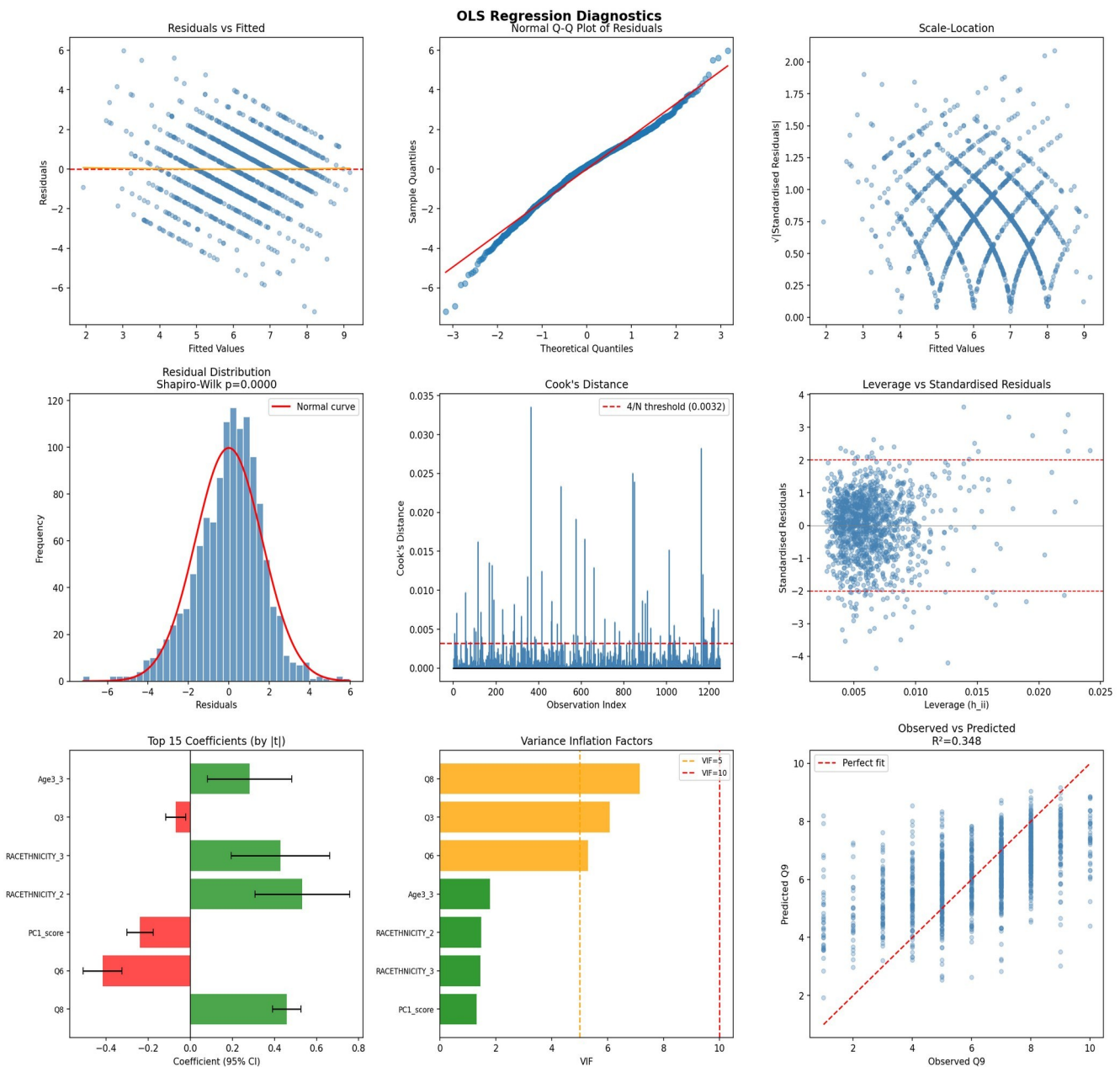
— Key Diagnostics —

$R^2$  = 0.3479  
 Adjusted  $R^2$  = 0.3443  
 $F(7,1244) = 94.827$ ,  $p = 6.4815e-111$   
 AIC = 4822.54  
 BIC = 4863.60  
 Durbin-Watson = 2.091 (target  $\approx 2.0$ )  
 Shapiro-Wilk  $p = 0.0000$  (residuals)

— Variance Inflation Factors (VIF) —

Variable VIF  
     Q8 7.15  
     Q6 5.29  
 PC1\_score 1.31  
     Q3 6.07  
 RACETHNICITY\_2 1.47  
 RACETHNICITY\_3 1.44  
     Age3\_3 1.79

**Figure 6: Regression Diagnostics**



Tactics for achieving Sleep Quality

Respondents were split into two groups using the median score of the “Q9\_sleep quality” variable (median score = 7; see Table 2) and crossclassified with the 14

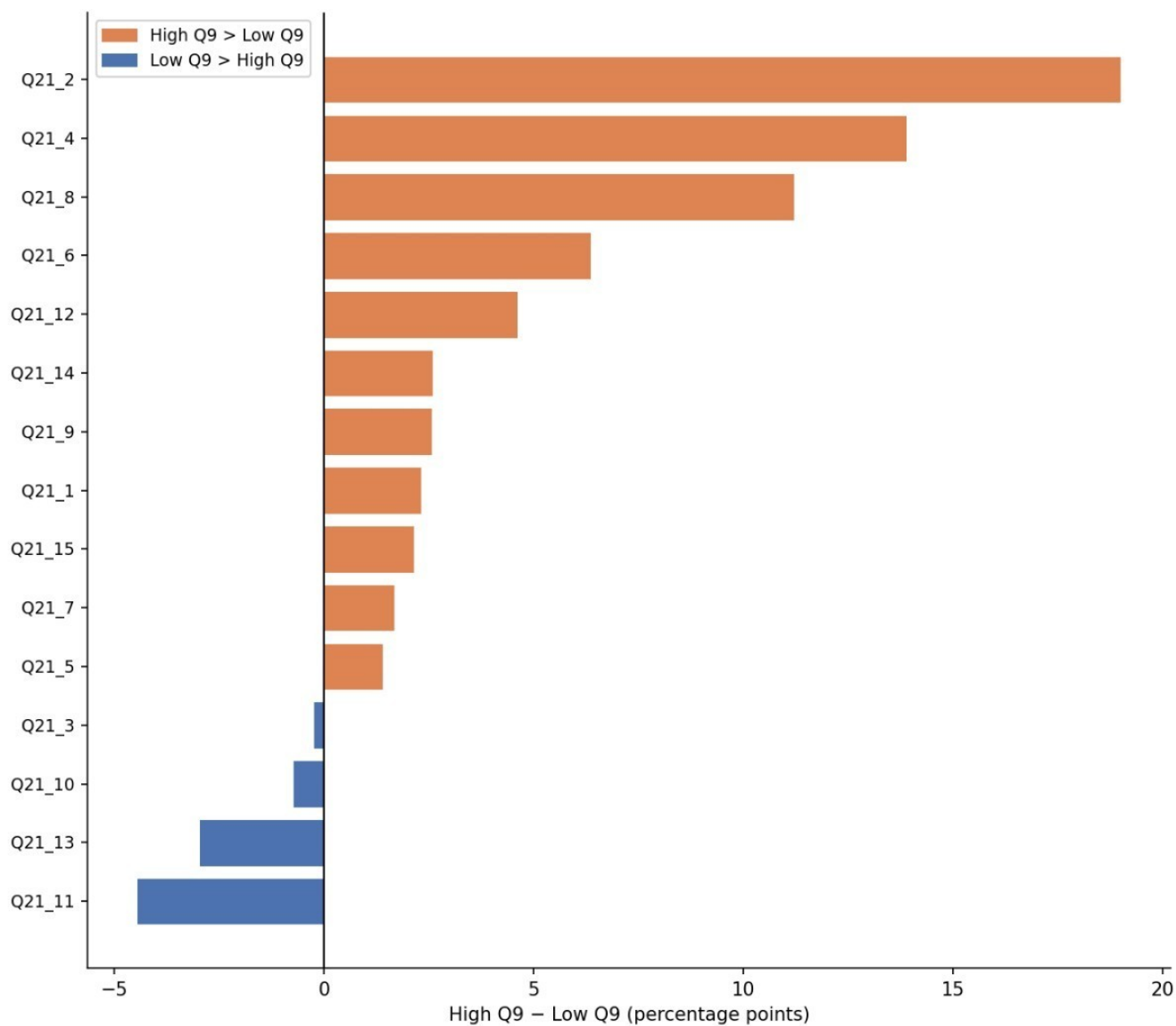
sleep facilitators given in “Q21\_sleep\_facilitators”, Table 1. Figure 7 shows the results of this exercise. More number of respondents who rate their sleep quality as high have learned to get up at the same time every

morning, use the bed only for sleep, and maintain a healthy diet that help one sleep better. In contrast, more number of respondents with low or poor sleep quality engage in tactics such as

avoiding alcohol and caffeine to get good quality sleep. Appendix 2 shows cross classifications and related statistical tests for each of the 14 sleep facilitators.

**Figure 7: Sleep Facilitators, Difference in Use of Tactics by High vs. Low Sleep Quality Raters**

**Difference Score Conceptualization**



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## Summary and Conclusion

This paper provides epidemiological data on sleep quality of Midwesterners. Data are from an AARP survey on healthy living and sleep which polled a nationally representative sample of 1,610 adults, age 40 and above, during April 3 – 18, 2024.

The Midwest region had a weighted total of 33.38 million respondents; other regions in the nation had 126.91 million weighted respondents. Microdata from the survey were analyzed using both descriptive statistics and multivariate procedures.

Results of data analysis show:

- 1) that the median sleep quality of the respondents, rated on a 1-10 scale with 10 signifying “very best quality sleep”, was 7. This “above average” rating did not differ between the census regions and between the metro/nonmetro populations in the Midwest.
- 2) A principal component analysis of four health items: physical, brain, mental, and emotional, each rated on a 5-step “Poor to Excellent” scale, yielded one principal component which explained 75% of the variability in the data. The component score for this principal component, PC1: “ill health”, had a median value of 0.003 indicating that at least 50% of the

respondents had health issues.

PC1 correlated negatively with both hours of sleep and sleep quality variables.

- 3) To overcome sleep issues, respondents in the metro spend \$117 per month, on average, on sleep aids such as medicine and therapy. The same number for the nonmetro is \$22.
- 4) Other tactics that people use to get quality sleep include the use of bed only for sleep, and avoiding caffeine and alcohol.

In conclusion, this research not only adds to our knowledge about sleep quality in the Midwest census region, but also highlights an important area for research on sleep quality - why do minorities report better quality sleep, see Table 4 in the text. In earlier *Research Briefs*, I showed that health beliefs and schema differ between the Whites and the minorities in the Midwest census region<sup>11</sup>. This line of inquiry should be expanded to explore differences in sleep-related semantic memory among cultures.

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11 Athiyaman, A. (2021). Differing perceptions of external environment: The case of ethnic groups in the Midwest, metro versus nonmetro region, *Research Brief*, 3(11), July. Available: [http://www.iira.org/wp-content/uploads/2021/07/ethnicity\\_pereceptions\\_v3\\_n11\\_3.pdf](http://www.iira.org/wp-content/uploads/2021/07/ethnicity_pereceptions_v3_n11_3.pdf); and Athiyaman, A. (2023). Health related beliefs of ethnic groups: An exploratory analysis, *Research Brief*, 5(11), June 1. Available: [https://iira.org/wp-content/uploads/2023/07/RB5\\_11-Health-Related-Beliefs-of-Ethnic-Groups0AAn-Exploratory-Analysis.pdf](https://iira.org/wp-content/uploads/2023/07/RB5_11-Health-Related-Beliefs-of-Ethnic-Groups0AAn-Exploratory-Analysis.pdf).

## Appendix 1: Sleep Improvement Behaviors<sup>12</sup>

Behaviors to Adopt	Behaviors to Avoid
<ul style="list-style-type: none"> <li>→ Use the bed only for sleep: If you cannot sleep within 20 minutes, get out of bed and engage in relaxing activities in dim light before returning to bed.</li> <li>→ Go to bed and get up at the same time each day.</li> <li>→ Bed should be comfortable and the bedroom quiet and dark.</li> <li>→ Relax 20-30 minutes before sleep (for example, meditate, listen to soft music).</li> <li>→ Take a warm bath.</li> </ul>	<ul style="list-style-type: none"> <li>→ Napping after 3PM.</li> <li>→ Caffeine in the afternoon.</li> <li>→ Do not sleep too early.</li> <li>→ Avoid the following 2-3 hours before sleep time:               <ul style="list-style-type: none"> <li>→ heavy eating;</li> <li>→ smoking or alcohol;</li> <li>→ vigorous exercise.</li> </ul> </li> <li>→ Around bedtime, avoid:               <ul style="list-style-type: none"> <li>→ solving problems including thinking about life problems.</li> <li>→ Reviewing events of the day.</li> </ul> </li> </ul>

### Answer keys for “Q7\_Knowledge” Items

Item	Answer
1) If you don't fall asleep after 20 minutes you should get out of bed and do a quiet activity	True
2) Your body gets used to lack of sleep	False
3) If you are having trouble falling asleep, stay in bed until you can	False
4) Alcohol before bed improves sleep	False
5) Poor sleep is a normal part of aging	False
6) A warm bedroom temperature is best for sleeping	False
7) Sleeping with a light on is harmless	False
8) You eat spiders in your sleep	False
9) Napping makes up for a lack of nighttime sleep	False
10) Snoring is harmless	False
11) Adults ages 65 and older need less sleep than younger adults	True
12) Poor sleep quality and lack of sleep can negatively affect your physical health	True
13) Poor sleep quality and lack of sleep can negatively affect your mental health	True

<sup>12</sup> Scammell, T. E., Saper, C. B., & Czeisler, C. A. (2018). Sleep disorders. *Harrison's Principles of Internal Medicine*.

## Appendix 2: Crosstabulations, Sleep Facilitators

Item	Sleep Quality (Median = 7)		
	LT Median	GTE Median	Phi Coef.
Going to bed at the same time every night (within 15 minutes), even on weekends or during vacations	38%	40%	.02
Getting up at the same time every morning (within 15 minutes), even on weekends or during vacations	27%	46%	.18
Setting a bedtime that is early enough to get at least 7-8 hours of sleep	33%	33%	.00
Using the bed only for sleep and sex	37%	51%	.13
Limiting exposure to bright light in the evenings	17%	19%	.02
Turning off electronic devices at least 30 minutes before bedtime	16%	22%	.07
Exercising regularly	37%	38%	.01
Maintaining a healthy diet	29%	40%	.11
Maintaining a cool bedroom temperature	64%	67%	.02
Avoiding consuming caffeine in the afternoon or evening	48%	47%	-.01
Avoiding consuming alcohol before bedtime	37%	32%	-.04
Reducing your fluid intake before bedtime	26%	31%	.05
Practicing meditation, deep breathing, or yoga	15%	12%	-.04
Ensuring the bedroom is completely dark.	46%	49%	.02