

Final Project: The Relationship between Sleep, Depression, Quality of Life, and  
Socioeconomic Status

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Author Note

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### Abstract

Depression is a widespread and debilitating mental illness. Among a series of protecting factors, high quality sleep is a potent and relatively easily manageable factor that may reduce depression and increase life quality. In this study, we examined the associations among depression symptoms, sleep quality and life quality in a high risk sample. Important variables as socioeconomic status, education level and ethnicity were controlled for. With multiple regression analyses, we found more depression symptoms were correlated with lower life quality and sleep quality. Meanwhile, sleep quality was positively associated with life quality. The results indicate that intricate and strong associations exist among depression symptoms, sleep and life quality. Clinical implications were discussed.

*Keywords:* sleep, depression, quality of life, SES

Word count: X

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### **Introduction**

Sleep quality, typically indexed by a combination of sleep efficiency and total sleep time (TST), is an increasingly important outcome in the context of long-term health. While sleep efficiency is defined as the percentage of time spent sleeping while laying in bed. Whereas, total sleep time is the amount of time spent sleeping, accounting for factors such as sleep onset latency and awakenings. There is a multitude of studies that evidence poor sleep as a prospective risk factor in premature mortality (Knutson, Spiegel, Penev, & Van Cauter, 2007). More specifically, chronically disrupted and limited sleep has been linked to increased rates of obesity, diabetes, cardiovascular disease, cognitive impairment, and mental health disorders (Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005).

Additionally, recent epidemiological research suggests that sleep has continued to decrease over the past 30 years, which is consistent with the significant increase in sleep-related complaints in the workforce (Ferrie, Kumari, Salo, Singh-Manoux, & Kivimäki, 2011). In this review by Ferrie and colleagues, the reduction in sleep quality is also thought to be associated with the staggering increase in work-related and vehicular accidents. While research has provided evidence between sleep quality and health-outcomes, there are few studies examining other global measures such as quality of life.

Quality of life is a helpful and comprehensive measure of an individual's subjective experience. For example, this variable may encompass interpersonal and familial relationships, occupational satisfaction, financial security, and intellectual development. While there may be tangible health-related outcomes (e.g., number of hospital visits), the subjective interpretation of distressing impairments due to poor sleep quality may also provide valuable insights. This overall outcome can adequately capture subthreshold depressive symptoms, which may still benefit from various interventions (e.g., cognitive-behavioral therapy for insomnia).

While this global measure may capture the negative impact of poor sleep quality through broad strokes, depression is a more clinically-specific outcome to consider. Depressive symptoms, such as low mood and irritability, have been consistently linked to sleep-related psychopathology (Spoormaker & Bout, 2005). This pattern of poor sleep quality may increase obstacles associated with obtaining reliable treatment by exacerbating current depressive symptoms. Therefore, sleep quality seems to be at the root of these domain-spanning impairments, and an essential target for intervention.

In this present study, we set out to evaluate evidence for the association between sleep quality, depression, and quality of life in a sample of diverse sample of adults. These relationships will also be investigated in the context of low, medium, and high SES as a moderator. Given the importance of sleep quality and mental health on long-term health outcomes, we hope to enrich the current literature with a better understanding of these complex factors. Findings from this study will inform models of psychopathology and provide a foundation from which causal and longitudinal intervention-focused research can be constructed.

## Methods<sup>1</sup>

### Participants

Participants were recruited through Amazon Mechanical Turk (MTurk). MTurk is a survey tool offered through Amazon.com, where people around the world can complete surveys for monetary compensation. MTurk is commonly used in social science research studies, and it has been found to be representative.

In total, 500 participants were included in this study, all of whom had complete data. Out of 500 participants, 194 as “low” SES, 244 identified “middle” SES, and 62 identified as “high” SES. Out of 500 participants, 64 had not graduated, 157 completed high school, 96 had a postsecondary certificate, and 183 had some postsecondary education. Additionally,

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<sup>1</sup> This is a fictional Methods section, as we simulated our data. However, this is a realistic way that we could go about collecting this data in the future

344 identified as European-American, 51 identified as African American, 51 identified as Hispanic, 27 identified as Asian-American, 15 identified as American Indian/Alaskan Native, 11 identified as Pacific Islander, and 1 identified as “other.”

## **Materials**

**Depressive Symptoms Scale.** A scale to measure depressive symptoms was created by the researchers for the purposes of this study. Participants were instructed to rate each item on Likert-type scale, where 1 corresponds to “strongly disagree,” 5 corresponds to “strongly agree.” The scale consisted of three items, including: “Over the last 2 weeks, I have felt little interest or pleasure in doing things;” “Over the last 2 weeks, I have felt down, depressed, or hopeless;” and “Over the last 2 weeks, I have felt tired or had little energy.” Scale items were summed to create a depression score, where higher scores represent higher depressive symptoms.

**Quality of Life Scale.** A scale to measure participants’ quality of life was created by the researchers. Participants were instructed to rate each item on Likert-type scale, where 1 corresponds to “strongly disagree,” and 5 corresponds to “strongly agree.” The scale consisted of four items, including: “My life is ideal;” “I am satisfied with my life;” “So far I have been able get the important things I want from life;” and “I have accomplished many of the things in my life.” Scale items were summed to create a total quality of life score, where higher scores represent better quality of life.

**Sleep Quality Scale.** A scale to measure participants’ sleep quality was created by the researchers. Participants were instructed to rate each item on Likert-type scale, where 1 corresponds to “strongly disagree,” and 5 corresponds to “strongly agree.” The scale consisted of three items, including: “I am satisfied with the time I spend sleeping;” “I am satisfied with my quality of sleep;” and “When I wake up, I feel refreshed.” Scale items were summed to create a total sleep quality score, where higher scores represent better sleep quality.

**Demographics Questionnaire.** Participants were also asked to complete a demographics questionnaire, which asked about their socioeconomic status, race/ethnicity, and educational background.

## Procedure

An online version of this study was created through Qualtrics survey software, and the survey link was distributed to participants on the via Amazon Mechanical Turk. The study was advertised as “a study of sleep and well-being.” After clicking the survey link, participants were informed of study procedures and content through an informed consent process. After completing the study, participants received academic credit as compensation and were presented with debriefing materials. The University of Oregon’s Office of Research Compliance (Institutional Review Board) approved this study.

## Data analysis

We used R (Version 3.4.3; R Core Team, 2017) and the R-packages *cowplot* [R-cowplot], *bindrcpp* (Version 0.2.2; Müller, 2018), *dplyr* (Version 0.7.6; Wickham, François, Henry, & Müller, 2018), *forcats* (Version 0.3.0; Wickham, 2018a), *Formula* (Version 1.2.3; Zeileis & Croissant, 2010), *ggplot2* (Version 3.0.0; Wickham, 2016), *gridExtra* (Version 2.3; Auguie, 2017), *here* (Version 0.1; Müller, 2017), *Hmisc* (Version 4.1.1; Harrell Jr, Charles Dupont, & others., 2018), *janitor* (Version 1.1.1; Firke, 2018), *kableExtra* (Version 0.9.0; Zhu, 2018), *knitr* (Version 1.20; Xie, 2015), *lattice* (Version 0.20.35; Sarkar, 2008), *papaja* (Version 0.1.0.9842; Aust & Barth, 2018), *purrr* (Version 0.2.5; Henry & Wickham, 2018), *readr* (Version 1.1.1; Wickham, Hester, & Francois, 2017), *rio* (Version 0.5.10; C.-h. Chan, Chan, Leeper, & Becker, 2018), *stringr* (Version 1.3.1; Wickham, 2018b), *survival* (Version 2.42.6; Terry M. Therneau & Patricia M. Grambsch, 2000), *tibble* (Version 1.4.2; Müller & Wickham, 2018), *tidyr* (Version 0.8.1; Wickham & Henry, 2018), and *tidyverse* (Version 1.2.1; Wickham, 2017) for all our analyses. We calculated means and standard deviations for each of the total scale scores, and we separated means by socioeconomic status. We also calculated Pearson’s *r* correlation coefficients between depressive symptoms, quality of life,

and sleep quality total scores. The authors interpreted our correlational results as small (.10-.29), medium (.30-.49), and large correlations (.50-1.00).

## **Results**

### **Descriptive Statistics**

The mean depression total score for the sample is 7.53 . The mean sleep quality total score for the sample is 9.94. The mean quality of life total score for the sample is 7.57. Mean total scores separated by socioeconomic status are listed in Table 1 and graphically displayed in Figure 1.

### **Correlation Results**

Depressive symptoms, sleep quality, and quality of life scores were significantly correlated with each other,  $p < .05$  (see Table 2).

### **Exploratory Analyses in Low SES Individuals**

The relationships between these depressive symptoms, sleep quality, and quality of life scores in low SES individuals are displayed in Figure 2. [need to input tidied and spread data in low SES individuals and I need to mess with aspect ratios of figures]

## **Discussion**

Our results confirmed that more depression symptoms were correlated with lower life quality and sleep quality. Whereas sleep quality was positively associated with life quality. The results were consistent with past literature and our hypothesis. Based on the symptoms from major depressive disorder diagnosis, a patient suffering from depression is likely to experience either hypersomnia or insomnia. Insomnia is most related to low sleep quality. Meanwhile, hypersomnia does not guarantee high sleep quality as much too long duration of sleep may cause dizziness and lethargy in the patients. In reverse, frequent sleep disturbances and the discomfort and stress that come with low sleep quality may negatively impact a patient's everyday mood and reduce the general energy level to engage in more mood-boosting activities. These bidirectional influences may explain the negative correlation

between depression and sleep quality that we detected with our sample. As sleep is an instrumental component in everyday life, lower sleep quality will inevitably decrease life quality. Higher life quality may consist of more comfortable sleeping environment and less sleep-hindering stress. These potential connections help elucidate the positive association between sleep quality and life quality. Limitations of our study lie in our correlational study design such that we were unable to examine causal relationship among the variables. We also relied on self-report measures which may be susceptible to reporter bias. Possible bias in this high risk sample include underreport depression symptoms due to low insight or emotional numbness, as well as overreporting symptoms due to Hawthorne effect or other motivations. In studies to follow, we will also adopt structured clinical interview and objective measures of the key variables. We will incorporate sleep intervention (e.g., insomnia cognitive behavior therapy) to manipulate the sleep quality level to examine causal relationship between depression symptoms and sleep quality. An active and a waitlist control groups will be recruited to rule out more confounds. More sophisticated statistical analyses such as multilevel modeling may be adopted. Clinical implications from the results may inform clinicians and the general public to pay more attention to sleep quality with an aim of keeping depression at bay or reducing depressive symptoms. In general, our study with a high risk sample demonstrated the intricate associations among depressive symptoms, sleep and life quality.



## References

- Auguie, B. (2017). *GridExtra: Miscellaneous functions for “grid” graphics*. Retrieved from <https://CRAN.R-project.org/package=gridExtra>
- Aust, F., & Barth, M. (2018). *papaja: Create APA manuscripts with R Markdown*. Retrieved from <https://github.com/crsh/papaja>
- Chan, C.-h., Chan, G. C., Leeper, T. J., & Becker, J. (2018). *Rio: A swiss-army knife for data file i/o*.
- Ferrie, J. E., Kumari, M., Salo, P., Singh-Manoux, A., & Kivimäki, M. (2011). Sleep epidemiology—a rapidly growing field. Oxford University Press.
- Firke, S. (2018). *Janitor: Simple tools for examining and cleaning dirty data*. Retrieved from <https://CRAN.R-project.org/package=janitor>
- Gangwisch, J. E., Malaspina, D., Boden-Albala, B., & Heymsfield, S. B. (2005). Inadequate sleep as a risk factor for obesity: Analyses of the nhanes i. *Sleep*, 28(10), 1289–1296.
- Harrell Jr, F. E., Charles Dupont, & others. (2018). *Hmisc: Harrell miscellaneous*. Retrieved from <https://CRAN.R-project.org/package=Hmisc>
- Henry, L., & Wickham, H. (2018). *Purrr: Functional programming tools*. Retrieved from <https://CRAN.R-project.org/package=purrr>
- Knutson, K. L., Spiegel, K., Penev, P., & Van Cauter, E. (2007). The metabolic consequences of sleep deprivation. *Sleep Medicine Reviews*, 11(3), 163–178.
- Müller, K. (2017). *Here: A simpler way to find your files*. Retrieved from <https://CRAN.R-project.org/package=here>
- Müller, K. (2018). *Bindrcpp: An ‘rcpp’ interface to active bindings*. Retrieved from <https://CRAN.R-project.org/package=bindrcpp>
- Müller, K., & Wickham, H. (2018). *Tibble: Simple data frames*. Retrieved from <https://CRAN.R-project.org/package=tibble>
- R Core Team. (2017). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from

- <https://www.R-project.org/>
- Sarkar, D. (2008). *Lattice: Multivariate data visualization with r*. New York: Springer.
- Retrieved from <http://lmdvr.r-forge.r-project.org>
- Spoormaker, V. I., & Bout, J. van den. (2005). Depression and anxiety complaints; relations with sleep disturbances. *European Psychiatry*, 20(3), 243–245.
- Terry M. Therneau, & Patricia M. Grambsch. (2000). *Modeling survival data: Extending the Cox model*. New York: Springer.
- Wickham, H. (2016). *Ggplot2: Elegant graphics for data analysis*. Springer-Verlag New York.
- Retrieved from <http://ggplot2.org>
- Wickham, H. (2017). *Tidyverse: Easily install and load the 'tidyverse'*. Retrieved from <https://CRAN.R-project.org/package=tidyverse>
- Wickham, H. (2018a). *Forcats: Tools for working with categorical variables (factors)*.
- Retrieved from <https://CRAN.R-project.org/package=forcats>
- Wickham, H. (2018b). *Stringr: Simple, consistent wrappers for common string operations*.
- Retrieved from <https://CRAN.R-project.org/package=stringr>
- Wickham, H., & Henry, L. (2018). *Tidyr: Easily tidy data with 'spread()' and 'gather()' functions*. Retrieved from <https://CRAN.R-project.org/package=tidyr>
- Wickham, H., François, R., Henry, L., & Müller, K. (2018). *Dplyr: A grammar of data manipulation*. Retrieved from <https://CRAN.R-project.org/package=dplyr>
- Wickham, H., Hester, J., & François, R. (2017). *Readr: Read rectangular text data*.
- Retrieved from <https://CRAN.R-project.org/package=readr>
- Xie, Y. (2015). *Dynamic documents with R and knitr* (2nd ed.). Boca Raton, Florida: Chapman; Hall/CRC. Retrieved from <https://yihui.name/knitr/>
- Zeileis, A., & Croissant, Y. (2010). Extended model formulas in R: Multiple parts and multiple responses. *Journal of Statistical Software*, 34(1), 1–13.
- [doi:10.18637/jss.v034.i01](https://doi.org/10.18637/jss.v034.i01)
- Zhu, H. (2018). *KableExtra: Construct complex table with 'kable' and pipe syntax*. Retrieved

from <https://CRAN.R-project.org/package=kableExtra>

Table 1

*Mean Depression, Sleep Quality, and Quality of Life Scores by SES Group.*

SES	Mean Depression Score	Mean Sleep Quality Score	Mean Quality of Life Score
High	7.37	9.94	7.74
Low	7.34	10.03	7.66
Med	7.72	9.86	7.45

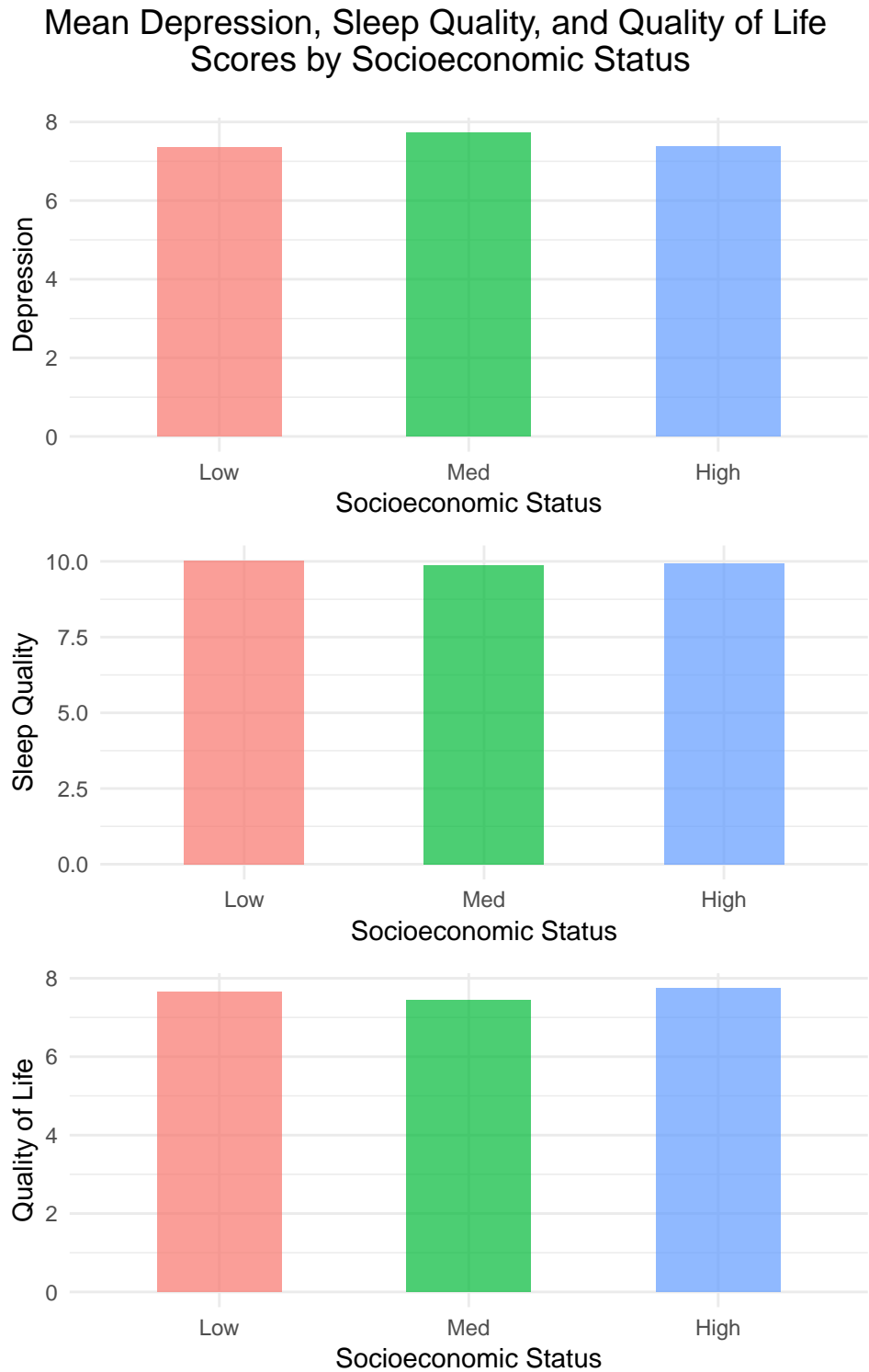
*Note.* This table was created with `apa_table()`

Table 2

*Correlations between Depression, Sleep Quality,  
and Quality of Life Scores.*

row	column	cor	p
Sleep Quality	Depression	-0.20	0.00
Sleep Quality	Quality of Life	0.22	0.00
Depression	Quality of Life	-0.55	0.00

*Note.* This table was created with apa\_table()

*Figure 1*

### Scatterplots of the Relationships between Depression, Sleep Quality, and Quality of Life Scores

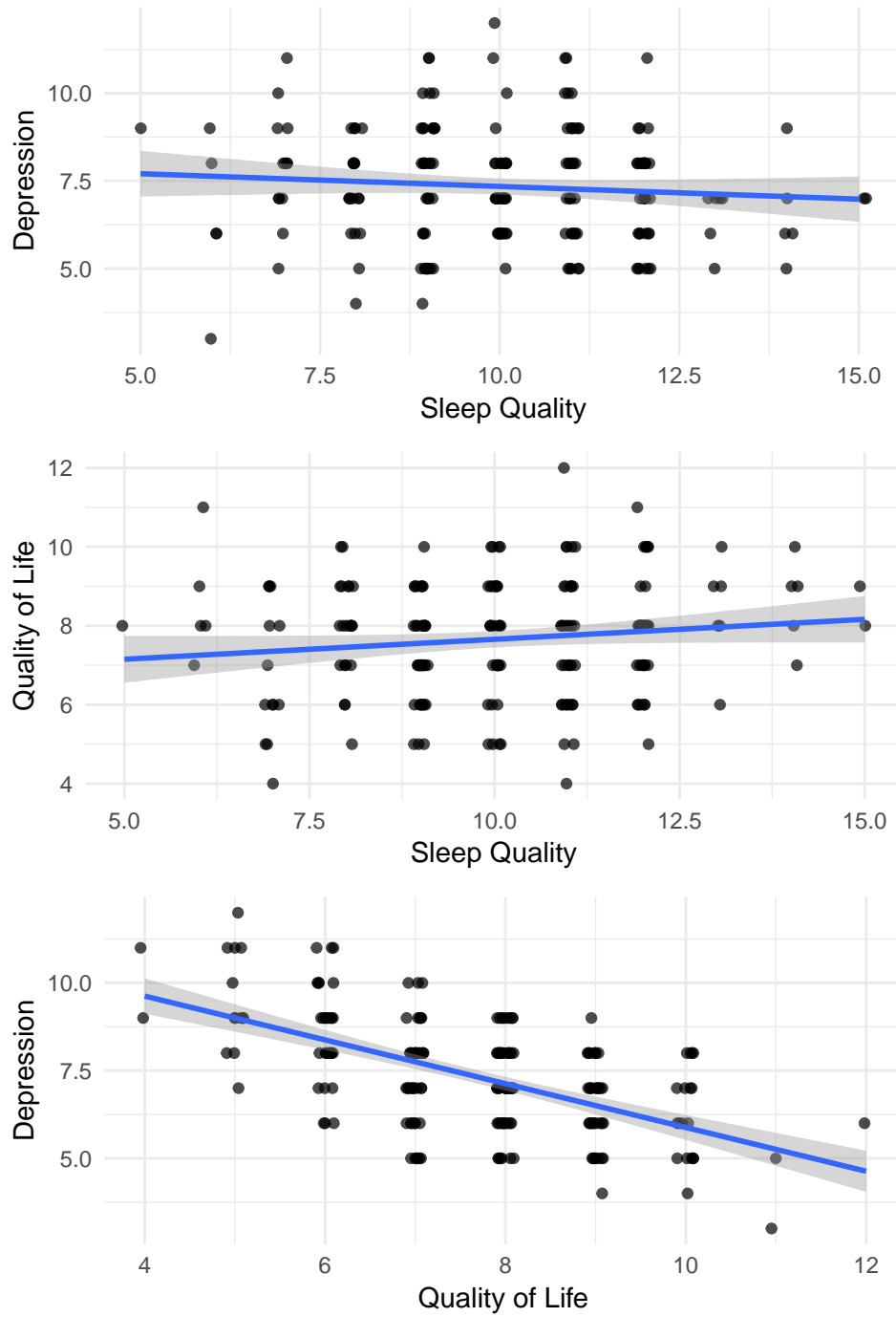


Figure 2