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The association of long working hours and the use of prescription sedatives among U.S. workers.

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THE ASSOCIATION OF LONG WORKING HOURS AND THE USE OF PRESCRIPTION SEDATIVES AMONG U.S. WORKERS

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DEDICATION

This dissertation is dedicated to my parents for their unequivocal love and support. To the love of my life, Rahel, for her unwavering love, and my siblings, Dr. Chinedu and Emeka, you all made this possible.

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ABSTRACT

THE ASSOCIATION OF LONG WORKING HOURS AND THE USE OF PRESCRIPTION SEDATIVES AMONG U.S. WORKERS

Emmanuel U. Ezekekwu

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BACKGROUND: Meeting the needs of a round-the-clock and globalized society has led to an increase in long working hours. This trend has been accompanied by a corresponding rise in sleep disorders and subsequent use of sedating medications. Overtime hours have been associated with adverse health outcomes such as cardiovascular diseases, symptoms of psychological distress, and health behaviors, including risky intake of alcohol and smoking.

Hence, the main objectives of this three-paper dissertation were to examine the multi-faceted relationship between working hours, the use of prescription sleep aids, the onset of psychological distress, and the use of health care services.

METHODS: The 2010-2019 Medical Expenditure Panel Survey (MEPS) data was utilized.

The first paper investigated the relationship between working hours and the use of prescribed sedating medications. Different regression models were employed, ranging

from multivariable linear regression, Tobit regression, Heckman regression, and multivariable logistic regression. The second paper utilized a fixed-effect linear model in evaluating the relationship between working hours and the onset of psychological distress. The third paper also employed fixed-effect estimators in modeling the association between working hours, health care utilization, and the use of sedating medications.

FINDINGS: Long working hours were associated with increased odds of using sleep aids and medications with sedative properties. Females had a higher likelihood of using sleep aids when compared to males. Also, professional services had the highest likelihood of using sleep medications. Over time hours was associated with the onset of psychological distress, with differences in the risk of onset across gender. Respondents working very long hours had the highest odds of using outpatient medical services. This association between very long hours and the use of outpatient services was significantly more pronounced in respondents using medications with sedating side effects.

CONCLUSIONS: Long working hours were associated with an elevated risk of using sedating medications, onset of psychological distress, and healthcare utilization. This highlights the probable negative impact of overtime hours on the health status of individuals. Implementing policies that encourage work-life balance and aid interventions that decrease work-related stress may help in mitigating risks associated with long work hours.

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INTRODUCTION

Globally, long working hours persist as a prevalent phenomenon, and the United States is no exception. According to a report by the International Labor Organization, the U.S. ranked as the fourth-highest country in terms of the proportion of workers who work overtime weekly, indicating the widespread practice of extended working hours in the country (Bannai et al., 2015).

Several factors are responsible for this trend of long working hours in the U.S., such as motivations for increased wages, career development, and strong cultural influences (Li et al., 2019). One of the primary reasons is the motivation for increased wages, as many employees earn more financial rewards from working overtime hours. Also, the incentive for career development is another crucial factor driving the trend, as some employees believe that working longer hours could help them climb the corporate ladder more quickly. Additionally, cultural influences such as the "workaholic" mentality also contribute to the practice of working long hours in the U.S.

It is crucial to note that while long working hours may seem like an efficient way to increase productivity, it can have deleterious consequences on employees' physical and mental well-being, leading to sleep disorders, fatigue, burnout, and stress (Cheng et al., 2014; Lunde et al., 2016; Skogstad et al., 2019). Moreover, the quality of work produced during extended working hours may not be up to par with that of regular working hours, which can have adverse effects on organizational performance.

Long working hours, Sedating Medications, and Health Outcomes

The continuous rise in the prevalence of long working hours has been accompanied by an increase in sleep disorders (Virtanen et al., 2009; Nakashima et al., 2011; Cheng et al., 2014). Sleep disorders, while being under-recognized, remain a persistent public health challenge (Hale, Troxel, & Buysse, 2020). The Institute of Medicine estimates that between 50 to 70 million people experiences sleep disorders in the U.S. (IOM, 2006). The American psychiatric association defines sleep disorders as challenges with the timing, quantity, and quality of sleep, which creates problems associated with distress and functioning during the daytime (APA, 2019). Insomnia is the most common sleep disorder, and others include obstructive sleep apnea, narcolepsy, and restless leg syndrome (APA, 2019). Sleep disorders have been associated with several chronic ailments such as cardiovascular diseases, depression, obesity, diabetes, and increased risk of mortality (Roane & Taylor, 2008; Chandola, Ferrie, Perski, Akbaraly, & Marmot, 2010; Cappuccio FP et al., 2010; CDC, 2018). It also extends to increased risk for accidents at the workplace and vehicle crashes and has been estimated to cost about $ 150 billion annually through indirect costs. These include workplace accidents, presenteeism, and absenteeism (WEF, 2010).

Sleep and substance abuse disorders have been closely linked (Roane & Taylor, 2008; Mahfoud, Streem, & Budur, 2009). Also, it is common practice to use medications, including prescribed and controlled medicines, for their side effects, such as sedating effects, and for recreational purposes (Lopez-Quintero et al., 2021). Thus, the use of medications with secondary sedating side effects, such as pain medications, anti-histaminic drugs, and anti-depressants, has increased (Votaw et al., 2019). From 2003 to

2012, there was a notable surge of more than 65% in the treatment of individuals with sedative-tranquilizer use disorder (Abuse, 2014). Additionally, there has been a substantial increase in the mortality rate associated with benzodiazepine-related overdoses, with the numbers soaring over 400% from 1999 to 2013 (Bachhuber et al., 2016). Sedating medications have been linked with adverse health outcomes, including increased risk of cardiovascular diseases, morbidity, and mortality (Mailliet, Galloux & Poisson, 2001; Mallon, Broman, & Hetta, 2009; Kivimäki et al., 2015; Kim et al., 2018; Skogstad et al., 2019).

The prevalence of long working hours in the U.S. working population is expected to lead to a continuous increase in the use of sedating medications and other associated substance abuse to aid sleep. However, while many studies have highlighted the relationship between long working hours and high risky consumption of alcohol, there is a paucity of studies examining the influence of working hours on the use of sedating medications in the working population.

Also, the studies examining the existing relationship between working hours and psychological distress have been mixed (Afonso et al., 2017; Li et al., 2019; Virtanen et al., 2011; Wong et al., 2019 Vs. Angrave & Charlwood, 2015; Lee et al., 2017; Rugulies et al., 2019) mainly due to study designs challenges. Despite the high prevalence of long working hours and psychological distress in the U.S., longitudinal studies examining the relationship between working hours and psychological distress among U.S. workers are sparse.

Furthermore, the increase in the incidence and prevalence of chronic diseases associated with long working hours is expected to reflect in the elevated use of health

services by employees. Also, the literature informs that long working hours are linked with reduced utilization of preventive health services among employees. This is primarily attributed to the lack of time available to workers putting in overtime hours (Fell et al., 2007). Preventive health services are important in sustaining the health of individuals, especially those with increased risk of chronic diseases. However, studies investigating the associations between long working hours, healthcare utilization, and the use of medications in the U.S. is sparse.

Overview

This dissertation presents a unique approach in its three-staged strategy in investigating the multi-faced relationships between working hours, the use of prescription sleep aids, the onset of psychological distress, and the use of health care services among U.S. workers. A nationally representative panel of full-time workers in the U.S. to examine these relationships.

The first manuscript applied the Andersen healthcare utilization model to conceptualize the relationship between long working hours and the use of prescription sleep aids. This is the first study to examine the relationship between long working hours and the use of sleep aid medications, along with the use of medications with sedative properties. Methodologically, different regression models were utilized, including multivariable linear regression, Tobit regression, Heckman regression, and multivariable logistic regression, to ensure consistency, robustness, and reliability of observed associations. The independent variable and outcome variables were working hours and the use of sedating medications, respectively. This paper provides an initial insight into

characterizing the important association between working hours on the use of prescribed sedating medications.

The second manuscript utilized the longitudinal structure of the data to investigate the relationship between long working hours and psychological distress. The study utilized a modified WHO logic model (Pega et al., 2021; Rugulies et al., 2021) to conceptualize this relationship. The model informs that long working hours influence the onset of psychological distress through two causal pathways–psycho-physiological and health–behavioral pathways.

This study represents an improvement over previous research that was hampered by problems of reverse causality and cross-sectional data. Methodologically, the study assessed this relationship in individuals without psychological distress at baseline. The assumption here is that individuals working overtime hours will have a higher risk of psychological distress. This provides longitudinal evidence of the existing relationship between working hours and the onset of psychological distress among U.S. workers.

The concluding or third manuscript of this dissertation examined the relationship between working hours, health care utilization, and the use of sedative medications in the U.S. It utilized the longitudinal structure of the data to investigate these relationships. Employing the Andersen healthcare utilization model to conceptualize these various associations. Fixed effect estimators were utilized in modeling the relationship between working hours, the use of sedating medications, and health care services among full-time employees in the U.S. An assumption here is that individuals working long hours will have a higher use of healthcare services, especially healthcare services with less time requirement. Also, individuals working overtime hours burdened with chronic diseases

are expected to have higher use of health care services. It operationalized the use of health care services through five dependent variables: annual outpatient visits, office-based visits, emergency department visits, hospital discharges, and dental visits. Furthermore, further analyses were performed on characterizing annual outpatient visits to further understand the observed relationships.

Together, these manuscripts address crucial gaps in our current knowledge of the multi-dimensional relationship between working hours and health outcomes. The findings from this research offer a solid foundation of evidence and valuable insights into the relationship between working hours, the use of sleep aids, and their negative impact on health outcomes. Therefore, these findings can serve as a guiding tool for employers, health systems, and researchers in creating interventions and making recommendations regarding work-based policies, with the ultimate aim of enhancing the health and well-being of employees.

CHAPTER ONE: EXAMINING THE RELATIONSHIP BETWEEN LONG WORKING HOURS AND THE USE OF PRESCRIPTION SEDATIVES AMONG U.S. WORKERS

1.0. OVERVIEW

OBJECTIVES: The demands of a round-the-clock service and globalized society have led to an increase in long working hours. This trend has been accompanied by a corresponding rise in sleep disorders. Additionally, sedative-tranquilizers have been reported as the third most commonly misused drug class in the U.S. Given the prevalence of long working hours among the U.S. working population, it is expected that there will be a continued increase in the use of sleep aid medications among this population, along with an associated increase in substance abuse to aid sleep.

METHODS: The 2010-2019 Medical Expenditure Panel Survey (MEPS) data from the University of Minnesota's Integrated Public Use Microdata Series (IPUMS) was utilized. Sleep aids and medications with sedation as a side effect were identified. Furthermore, we employed different regression models ranging from multivariable linear regression, Tobit regression, Heckman regression, and multivariable logistic regression, to ensure consistency, robustness, and reliability of associations between working hours and the use of medications.

RESULTS: Overall, a sample of 81,518 observations of full-time workers was analyzed. Working 56hours or more per week was significantly associated ($p < 0.05$) with an increased odds of using sleep aids and medications with sedative properties by 13% (Adjusted Odds Ratio, aOR =1.13, 95% Confidence Interval, CI=1.01:1.26) and 9% (aOR=1.09, 95% CI=1.03:1.16), respectively more than that among those who worked fewer hours. Females in our study had a higher likelihood (aOR=1.11, 95% CI=1.05:1.19) of using sleep aids when compared to males. Also, professional services had the highest likelihood (aOR=1.31, 95% CI=1.14:1.50) of using sleep medications.

CONCLUSION AND POLICY IMPLICATION: We found that long working hours were significantly associated with an elevated use of sleep aids and medications with sedative properties among U.S. workers. Specifically, female workers and individuals working in professional services had the highest likelihood of using sleep medications. Employees should be enlightened on the implications of long working hours on their health.

1.1. INTRODUCTION

Long working hours have increased with the continuous attempts at meeting the needs of 24-hour service and a globalized society. The rise in poor sleep quality has accompanied this increase. Also, sleep and substance abuse disorders have been closely linked (Mahfoud et al., 2009; Roane & Taylor, 2008; Weissman et al., 1997). A previous study found that one in three Americans frequently gets less than the recommended amount of sleep (Liu et al., 2016). Furthermore, long working hours have been linked to adverse health outcomes and behaviors such as cardiovascular diseases (Bannai & Tamakoshi, 2014; Cheng et al., 2014; Grosch et al., 2006; Kim et al., 2016; Lunde et al., 2016; Wong et al., 2019), depression and anxiety (Cheng et al., 2014; Lallukka et al., 2008; Lunde et al., 2016; Skogstad et al., 2019), risky alcohol use, and smoking (Bannai & Tamakoshi, 2014; Virtanen et al., 2015).

Sedative and hypnotic medications, commonly referred to as "sleep aids," are used to initiate or maintain sleep due to their known ability to suppress the central nervous system (Chong et al., 2013). Sedative – tranquilizers have been reported as the third most misused drug class by adolescents and adults in the United States population (Votaw et al., 2019). For example, the prescription of Benzodiazepines – a predominant class of sedatives, doubled from 2003 to 2015 (Agarwal & Landon, 2019).

Furthermore, it is common practice to use medications, including prescribed and controlled medicines, for their side effects, such as sedating effects, and for recreational purposes (Lopez-Quintero et al., 2021). As such, the use of medications with secondary sedating side effects, such as pain medications, anti-histaminic drugs, and anti-

depressants has increased (Votaw et al., 2019). Between 2003 to 2012, treatment for sedative – tranquilizers use disorder increased by over 65% (Abuse, 2014). Also, there has been a significant rise in benzodiazepine-related overdose mortality by over 400% increase between 1999 and 2013 (Bachhuber et al., 2016). Recently, a study (Lopez-Quintero et al., 2021) found that 40% of their study population that used prescription medications extra-medically used pain relievers as sleep aids. Other medical literature regarding the off-label use of medications not indicated for insomnia endorses the concept that people utilize a variety of products with sedative properties for sleep. The often referenced "Up to Date" peer reviewed clinical practice reference includes a section on medications that can be used for insomnia off label, such as several antidepressants (Neubauer et al., 2021). A national study of prescription medications for insomnia reported that 55% of persons using medications for insomnia also concurrently used sedating medications, with 10% taking three or more other sedating medications concurrently (Bertisch et al., 2014).

The prevalence of long working hours in the U.S. working population is expected to lead to a continuous increase in the use of sleep aid medications in this population with other associated substance abuse to aid sleep. However, despite the availability of studies highlighting the relationship between long working hours and the consumption of alcohol, the relationship between long working hours and the use of sleep aid medications has rarely been examined. Notedly, there is a higher prevalence of the extra-medical use of prescription medications for sleep in the U.S. compared to several European countries (Lehne et al., 2018; Schepis et al., 2018). Also, studies have linked the use of hypnotics, over-the-counter sleep medications to adverse health outcomes such as cardiovascular

diseases (Jehle et al., 2013; Kim et al., 2018; Mailliet et al., 2001; Mallon et al., 2009) in the general population. With benzodiazepines associated with an increased incidence and risk of mortality from cardiovascular diseases (Kim et al., 2018).

To our knowledge, this is the first study examining the relationship between long working hours and the use of sleep aid medications, along with the use of medications with sedative properties. Hence, the key objective of this study was to characterize the relationship between working hours on the use of sleep aids and medications with sedative properties. We applied the Andersen healthcare utilization model to conceptualize our research questions (Andersen, 1995). This model is relevant to our research as it posits that a person's health behavior and healthcare service use are significantly influenced by enabling, predisposing, and needs factors.

Our conceptual model (*figure1*) explains that working hours influence the mutable population characteristics (specifically the need factors such as health status) and recurrently influence individuals' health behaviors. Working hours represent the environment, influenced by the occupation, and have been reported to affect health behaviors such as the consumption of alcohol (Virtanen et al., 2015; Wong et al., 2019). At the same time, the health behavior constructs in our model represent the use of sleep aids or medications with sedative properties.

The population characteristics include predisposing, enabling, need, and motivating factors. The predisposing construct represents individuals' factors or conditions that influence their use of health services (Andersen & Newman, 1973; Andersen, 1995). This construct is classified mainly as demographic and social factors. Demographic factors include age, gender, and race. Health disparities exist in the U.S.

based on predisposing constructs such as race, socioeconomic status, age, and gender (Lee, Black, & Held, 2019). At the same time, the social structure includes various factors that define an individual status in the community, such as marital status, education, and occupation.

Additionally, the enabling factors refer to the means individuals have available to use these services. This includes resources like income, health insurance, and the individual's region (Andersen and Newman, 1973). An individual's insurance status will likely determine if the individual will use health services and obtain prescription medications for sleep. However, health insurance is an outcome variable as individuals working 30 or more hours per week are eligible for employee health insurance in the U.S. (Carroll & Miller, 2019). Furthermore, the level of income increases the ability to access health care. The need factor is represented by health status, which was self-reported and thus, a perceived need.

Also, motivating factors influences the amount of time an individual spends working. Professionals and persons with higher socioeconomic status are motivated to work long hours due to its potential financial and career rewards. However, individuals might be co-opted to work long hours due to the financial strains they face, even if they earn meager wages. As measures of motivation, we used the family size and the receipt of food stamps. The presence of large family sizes may bring about heightened financial demands for families, while receipt of food stamp suggests the presence of financial difficulties associated with food insecurity. Family size and receipt of food stamps have been utilized as indicators of financial strains in prior studies (Bhattarai et al., 2005; Kabir, 2021).

The findings from this research could ground evidence and insights into the relationship between working hours, use of sedative-hypnotic, sleep aid substances, and adverse health outcomes. Hence, the findings can guide employers, health systems, and researchers in designing interventions and recommendations for developing work-based policies to improve the health status of employees.

1.2. METHODS

1.2.1. Data Sources

We utilized the 2010-2019 Medical Expenditure Panel Survey (MEPS) data. This is a longitudinal national probability survey conducted by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS) (Quality, 2020). It collects data on access, utilization, and expenditures on health services, among other health information, for civilian non-institutionalized Americans. MEPS draws its sample from the National Health Interview Survey (NHIS) respondents from the preceding year. It uses an overlapping panel design to collect data from the survey respondents. The panel is designed to include five rounds of interviews over two full calendar years. Typically, for each participant in a calendar year, data from interview rounds one and two are collected in the first year, while data for rounds three, four, and five are collected in their second year.

The MEPS-Household Component (MEPS-HC), ongoing since 1996, provides information on the participants' demographic, health and employment status, socioeconomic characteristics, health care utilization, health care expenditures by payer, insurance coverage, and healthcare satisfaction. To increase the precision of estimates, MEPS and NHIS oversample subgroups of minorities such as African Americans and

Hispanics. After considering nonresponse rates from the NHIS, the overall MEPS response rates range between 46% and 71%. The MEPS HC enables the production of national estimates. It can also be analyzed at the person or event level.

MEPS elicit information directly from providers in its Medical Provider Component (MEPS-MPC). The main aim of the MEPS-MPC is to supplement or replace information collected during the MEPS-HC survey. The MEPS-MPC includes A pharmacy component as a subcomponent, where it collects medication detail information, the national drug code (NDC), and the medication's generic name. However, unlike the MEPS-HC, MEPS-MPC is not designed to produce national estimates. Thus, we weighted only the MEPS-HC component of the study in the descriptive statistics for the results in the main results. However, following (Solon et al., 2015), we also conducted our analysis using sample weights and accounting for the complex survey design of the MEPS. The weighted results are reported in *Appendices 6 to 10*.

1.2.2. IRB Approval Statement

The study was approved as exempt by the University of Louisville's Institutional Review Board (IRB # 21.0849). The publicly available de-identified dataset was used for this study, and the research did not meet the "Common Rule" definition of human subjects' research. Thus, it was classified as Non-Human Subjects Research (NHSR).

1.2.3. Data Organization

We employed a pooled sample design, and listwise deletion was used to eliminate missing cases. The dataset from MEPS comes in twenty varying files. Therefore, to ease the data management, we employed the MEPS surveys refined and organized at the University of Minnesota's Integrated Public Use Microdata Series (IPUMS). The

National Institute of Child Health and Human Development (NICHD) funds the IPUMS MEPS. This is designed to aid the researcher's use of the MEPS. It provides integrated data files for each year of the MEPS-HC survey with the ease of preselecting the variable before downloading the dataset (Blewett, 2020).

In the next step, we merged the IPUMS MEPS-HC with the prescription medicine event files in the MEPS Pharmacy component. The prescription medicine event files report prescribed medicines obtained or purchased by the participating households. Each record represents a singular prescribed medicine reported for the person within the survey round. A round is approximately 4 months which is the space between each round of data collection. After downloading prescription data files for 2010-2019, the files were appended and merged to the MEPS-HC component. This linking of the two datasets was done using the "MEPSID," which represents the unique households' identifier in both datasets.

1.2.4. Dependent Variable

The dependent variables in this study were the use of sleep aids and medications with sleep aid properties, extracted from the prescription medicines event files of the MEPS pharmacy component. We defined a prescription as any prescription of a specific medication with its accompanying supply frequency (Chen et al., 2020). We used the number of prescriptions recorded as a continuous dependent variable rather than the quantity of medications recorded. Prescription for a medication represents a reliable need for the medication and can be compared across drug types. On the other hand, the

quantity of medications may not be directly comparable across drug types as they do not have the same dose-effect relationship.

Using the Multum Lexicon Therapeutic class Codes in MEPS, sleep aids were identified. The Multum variables classification in MEPS prescribed medicine files represented the most recent classification of the medications available when the data was recorded. Examples of these sleep aids medication classes include anxiolytics, sedatives, and hypnotics.

To identify medications with sedation as a side effect, we used Wolters Kluwer's Facts and Comparisons®, also known as "Drug Facts and Comparisons", a referential drug resource to identify medications with adverse effects (Comparisons eAnswers., 2021). Medications with drowsiness, dizziness, feelings of sluggishness, or heaviness listed as common or serious adverse effects were defined as having a potential for sedation as an adverse effect (*Appendix 1*). Facts and Comparisons is a product of Wolters Kluwer Health, which is a compendium offering comprehensive drug, disease, and clinical reports. It gives users access to several databases, modules, and medication reference tools for pharmacists and drug information experts. It has been reported as one of the most preferred drug resource used by drug information experts (Grizzle et al., 2019; Roblek et al., 2015). It was recorded to have a completeness score of 95.8%, computed with index value measures such as adverse drug reactions, drug interactions, contraindications, indications, and unlabeled uses (Clauson et al., 2007; Roblek et al., 2015). Facts and Comparisons® was ranked top alongside Micromedex, Clinical Pharmacology, and Lexi-Comp (Clauson et al., 2007; Hanrahan & Cole, 2014). It was grouped among the most accurate and user-friendly medication identifiers with a score of

96.5% (Jackevicius et al., 2019). Furthermore, it was found to have a sensitivity of 93% and a positive predictive value (PPV) of 95.3% in finding black box warnings (Cheng et al., 2010).

1.2.5. Primary Independent Variable

The primary independent variable is work hours per week. The MEPS-HC recorded this variable if respondents in the survey were sixteen years and older and had a current main job. It measured the number of hours worked per week, excluding the unpaid travel time transiting to and from the job. We used 30 hours/week as a baseline as they are considered full-time workers and eligible for health insurance coverage in the U.S. (Carroll & Miller, 2019). Previous research informs that individuals working less than standard working hours, such as part-time workers, could belong to a different health-selected category, such as pre-existing health conditions, or might work less due to family responsibilities (Kivimäki et al., 2015; Li et al., 2020; Virtanen et al., 2012). As such, these groups of individuals working fewer hours may not serve as appropriate comparators.

To better understand medications and use trends associated with work hours, we generated four alternatively-used dummy variables based on weekly work hours. Specifically, our first dummy variable was assigned 1 if an individual worked 36 hours or more per week (h/week), and 0 otherwise. Our second dummy variable took the value of 1 if an individual worked 46 h/week, and 0 otherwise; the third dummy variable was assigned 1 if an individual worked 56 h/week, and 0 otherwise; the fourth dummy variable took the value of 1 if an individual worked 66 h/week, and 0 otherwise. These stratifications were carried out with the aim of identifying the best threshold to

dichotomize long working hours in relation to the use of sleep aids and medications with sedative side effects.

1.2.6. Covariates

The selection of covariates was guided by the conceptual framework of the study using the Gelberg-Andersen behavioral health model. We used age, race, marital status, family size, education, occupation, and panel year as predisposing factors. We categorized age, race, marital status, and family size into three: respectively, 18-26, 27-64, and ≥ 65 years; White, Black, and other; married, divorced (including widowed and separated), and unmarried; and ≤ 3, 4−6, and > 6 members. We used age categories aligned with changes in health insurance coverage. The U.S. Patient Protection and Affordable Care Act stipulates that individuals are eligible to be covered by their parent's health insurance until age 26 (Croteau et al., 2021; Patrick & Yang, 2021; Weir et al., 2018).

Additionally, education, as a covariate, was recoded into two categories: having less than a college education and having some college or more education. Occupation is the specific work category of the respondents and was recoded into six categories: natural resources (including mining and construction), leisure (including hospitality services), trade (including wholesale and retail trade), professional services, manufacturing, or other sectors. Panel year, the first year a respondent was surveyed, accounts for variations in healthcare during the study period that could influence medication use and relative health outcomes.

The enabling factors include region, income, receipt of food stamps, and the first-round health status. Health insurance status is an outcome variable of the primary

independent variable – working hours. Thus, it was excluded as a covariate to avoid multicollinearity, as work hours predicts health insurance status. U.S. workers working 30 or more hours per week are eligible for employee health insurance (Carroll & Miller, 2019). MEPS region variable is the census region recorded as northeast, mid-west (including northcentral), south, and west. We recoded income into two: poor to low income (less than 100% to 199% of the federal poverty line) and middle to high income (200% and above the federal poverty line). The receipt of food stamps is a yes/no variable. We recoded the self-reported health status into four: excellent (combination of excellent and very good), good, fair, and poor.

1.2.7. Study Population

The inclusion criteria include participants that are 18 years and above, participated in survey years 2010 to 2019 (panel 14 to 22), and considered full-time workers (worked at least 30 h/week). While the exclusion criteria were part-time workers (worked less than 30 h/week) and participants with any missing outcome or predictor variables.

1.2.8. Data Analysis

The data were analyzed using Stata Statistical Software: Release 15 (StataCorp, 2021). We weighted the MEPS-HC component to estimate the descriptive statistics. Considering the complex survey design of the MEPS, we accounted for the weight, clusters, and strata. We used exploratory, descriptive statistics to examine the distribution of independent variables. We examined the frequency distributions of our study's participant categorical variables. The continuous variables' means, standard deviation,

median, and interquartile ranges were also assessed. This was followed by examining the distribution of the participant characteristics across both dependent variables (use of sleep aids and use of medications with sedative properties) using the Chi-square test.

Furthermore, we employed different regression models ranging from multivariable linear regression, Tobit regression, Heckman regression, and multivariable logistic regression, to ensure consistency, robustness, and reliability of associations between the independent and dependent variables in our study.

We first utilized a multivariate linear probability model to estimate the association between the number of prescriptions of sleep aids or medications with sleep aid properties with working hours. Since the data on the outcome variable (number of prescriptions) were censored at zero due to the short period of observation, a linear regression might not be the best approach for analyzing the data. Data on the number of prescriptions were collected in five rounds over two calendar years. As a result, prescriptions and use of medications that occurred outside of these rounds or survey period would be reported as zero. Additionally, no information is collected for over-the-counter sleep aids or medications with sedative properties. Thus, we employed Tobit regression to identify the factors related to the left-censored nature of the data. The Tobit regression marginal effects were then compared with the multivariate linear probability model.

An important limitation of the Tobit model is assuming a normal distribution for the error terms (Cameron & Trivedi, 2010). A potential remedy for the problem is to estimate a two-part model: the selection into using medications versus the degree of medication utilization among users. The use of a two-part model is justified if the error

terms of the two parts are independent. Therefore, we proceeded to test for independence using the Heckman regression model (Cameron & Trivedi, 2010; Koné et al., 2019). Subsequently, we conducted an equivalent multivariate logistic regression to model the association between working hours and the use versus nonuse of medications. Additionally, multivariable linear regression was performed to model the association between working hours and the use of medications among identified users. In this multivariable linear regression, the dependent variables were the number of prescriptions of sleep aids and medications with sedative properties among the identified users. In contrast, the independent variable remained the working hours of the identified users.

1.3. RESULTS

1.3.1. Descriptive Statistics

Table 1 describes the characteristics of the study sample stratified by different work hour cutoffs. We stratified work hours into four categories, with a cutoff of ten hours intervals using four dummy variables*:* 36 h/week, 46 h/week, 56 h/week, and 66 h/week. Overall, the number of records was 81,518, representing 98,995,693 individuals in the United States. Most of the participants worked 36 hours or more per week (87,383,592), while few worked 66 hours or more per week (2,185,941). More respondents utilized medications with sedative properties (34.5%), while the prevalence of prescription sleep aids use was substantially smaller (6.2%). The average numbers of prescriptions of sleep aids use and medications with sedative properties in our sample were 2.83 (standard deviation, SD=2.29) and 2.82 (SD=3.46), respectively, within the

survey round. A round is approximately four months, the space between each round of data collection.

The use of sleep aids was most common among participants that worked 56 hours or more per week, with a prevalence rate of 7.0% and a mean prescription sleep aid number of 3.16 (SD=2.58) among users. This group was followed by those who worked 66 hours or more per week, with a prevalence of 6.6% and a mean prescription sleep aid number of 3.06 (SD=2.79) among users. Similarly, the use of medications with sedative properties was the highest among participants that worked 56 hours or more per week, with a mean prescription sleep aid number of 3.18 (SD=3.54) among users and a prevalence rate of 36.1%. This group were followed by individuals that worked 66 hours or more per week with a mean of 3.13 (SD=3.36) among users and a prevalence rate of 36.4%.

Under predisposing factors, most respondents were between the ages of 27 to 64 years (85.3%), 83.6% of the sample identified as White, followed by 10.1% as Black, and 6.4% as Other. More than half of the sample were female (55.5%), and married respondents accounted for over half of the sample (57.4%). Most of the respondents (68.3%) had at least a college education. By occupation, professional services (39.5%) accounted for the largest proportion of the sample, and the largest portion of the respondents was from the survey year 2014 (11.0%).

By enabling factors, the largest proportion of the participants resided in the southern region of the U.S. (39.3 %), followed by those living in the North Central-Midwest (24.2%). In comparison, the Northeast (15.2%) had the least proportion. Most of the respondents were classified as middle to high-income earners (84.4%) – who earned

at least 200% and above the federal poverty threshold. In comparison, 15.6% were classified as poor to low income or earned below 200% of the federal poverty threshold. Additionally, by need factors, most of the respondents were either in excellent (14.9%) or good health (74.3%). Also, the majority of the respondents had a small family size of less than or equal to 3 members (69.3%), and 94.2 % of the sample did not receive food stamps.

1.3.2. Bivariate Analysis

The Chi-square test of independence analysis in *Table 2* yielded a statistically significant association (with p-values, *p*, smaller than 0.05) between working 56 hours or more per week and the use of prescription sleep aids. The corresponding association was statistically significant at the 10% level for 36 or more and 46 or more work hours per week but statistically insignificant for 66 or more work hours per week. In addition, there was a statistically significant association between working 56 hours or more per week and the use of prescription medications with sleep aid properties. There was a significant association between the use of prescription sleep aids and all predisposing, enabling, and need factors. Participants aged between 27-64 years (90.2%, $p<0.000$), White (75.1%, $p<0.000$), female (57.5%, $p<0.000$), married (53.9%, $p<0.000$), with less than or equal to three family members (77.5%, $p<0.000$), have some college or more (67.6%, $p<0.000$), working in professional services (42.9%, $p<0.000$), the southern region of the U.S. (36.5%, $p<0.000$), middle to high income (81.1%, $p<0.000$), did not receive food stamps (92.2%, $p=0.001$), and reported having good health status (73.9%, $p<0.000$) made up the highest proportions of those who used prescription sleep aid.

Furthermore, the use of medication with sedative side effects had similar significant proportions and associations with the covariates compared to the use of prescription sleep aids. However, the covariates, education (p=0.072), and income (p=0.924) did not show significant associations at 5% level with the use of medications with sedative side effects.

1.3.3. Correlates of the Use of Prescription Sleep Aids

The bivariate analysis showed the strongest association between the 56 hours or more per week category, the use of sleep aids, and medications with sleep aid properties. Subsequently, we provided results only for the 56 hours or more per week category in the result section of our analysis. The results for other work hour categories are provided in *Appendices 2−5* of the paper. Overall, we found a similar pattern of positive associations between work hours and the use of medications across the various work hour categories (36 hours, 46 hours, and 66 hours) when compared to the 56 hours per week category. However, they were largely insignificant ($p > 0.05$).

In the linear regression analysis in *Table 3*, the number of prescriptions was used as the outcome variable. We found that working 56 hours or more per week was associated with a 0.05 unit increase in the sleep aid prescription. The increase translates to an average of additional 14 prescription sleep aid pills within the survey round.

Due to the censored dependent variable data, we employed Tobit regression which resulted in a positive association between working 56 hours or more per week and using prescription sleep aids. We found the significant coefficients ($p < 0.05$) from the

Tobit marginal effect similar and comparable with the linear regression coefficients. The Tobit marginal effects showed that individuals working 56 hours or more per week were associated with a 0.07 unit increase in the prescription of sleep aids, translating to an additional 20 prescription sleep aid pills within the survey round on average. Nonetheless, the conditional moment test for normality in a Tobit model indicated strong non-normality of the error terms ($p < 0.001$), challenging the validity of the Tobit results (Cameron & Trivedi, 2010; Drukker, 2002).

To test if the analysis can be conducted in two parts (*i.e.*, the selection into using sleep aids versus the extent of sleep aid use among users), we ran a Heckman regression (see *Appendix 2a*). The regression resulted in estimating a statistically insignificant selection hazard ratio, indicating the independence of the two parts (inverse Mills' ratio=8.99, p=0.701). Therefore, we proceeded with analyzing the two parts independently. Results from the adjusted logistic regression (aOR) showed that the odds of using prescription sleep aids among respondents who worked 56 hours or more per week was 13% more than that among those who worked fewer hours (aOR=1.13, 95% Confidence Interval, CI=1.01:1.26). The logit marginal effect also yielded a significant (p<0.05) positive association between working 56 hours or more per week and the likelihood of using prescription sleep aids. It informed that the predicted probability of using sleep aids is 0.007 (CI=0.000, 0.014) greater for the individual that worked 56 hours or more per week than for one that worked less than 56 hours per week.

Additionally, the linear regression analysis among users of prescription sleep aids showed that respondents who worked 56 hours or more per week had 0.37 more sedative prescription compared to those who worked less than 56 hours per week while

controlling for other covariates. This coefficient represents an average of an additional 110 prescription sleep aid pills for respondents in this category (individuals that worked 56 hours or more per week and used sleep aids).

Individuals aged 27-64 years were 2.2 times more likely to have used prescription sleep aids than respondents aged 18-26 years (aOR=2.20, 95% CI=1.90:2.56). Compared to males, females were 11% (aOR=1.11, 95% CI=1.05:1.19) more likely to use prescription sleep aids. While those who reported being divorced (aOR=1.13, 95% CI=1.05:1.21), had some college or more education (aOR=1.24, 95% CI=1.16:1.32), and residents of North central – Midwest (aOR=1.15, 95% CI=1.04:1.27) had a higher likelihood of using prescription sleep aids.

In addition, respondents that worked in professional services were 31% (aOR=1.31, 95% CI=1.14:1.50) more likely to have used prescription sleep aids than those working in natural resources. Those who reported poor health status were 2.6 times more likely to have used prescription sleep aids than persons with excellent health status (aOR=2.609, 95% CI=2.102:3.238). African Americans/Blacks (aOR=0.46, 95% CI=0.41:0.50), and those with 4-6 family members in the household (aOR=0.67, 95 CI=0.62:0.72) were less likely to report the use of prescription sleep aids.

1.3.4. Correlates of the Use of Prescription Medications with Sedative Properties

In the linear regression analysis in *Table 4*, we found that working 56 hours or more per week was associated with a 0.19 unit increase in medications with sedative properties prescription. The increase translates to an average of additional 38 pills with sedative properties within the survey round. Likewise, we found the Tobit marginal effects had significant positive coefficients ($p < 0.001$) and were comparable to the linear

regression coefficients. The Tobit marginal effects informed that individuals working 56 hours or more per week were associated with a 0.11 unit increase in the prescription of medications with sedative properties, translating to an average of additional 22 pills with sedative properties within the survey round. Furthermore, the conditional moment test for normality in a Tobit model indicated strong non-normality of the error terms ($p < 0.001$).

Correspondingly, to test if the analysis can be conducted in two parts (*i.e.*, the selection into using medications with sedative properties versus the extent of medications with sedative properties use among users), we ran a Heckman regression (see *Appendix 2b*). The regression produced a statistically insignificant selection hazard ratio, indicating the independence of the two parts (inverse Mills' ratio=33.08, p=0.434).

Analyzing the two parts independently, the results from the adjusted logistic regression (aOR) informed that the odds of using medications with sedative properties among respondents who worked 56 hours or more per week was 9% more than that among those who worked fewer hours (aOR=1.09, 95% CI=1.03:1.16). Likewise, the logit marginal effect showed a significant (p<0.01) positive association between working 56 hours or more per week and the likelihood of using medications with sedative properties. It informed that respondents who worked 56 hours or more per week had 2% (CI=0.7%, 3.3%) more likelihood to use medications with sedative properties.

Furthermore, the linear regression analysis among users of medications with sedative properties showed that respondents who worked 56 hours or more per week had 0.35 more prescription with sedative properties than respondents who worked less than 56 hours per week. This coefficient represents an additional 70 prescription pills of

medications with sedative properties for respondents in this category within the survey round.

Respondents who reported being divorced (aOR=1.06, 95% CI=1.02:1.10) and receiving food stamps (aOR=1.15, 95% CI=1.08:1.21) had a higher likelihood of using medications with sedative properties. While respondents with race classified as other (aOR=0.89, 95% CI=0.85:0.95) and those with 4-6 family members in the household (aOR=0.82, 95% CI=0.79:0.85) were less likely to report the use of prescription prescriptions with sedative properties.

Like prescription sleep aids use, respondents who reported poor health status were 2.6 times more likely to have used medications with sedative properties than persons with excellent health status (aOR=2.60, 95% CI=2.29:2.94). Also, respondents that worked in professional services were 14% (aOR=1.14, 95% CI=1.07:1.22) more likely to have used medications with sedative properties than those who worked in natural resources.

Unlike the aOR results from the sleep aids use, Individuals aged 65 years and older had the highest likelihood of using medications with sedative properties compared to those between 18-26 years (aOR=1.50, 95% CI=1.37:1.63). Also, covariates: sex, education, region, and income did not show a significant association ($p > 0.05$) between working 56 hours or more per week and using medications with sedative properties.

1.3.5. Supplemental Analysis

Additionally, following (Solon et al., 2015), we also conducted our analysis using sample weights and accounting for the complex survey design of the MEPS (*Appendices 6 to 10*). The analysis yielded similar results. Though the point estimates changed, the associations were similar to the unweighted results. The differences between the two sets

(unweighted vs. weighted) were consistent with the observed heterogeneity in the treatment effects and the reported oversampling for minority groups in the MEPS (Quality, 2020; Schaller & Zerpa, 2019).

1.4. DISCUSSION

We found a similar pattern of associations between long working hours, the use of prescription sleep aids, and medications with sedative properties. The overall prevalence of prescription sleep aids use (6.2%) was similar to the overall incidence rate (6.3%) of risky alcohol use found in the landmark paper by Virtanen et al. 2015 (Virtanen et al., 2015) – that explored the relationship between long working hours and risky alcohol use. Furthermore, previous national estimates reported the monthly prevalence of prescription sleep aid use at 4% among adults aged 20 years and older (Chong et al., 2013). While other studies estimate the prevalence of hypnotics among the general population to range between 3.5% and 11.7% (Chong et al., 2013; Ohayon et al., 1998; Vaidya et al., 2014).

In the analysis of the use of medications with sedative properties, we found a prevalence of 34.5% across respondents. Likewise, a recent report (Lopez-Quintero et al., 2021) informed that about 40% of individuals aged 12 and older used prescription pain medications in combination with sedatives and tranquilizers to aid sleep. Several studies link the use of opioids and sleep due to associated pain reduction and increased initiation of sleep–drowsiness (Angarita et al., 2016; Cheatle & Webster, 2015; Serdarevic et al., 2017).

The results from the Tobit models, with significant positive coefficients that were comparable to the coefficients from the linear probability model, informed a positive association between working 56 hours or more per week and the use of prescription sleep

aids. This adds to the robustness of our analysis (Cameron & Trivedi, 2010; Foster & Kalenkoski, 2013; Wang & Griswold, 2017). The Tobit marginal effects showed that individuals who worked 56 hours or more per week were associated with an increased likelihood of using sleep aids and medications with sedative properties by increased prescription units of 0.07 and 0.11, respectively. These increases translate to an average of additional 20 prescription sleep aid pills, and 22 pills with sedative properties, respectively within the survey round.

We found that the odds of using prescription sleep aids and medications with sedative properties among respondents who worked 56 hours or more per week was 13% and 9%, respectively more than that among those who worked fewer hours. Likewise, a previous meta-analysis of 63 studies with over 333,000 participants across 14 countries found that working 55 hours or more per week was associated with a 12% increased odds of new-onset of risky alcohol use (Virtanen et al., 2015). This increased odds of the association between long working hours and the use of sedative medications could result from the impact of long working hours on sleep.

Also, we found that among the users of sleep aids and medications with sedative properties, those who worked 56 hours or more per week were associated with higher uses (frequency) of these medications compared to those that worked lesser hours. Previous studies (Artazcoz et al., 2009; Nakashima et al., 2011; Virtanen et al., 2009) have shown significant positive relationships between working long hours and the risk of sleep disorders. Also, national estimates reported that 6% to 10% of individuals in the U.S. had been diagnosed with a sleep disorder (Laposky et al., 2016; Liu et al., 2013). Evidence informs that the use of prescription sleep aids are higher among individuals

with sleep disorders (Chong et al., 2013). Long working hours increase the likelihood of stress and are accompanied by an increased prevalence of sleep disorders (Kivimäki et al., 2012; Virtanen et al., 2009; Virtanen et al., 2015). This increased prevalence of sleep disorders likely results in the subsequent use of medications to aid sleep.

Furthermore, we found that females in our study had a higher likelihood of using sleep aids when compared to males. Similarly, several previous findings report that females have a higher chance of using sleep aids than males (Chong et al., 2013; Lopez-Quintero et al., 2021; Vaidya et al., 2014). A rationale theorized for this is females have a higher risk of developing sleep disorders when exposed to long working hours compared to males (Wong et al., 2019). Additionally, employed females have been noted to have increased exposure to unpaid work such as household chores, which result in higher work hours and reduced sleep duration compared to employed males (Bianchi, 2000; Sayer, 2005). Also, insomnia has been reportedly higher in middle-aged women and was linked to peculiar hormonal and psychological changes in this age group (Cirignotta et al., 1985).

Our study found significant differences in the associations between long working hours and the use of sleep medications across socioeconomic groups. Professionals – individuals involved in education, such as teachers and health care workers, had the highest likelihood of using prescription sleep aids and medications with sedative properties. Earlier literature reports that professionals have an increased likelihood of working long hours as it could result in possible financial and career rewards for them (Romani & Ashkar, 2014; Wisetborisut et al., 2014). On the other hand, long working hours could be a response to dire economic needs and financial strain in a continuous

attempt to make ends meets for individuals of lower socioeconomic status. In our study, respondents who reported receiving food stamps – an indication of financial difficulty, had a 15% higher likelihood of using medications with sedative properties than those who did not receive food stamps (aOR=1.15, 95% CI=1.08:1.21).

However, respondents with 4-6 family members (additional indication of financial motivation) in the household had a lower likelihood of using prescription sleep aids and medications with sedative properties. The association between long working hours, use of sleep medications, and financial need might be additionally influenced by the health status of the individuals.

In our study, individuals who reported poor health status had a significantly increased likelihood of using prescription sleep medications and medications with sedative properties (2.7 and 2.6 times, respectively) compared to those who reported excellent health status. Long working hours have been linked to poor health outcomes. Prior literature found that individuals with poor health status are more likely to use prescription pain medications and sleep medications (Lopez-Quintero et al., 2021).

1.4.1. Policy and Theoretical Implications

Our study provides evidence of the association between long working hours and the use of medications with sedative properties. The use of sleep medications has several implications. Previous studies have linked sleep aids medications with increased mortality (Kivimäki et al., 2015; Skogstad et al., 2019). However, other studies found no significant associations (Jaussent et al., 2013; Phillips & Mannino, 2005; Rumble & Morgan, 1992). The chronic use of these medications increases the risk of cognitive and psychomotor impairments, car and workplace accidents, and addiction (Kim et al., 2016;

Mizoue et al., 2001). Thus, the residual effects of sleep medications and their resultant effects present safety risks to the workers that use them and the public.

The similar patterns of utilization between prescription sleep aids and medications with sedative properties in our study support earlier findings that many persons use drugs with sedative properties for their off label use to aid sleep (Lopez-Quintero et al., 2021; Neubauer et al., 2021). This further increases the risks associated with the use of these medications, such as poly-drug users who believes that these sleep medications could significantly increase the intoxicating experience of other recreational drugs, such as narcotics (Votaw et al., 2019).

Furthermore, we found that working women had an increased risk of associations between using these medications and working long hours. This adds evidence to previous theories, which inform of additional household chores that female workers undertake and account for increased stress that results from extended working hours (Wong et al., 2019).

Government and private organizations should establish clearly defined standard work hours to protect and maintain the health of their citizens and employees. Also, employees should be enlightened on the implications of long working hours on their physical and mental health. There should be increased education on the associated risks of using sleep medications. Thus, behavioral and cognitive interventions that have been shown to improve and sustain sleep quality and hygiene with non-significant adverse effects (Martínez et al., 2014) should be promoted as a choice and sustainable alternative for workers.

1.4.2. Limitations

This study had several limitations. The study was largely based on self-reports and could be prone to misclassification bias. For example, self-report estimates of alcohol are known to under-report drinking (Gmel & Rehm, 2004). However, this does not automatically bias estimates of associations. In addition, observations with missing covariates were excluded, which may lead to residual confounding by unmeasured covariates and selection bias. Additionally, with survey data, there is an increased likelihood of recall and response bias. Despite this, we compared changes in the result with adjustments for sociodemographic factors and utilized a Heckman analysis to ensure non-sample bias.

We could not use the panel structure of the data due to the lack of observations and changes across the small sample. Therefore, we mainly inferred associations in the relationship between the variables rather than establishing causal inference. Additionally, MEPS does not collect information on over-the-counter medications (OTC). Thus, many non-prescription sleep aids which could be obtained OTC were likely missed. Notwithstanding, the confirmed prescriptions used in the study were not subjected to recall and social desirability bias. As such, it increased the specificity and reliability of the measurement of sleep aid use.

Lastly, we could not test all the components of our conceptual models due to the limitations of the data. Future studies could explore other patterns in the relationship between the use of sleep aids and other constructs from our conceptual model.

1.5. CONCLUSION

The continuous attempts at meeting the needs of round-the-clock service and globalized society have increased long working hours. An increase in sleep disorders has

accompanied this increase. Also, sleep and substance abuse disorders have been closely linked. Our study found that long working hours were significantly associated with an increased use of sleep aids and medications with sedative properties. Working 56hours or more per week was significantly associated with an increased odds of using sleep aids and medications with sedative properties by 13% and 9%, respectively more than that among those who worked fewer hours. Working females in our study had a higher likelihood of using sleep aids when compared to males. At the same time, people working in professional services had the highest likelihood of using sleep medications. Also, we found an increased frequency of sleep medication use among users exposed to long working hours.

Our findings can guide employers, health systems, and researchers in designing interventions and recommendations for creating work-based policies focused on improving the health status of employees. Government and private organizations should establish clearly defined standard work hours to protect and maintain the health of workers. Furthermore, there is a need for employee education on the potential health implications of long working hours and using medications for sleep. Along with the continuous expansion or promotion of behavioral and cognitive sleep interventions.

Figure 1. Conceptual framework depicting the influence of working hours on the use of sleep aid drugs (adapted from Aday & Andersen, 1974).

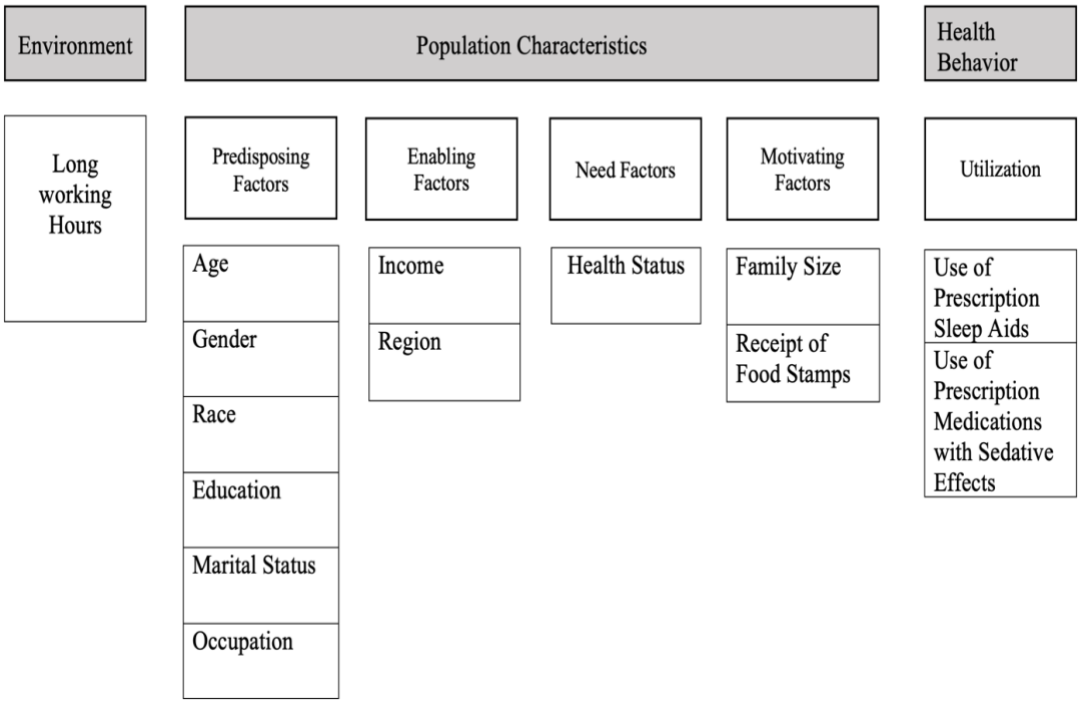


Table 1. Descriptive statistics of work hours and use of prescription medications

Variables	Overall	Cutoffs of Weekly Work Hours							
		36		46		56		66	
		< 36	≥ 36	< 46	≥ 46	< 56	≥ 56	< 66	≥ 66
Number of observations	81,518	10,696	70,822	65,920	15,598	76,193	5,325	79,943	1,575
% Sleep aids use	6.2	5.8	6.3	6.1	6.5	6.1	7	6.2	6.6
Mean sleep aids among users (SD)	2.83(2.29)	2.81(2.12)	2.84(2.30)	2.84(2.29)	2.81(2.28)	2.81(2.26)	3.16(2.58)	2.83(2.27)	3.06(2.79)
Median (IQR)	2(3)	2(3)	2(3)	2(3)	2(3)	2(3)	2(4)	2(3)	2(3)
% Use of medications with sedative properties	34.5	33.5	34.6	34.5	34.5	34.4	36.1	34.4	36.4
Mean sedative properties meds among users (SD)	2.82(3.46)	2.87(3.17)	2.82(3.51)	2.82(3.52)	2.83(3.20)	2.80(3.46)	3.18(3.54)	2.82(3.47)	3.13(3.36)
Median (IQR)	2(2)	2(3)	2(2)	2(2)	2(2)	2(2)	2(3)	2(2)	2(3)
Predisposing Factors									
Age (years)									
18-26	9	17.1	8	10.1	5.3	9.4	5	9.1	5.2
27-64	85.3	72.7	87	84.3	89.2	85.1	88	85.3	86.6
≥ 65	5.6	10.2	5	5.7	5.5	5.5	7	5.6	8.2
Race									
White	83.6	82.2	83.7	82.7	86.6	83.4	85.1	83.5	83.9
Black	10.1	11.2	9.9	10.7	8	10.1	9.3	10.1	10.7
Other	6.4	6.6	6.3	6.6	5.4	6.4	5.6	6.4	5.4
Sex									
Male	44.5	31.4	46.2	40.4	59.2	42.7	66.9	43.8	74.1
Female	55.5	68.6	53.8	59.6	40.8	57.3	33.1	56.2	25.9
Marital status									
Married	57.4	47.3	58.7	55.9	62.6	57.1	61.4	57.3	60.9
Divorced	20	21.7	19.8	20.2	19.3	19.9	20.7	19.9	23.1
Unmarried	22.6	31	21.5	23.9	18.2	23	17.8	22.8	15.9
Family size									
≤ 3 Members	69.3	67.9	69.5	69	70.5	69.1	71	69.2	72.6
4-6 Members	29.2	30.3	29	29.4	28.4	29.3	27.8	29.3	25.7

> 6 Members	1.6	1.8	1.5	1.7	1.1	1.6	1.2	1.6	1.7
Education									
Less than college	31.7	38.2	30.9	32.9	27.7	31.8	30.7	31.6	40.3
Some college or more	68.3	61.8	69.1	67.1	72.4	68.2	69.3	68.5	59.7
Occupation									
Natural resources	6.9	4.9	7.2	6	10.2	6.4	13.4	6.8	14.3
Hospitality services	5.9	14.7	4.7	6.2	4.5	6	4.6	5.9	4.5
Trade	11.3	15.9	10.7	11.4	10.7	11.3	10.9	11.3	11.7
Professional services	39.5	42.8	39	40.2	36.7	39.8	35.4	39.6	34.3
Manufacturing	11	3.1	12	10.5	12.8	11	10	11	8.1
Other	25.5	18.6	26.4	25.6	25.1	25.5	25.8	25.5	27
Year									
2010	9.6	9	9.7	9.6	9.5	9.6	9.6	9.6	10.3
2011	10.4	10.5	10.3	10.4	10.3	10.2	11.8	10.2	16
2012	10.4	10.3	10.4	10.4	10.4	10.3	10.9	10.3	13.5
2013	10	9.8	10	10.1	9.4	10.1	9	10	8.3
2014	11	11.5	11	10.9	11.3	11	11.7	11	11.2
2015	10.6	10.5	10.6	10.4	11.2	10.6	10.9	10.6	9.6
2016	10.2	9.2	10.4	10.2	10.2	10.2	9.8	10.3	8.4
2017	9.8	10	9.8	9.8	9.8	9.9	9.1	9.9	8
2018	9.6	9.7	9.6	9.5	9.8	9.6	9	9.6	8.5
2019	8.5	9.5	8.4	8.6	8.1	8.5	8.2	8.6	6.2
Enabling Factors									
Region									
Northeast	15.2	20.1	14.6	15.3	14.9	15.4	13	15.3	11.2
North Central, Midwest	24.2	23.6	24.3	23.7	26	23.9	27.4	24.2	24.6
South	39.3	36.2	39.8	39.4	39.2	39.4	38.7	39.3	43
West	21.3	20.2	21.4	21.7	19.9	21.3	20.9	21.3	21.3
Income									
Poor to low income	15.6	32	13.4	17.7	8	16.1	9.2	15.7	10.7
Middle to high income	84.4	68	86.6	82.3	92	83.9	90.8	84.3	89.3
Receipt of food stamp									
No	94.2	87.1	95.1	93.5	96.7	94.1	95.5	94.2	94.6
Yes	5.8	12.9	4.9	6.5	3.3	5.9	4.5	5.8	5.4
Need Factors									

Health Status									
Excellent	14.9	14.2	15	14.4	16.8	14.8	16.9	14.9	16.5
Good	74.3	73.1	74.5	74.5	73.8	74.5	72.2	74.5	68.8
Fair	9.6	11.1	9.4	9.9	8.3	9.6	9.6	9.5	13.4
Poor	1.2	1.6	1.1	1.2	1.1	1.2	1.2	1.2	1.3

Note: SD=standard deviation; IQR=interquartile range; REF=reference

Table 2. Bivariate Analysis

	Use of Prescription Sleep Aid				Use of Prescription Medications with Sedative Properties			
	Yes				Yes			
Variables	**Frequency**	**%**	**X**	***P***	**Frequency**	**%**	**X**	***P***
Part 1: Work Hour Categories								
≥ 36 hours/week								
30-35	621	12.3	3.3	0.071	3,611	13.0	0.9	0.337
≥ 36	4,432	87.7			24,244	87.0		
≥ 46 hours/week								
31-45	4,041	80.0	2.8	0.096	22,470	80.7	1.1	0.301
≥ 46	1,012	20.0			5,385	19.3		
≥ 56 hours/week								
31-55	4,680	92.6	6.4	0.012	25,925	93.1	10.9	0.001
≥ 56	373	7.4			1,930	6.9		
≥ 66 hours/week								
31-65	4,949	97.9	0.5	0.501	27,297	98.0	1.1	0.288
≥ 66	104	2.1			558	2.0		
Part 2: Predisposing Factors								
Age (years)								
18-26	201	4.0	151.2	0.000	1,927	6.9	217.2	0.000
27-64	4,556	90.2			24,185	86.8		
≥ 65	296	5.9			1,743	6.3		
Race								
White	4,262	75.1	259.2	0.000	21,062	75.6	24.7	0.000
Black	482	17.0			4,771	17.1		
Other	309	7.9			2,022	7.3		
Sex								
Male	1,999	42.5	19.4	0.000	11,667	41.9	7.2	0.007
Female	3,054	57.5			16,188	58.1		
Marital Status								
Married	2,722	53.9	67.0	0.000	15,105	54.2	143.4	0.000
Divorced	1,287	25.5			6,553	23.5		
Unmarried	1,044	20.7			6,197	22.3		
Family Size								
0 - 3 members	3,914	77.5	177.3	0.000	20,138	72.3	190.1	0.000
4 - 6 members	1,104	21.9			7,371	26.5		
> 6 members	35	0.7			346	1.2		
Education Level								
Less than College	1,636	32.4	68.1	0.000	10,656	38.3	3.2	0.072
Some College or more	3,417	67.6			17,199	61.7		

(continued)

Table 2. (Continued)

	Use of Prescription Sleep Aid				Use of Prescription Medications with Sedative Properties			
	Yes				Yes			
Variables	**Frequency**	**%**	**X**	***P***	**Frequency**	**%**	**X**	***P***
Occupation								
Natural resources	278	5.5	55.9	0.000	1,761	6.3	21.0	0.001
Hospitality services	268	5.3			1,822	6.5		
Trade	520	10.3			3,167	11.4		
Professional services	2,166	42.9			11,050	39.7		
Manufacturing	564	11.2			3,120	11.2		
Other	1,257	24.9			6,935	24.9		
Year								
2010	474	9.4	62.1	0.000	2,768	9.9	103.2	0.000
2011	526	10.4			2,892	10.4		
2012		10.0			2,918	10.5		
2013	491	9.7			2,867	10.3		
2014	531	10.5			2,952	10.6		
2015	506	10.0			3,046	10.9		
2016	485	9.6			2,811	10.1		
2017	501	9.9			2,599	9.3		
2018	513	10.2			2,596	9.3		
2019	521	10.3			2,406	8.6		
Part 3: Enabling Factors								
Region								
Northeast	673	13.3	20.7	0.000	3,790	13.6	16.9	0.001
North Central/Midwest	1,309	25.9			6,637	23.8		
South	1,846	36.5			10,841	38.9		
West	1,225	24.2			6,587	23.7		
Income								
Poor to low income	957	18.9	37.8	0.000	6,243	22.4	0.0	0.924
Middle to high income	4,096	81.1			21,612	77.6		
Receipt of food stamp (No - REF)								
No	4,661	92.2	10.1	0.001	25,214	90.5	12.0041	0.001
Yes	392	7.8			2,641	9.5		
Part 4: Need Factors								
Health Status								
Excellent	492	9.7	142.2	0.000	3,106	11.2	700.7854	0.000
Good	3,733	73.9			20,235	72.6		
Fair	713	14.1			3,949	14.2		
Poor	115	2.3			565	2.0		

Note: N=Frequency, %=Percentage; X=Chi-Square; *P*=p-value; REF=reference

Table 3. Regressions for the Use of Prescription Sleep Aids.

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid=YES)
Work hours/week					
≥ 56 h/week	0.046***	0.065*	1.126*	0.007*	0.370**
	(0.021, 0.070)	(0.015, 0.114)	(1.008, 1.258)	(0.000, 0.014)	(0.128, 0.611)
Age (18-26years - REF)					
27-64 years	0.104***	0.305***	2.203***	0.034***	0.513**
	(0.080, 0.127)	(0.254, 0.355)	(1.895, 2.561)	(0.030, 0.039)	(0.180, 0.847)
≥ 65 years	0.068***	0.251***	1.988***	0.028***	0.256
	(0.032, 0.103)	(0.179, 0.322)	(1.639, 2.412)	(0.020, 0.036)	(-0.168, 0.680)
Race (White - REF)					
Black	-0.127***	-0.313***	0.456***	-0.037***	-0.403***
	(-0.144, -0.109)	(-0.349, -0.277)	(0.413, 0.504)	(-0.040, -0.033)	(-0.624, -0.182)
Other	-0.086***	-0.171***	0.687***	-0.021***	-0.557***
	(-0.109, -0.063)	(-0.218, -0.124)	(0.610, 0.775)	(-0.026, -0.015)	(-0.822, -0.292)
Sex (Male - REF)					
Female	0.014*	0.046***	1.114***	0.006***	-0.022
	(0.001, 0.027)	(0.020, 0.073)	(1.047, 1.186)	(0.003, 0.010)	(-0.158, 0.113)
Marital status (Married - REF)					
Divorced	0.028***	0.053**	1.126**	0.007**	0.064
	(0.012, 0.045)	(0.021, 0.085)	(1.046, 1.211)	(0.003, 0.011)	(-0.094, 0.222)
Unmarried	0.002	0.009	1.035	0.002	-0.098
	(-0.015, 0.019)	(-0.025, 0.043)	(0.955, 1.122)	(-0.003, 0.007)	(-0.274, 0.079)
Family size (≤ 3 Members REF)					
4-6 Members	-0.072***	-0.171***	0.670***	-0.021***	-0.233**
	(-0.086, -0.058)	(-0.200, -0.141)	(0.623, 0.721)	(-0.025, -0.018)	(-0.393, -0.073)
> 6 Members	-0.101***	-0.307***	0.437***	-0.037***	0.071
	(-0.151, -0.051)	(-0.418, -0.197)	(0.311, 0.615)	(-0.048, -0.027)	(-0.686, 0.827)
Education (Less than college - REF)					
Some college or more	0.026***	0.086***	1.235***	0.012***	-0.078
	(0.012, 0.039)	(0.059, 0.114)	(1.157, 1.319)	(0.008, 0.015)	(-0.221, 0.065)
Occupation (Natural resources - REF)					
Hospitality services	0.022	0.02	1.037	0.002	0.234
	(-0.012, 0.056)	(-0.049, 0.090)	(0.869, 1.237)	(-0.007, 0.010)	(-0.152, 0.619)
Trade	0.035*	0.06	1.12	0.006	0.293
	(0.005, 0.065)	(-0.001, 0.121)	(0.961, 1.305)	(-0.002, 0.013)	(-0.040, 0.626)
Professional services	0.063***	0.123***	1.308***	0.015***	0.338*

	(0.036, 0.089)	(0.069, 0.177)	(1.142, 1.497)	(0.008, 0.021)	(0.043, 0.632)
Manufacturing	0.049**	0.094**	1.230**	0.011**	0.294
	(0.019, 0.079)	(0.034, 0.155)	(1.059, 1.428)	(0.003, 0.019)	(-0.033, 0.621)
Other	0.041**	0.094***	1.238**	0.011**	0.16
	(0.014, 0.069)	(0.039, 0.149)	(1.079, 1.420)	(0.004, 0.018)	(-0.140, 0.460)
Year (2010 - REF)					
2011	0.011	-0.008	0.964	-0.002	0.276
	(-0.017, 0.038)	(-0.064, 0.047)	(0.847, 1.096)	(-0.010, 0.005)	(-0.004, 0.556)
2012	-0.004	-0.051	0.856*	-0.009*	0.363*
	(-0.031, 0.023)	(-0.106, 0.004)	(0.752, 0.975)	(-0.016, -0.001)	(0.080, 0.645)
2013	0.009	-0.02	0.922	-0.005	0.372*
	(-0.019, 0.037)	(-0.076, 0.036)	(0.809, 1.052)	(-0.012, 0.003)	(0.087, 0.657)
2014	-0.006	-0.02	0.953	-0.003	0.004
	(-0.033, 0.022)	(-0.075, 0.036)	(0.837, 1.084)	(-0.010, 0.005)	(-0.276, 0.284)
2015	-0.019	-0.049	0.885	-0.007	0.015
	(-0.047, 0.008)	(-0.104, 0.006)	(0.777, 1.008)	(-0.014, 0.000)	(-0.268, 0.298)
2016	-0.011	-0.04	0.896	-0.006	0.119
	(-0.039, 0.016)	(-0.096, 0.016)	(0.786, 1.023)	(-0.014, 0.001)	(-0.167, 0.405)
2017	0.022	0.011	0.986	-0.001	0.401**
	(-0.006, 0.050)	(-0.045, 0.068)	(0.865, 1.123)	(-0.009, 0.007)	(0.118, 0.685)
2018	0.018	0.013	0.996	0	0.297*
	(-0.011, 0.046)	(-0.044, 0.070)	(0.874, 1.135)	(-0.008, 0.008)	(0.014, 0.581)
2019	0.033*	0.083**	1.191**	0.011**	0.053
	(0.003, 0.062)	(0.024, 0.141)	(1.046, 1.357)	(0.003, 0.020)	(-0.228, 0.335)
Region (Northeast - REF)					
North central, Midwest	0.028**	0.059**	1.150**	0.008**	0.065
	(0.007, 0.049)	(0.017, 0.100)	(1.043, 1.267)	(0.003, 0.013)	(-0.146, 0.275)
South	0.015	0.034	1.09	0.005	0.032
	(-0.004, 0.035)	(-0.005, 0.073)	(0.994, 1.196)	(-0.000, 0.010)	(-0.169, 0.233)
West	-0.01	0.004	1.036	0.002	-0.223*
	(-0.031, 0.011)	(-0.037, 0.045)	(0.940, 1.143)	(-0.003, 0.007)	(-0.437, -0.008)
Income (Poor to low income - REF)					
Middle to high income	0.001	0.014	1.041	0.002	-0.095
	(-0.016, 0.018)	(-0.021, 0.049)	(0.957, 1.132)	(-0.002, 0.007)	(-0.282, 0.092)
Receipt of food stamp (No - REF)					
YES	0.028*	0.046	1.092	0.005	0.231
	(0.005, 0.052)	(-0.005, 0.097)	(0.970, 1.228)	(-0.002, 0.012)	(-0.032, 0.494)
Health status (Excellent - REF)					
Good	0.058***	0.155***	1.469***	0.019***	0.219*
	(0.040, 0.076)	(0.119, 0.192)	(1.333, 1.618)	(0.015, 0.023)	(0.005, 0.432)
Fair	0.157***	0.308***	1.950***	0.037***	0.864***
	(0.132, 0.181)	(0.257, 0.358)	(1.729, 2.200)	(0.030, 0.044)	(0.601, 1.128)
Poor	0.258***	0.469***	2.609***	0.061***	1.082***
	(0.203, 0.312)	(0.359, 0.580)	(2.102, 3.238)	(0.043, 0.080)	(0.620, 1.545)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF=reference

Table 4. Regressions for the Use of Prescription Medications with Sedative Properties

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications=YES)
Work hours/week					
≥ 56 h/week	0.186***	0.114***	1.094**	0.020**	0.347***
	(0.119, 0.253)	(0.065, 0.163)	(1.032, 1.160)	(0.007, 0.033)	(0.187, 0.506)
Age (18-26years - REF)					
27-64 years	0.292***	0.235***	1.291***	0.054***	0.515***
	(0.228, 0.356)	(0.191, 0.278)	(1.216, 1.370)	(0.042, 0.067)	(0.344, 0.686)
≥ 65 years	0.376***	0.334***	1.495***	0.088***	0.481***
	(0.279, 0.473)	(0.266, 0.401)	(1.372, 1.629)	(0.069, 0.107)	(0.244, 0.718)
Race (White - REF)					
Black	-0.201***	-0.089***	0.974	-0.006	-0.502***
	(-0.248, -0.154)	(-0.121, -0.056)	(0.934, 1.015)	(-0.015, 0.003)	(-0.616, -0.389)
Other	-0.214***	-0.137***	0.893***	-0.025***	-0.452***
	(-0.277, -0.152)	(-0.180, -0.095)	(0.845, 0.945)	(-0.037, -0.013)	(-0.609, -0.295)
Sex (Male - REF)					
Female	0.001	0.008	1.016	0.003	-0.019
	(-0.034, 0.037)	(-0.017, 0.033)	(0.984, 1.049)	(-0.004, 0.011)	(-0.107, 0.068)
Marital status (Married - REF)					
Divorced	0.158***	0.085***	1.060**	0.013**	0.298***
	(0.113, 0.202)	(0.054, 0.117)	(1.020, 1.102)	(0.004, 0.022)	(0.193, 0.402)
Unmarried	-0.052*	-0.060***	0.919***	-0.018***	-0.019
	(-0.098, -0.006)	(-0.092, -0.028)	(0.882, 0.958)	(-0.027, -0.010)	(-0.132, 0.095)
Family size (≤ 3 Members REF)					
4-6 Members	-0.232***	-0.184***	0.816***	-0.045***	-0.330***
	(-0.271, -0.193)	(-0.211, -0.157)	(0.788, 0.845)	(-0.052, -0.037)	(-0.427, -0.234)
> 6 Members	-0.434***	-0.342***	0.682***	-0.081***	-0.704***
	(-0.569, -0.298)	(-0.431, -0.253)	(0.600, 0.775)	(-0.106, -0.056)	(-1.071, -0.338)
Education (Less than college - REF)					
Some college or more	-0.001	-0.001	0.999	0	-0.003
	(-0.037, 0.036)	(-0.027, 0.025)	(0.967, 1.032)	(-0.007, 0.007)	(-0.092, 0.085)
Occupation (Natural resources - REF)					
Hospitality services	0.051	0.046	1.069	0.014	-0.009
	(-0.041, 0.142)	(-0.017, 0.110)	(0.984, 1.160)	(-0.003, 0.032)	(-0.237, 0.219)
Trade	0.146***	0.093**	1.086*	0.018*	0.251*
	(0.065, 0.227)	(0.036, 0.149)	(1.010, 1.169)	(0.002, 0.034)	(0.049, 0.452)
Professional services	0.126***	0.106***	1.138***	0.028***	0.103

	(0.053, 0.199)	(0.056, 0.156)	(1.067, 1.215)	(0.014, 0.042)	(-0.078, 0.284)
Manufacturing	0.056	0.067*	1.110**	0.023**	-0.047
	(-0.025, 0.137)	(0.011, 0.123)	(1.032, 1.194)	(0.007, 0.038)	(-0.248, 0.154)
Other	0.069	0.080**	1.134***	0.028***	-0.064
	(-0.005, 0.143)	(0.029, 0.131)	(1.062, 1.212)	(0.013, 0.042)	(-0.247, 0.120)
Year (2010 - REF)					
2011	-0.002	-0.076**	0.841***	-0.039***	0.325***
	(-0.077, 0.073)	(-0.130, -0.023)	(0.787, 0.898)	(-0.054, -0.024)	(0.147, 0.503)
2012	-0.111**	-0.164***	0.764***	-0.060***	0.163
	(-0.185, -0.038)	(-0.216, -0.112)	(0.716, 0.815)	(-0.075, -0.045)	(-0.014, 0.341)
2013	-0.034	-0.086**	0.851***	-0.037***	0.181*
	(-0.110, 0.041)	(-0.139, -0.033)	(0.797, 0.909)	(-0.051, -0.022)	(0.003, 0.359)
2014	-0.059	-0.107***	0.834***	-0.041***	0.133
	(-0.133, 0.016)	(-0.159, -0.054)	(0.781, 0.890)	(-0.056, -0.026)	(-0.044, 0.310)
2015	-0.066	-0.097***	0.854***	-0.036***	0.084
	(-0.140, 0.008)	(-0.150, -0.045)	(0.800, 0.911)	(-0.050, -0.021)	(-0.091, 0.260)
2016	-0.034	-0.097***	0.831***	-0.042***	0.229*
	(-0.109, 0.041)	(-0.150, -0.044)	(0.777, 0.887)	(-0.057, -0.027)	(0.050, 0.408)
2017	0.047	-0.065*	0.831***	-0.042***	0.452***
	(-0.030, 0.124)	(-0.120, -0.011)	(0.777, 0.889)	(-0.057, -0.027)	(0.269, 0.634)
2018	0.068	-0.05	0.844***	-0.038***	0.484***
	(-0.009, 0.145)	(-0.105, 0.005)	(0.789, 0.903)	(-0.054, -0.023)	(0.301, 0.667)
2019	0.06	0.01	0.965	-0.008	0.236*
	(-0.020, 0.141)	(-0.048, 0.067)	(0.900, 1.034)	(-0.024, 0.008)	(0.049, 0.423)
Region (Northeast - REF)					
North central, Midwest	0.073*	0.049*	1.043	0.009	0.139*
	(0.016, 0.129)	(0.010, 0.089)	(0.993, 1.097)	(-0.002, 0.020)	(0.002, 0.275)
South	0.039	0.03	1.03	0.007	0.074
	(-0.013, 0.092)	(-0.007, 0.067)	(0.983, 1.079)	(-0.004, 0.017)	(-0.053, 0.202)
West	-0.059*	-0.029	0.984	-0.004	-0.126
	(-0.115, -0.003)	(-0.068, 0.010)	(0.936, 1.034)	(-0.014, 0.007)	(-0.263, 0.011)
Income (Poor to low income - REF)					
Middle to high income	-0.006	-0.004	0.993	-0.001	0
	(-0.052, 0.040)	(-0.037, 0.028)	(0.954, 1.035)	(-0.011, 0.008)	(-0.112, 0.112)
Receipt of food stamp (No - REF)					
YES	0.216***	0.152***	1.147***	0.031***	0.364***
	(0.152, 0.280)	(0.105, 0.199)	(1.084, 1.213)	(0.018, 0.044)	(0.211, 0.517)
Health status (Excellent - REF)					
Good	0.309***	0.259***	1.356***	0.064***	0.508***
	(0.261, 0.357)	(0.227, 0.291)	(1.296, 1.418)	(0.055, 0.073)	(0.379, 0.638)
Fair	0.932***	0.678***	1.957***	0.150***	1.407***
	(0.866, 0.999)	(0.630, 0.727)	(1.844, 2.076)	(0.137, 0.163)	(1.245, 1.570)
Poor	1.841***	1.199***	2.591***	0.219***	2.689***
	(1.693, 1.989)	(1.070, 1.328)	(2.287, 2.936)	(0.188, 0.249)	(2.382, 2.997)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF=reference

CHAPTER TWO: LONG WORKING HOURS AND ONSET OF PSYCHOLOGICAL DISTRESS: A LONGITUDINAL ANALYSIS

2.0. OVERVIEW

OBJECTIVES: Long working hours have been associated with adverse health outcomes such as cardiovascular diseases and symptoms of psychological distress. Despite the high prevalence of long working hours, and psychological distress in the U.S., longitudinal studies examining the relationship between working hours and psychological distress among U.S. workers are sparse. Thus, the aim of this study was to investigate the relationship between long working hours and psychological distress using a nationally representative panel of full-time workers in the U.S.

METHODS: The 2010-2019 Medical Expenditure Panel Survey (MEPS) data from the University of Minnesota's Integrated Public Use Microdata Series (IPUMS) was utilized. The dependent variable was self-reported psychological distress measured and identified using the Kessler-6 scale. Using a subset MEPS, comprised of full-time employees without psychological distress at baseline were identified. Furthermore, fixed-effect linear model were utilized in modeling the relationship between working hours and the onset of psychological distress.

RESULTS: Overall, the sample comprised 27,562 full time workers in the U.S with 55,124 observations. The highest significant rate of onset of psychological distress was observed at 7.0% (95% Confidence Interval, CI=0.8%, 13.3%, $p < 0.05$) for individuals working 61 hours or more per week (h/week), with the 30-35 h/week per week category as the reference. Also, we found that men working 51-60 h/week were significantly associated with a 7.2% increase in the onset of psychological distress (CI=0.2%, 14.2%, $p < 0.05$) as compared to men working 30-35 h/week.

CONCLUSION: Overall, the results of this study indicate a positive association between working long hours and the onset of psychological distress. The highest risk was found in individuals who worked very long hours, and a risk increase was also observed among those who worked regular, standard hours per week when compared to those working fewer hours per week.

2.1. INTRODUCTION

Mental disorders, such as psychological distress (P.D.), are reported to account for about 50% of all long-term disability and morbidity in the working-age population in the Organization for Economic and Development (OECD) countries (Afonso et al., 2017). Psychological distress refers mental illness and may include signs of anxiety and depression (Bessaha, 2017). It is usually measured using the Kessler-6 (K6) scale. (Kabir, 2021; Kessler, Barker, et al., 2003). While some research reports the K6 scale as unidimensional depicting only a single factor of nonspecific psychological distress, other research indicates the K6 depicts two factors of psychological distress, mostly anxiety and symptoms of depression (Lace et al., 2020).

Psychological distress and other mental illnesses continue to be a leading cause of disease burden globally (Collaborators, 2022). A recent study reported that approximately 14% of adults in the United States (U.S.) experienced severe psychological distress in 2020 (McGinty et al., 2020). While this prevalence of psychological distress may have partially been influenced by the COVID-19 pandemic, several studies have shown similar and consistent estimates of the prevalence of psychological distress and related mental disorders, such as depression and anxiety (Bischoff et al., 2017; Collaborators, 2022; Kessler et al., 2009).

Long working hours have been linked with negative health outcomes such as cardiovascular diseases (Bannai & Tamakoshi, 2014; Cheng et al., 2014; Grosch et al., 2006; Lunde et al., 2016; Wong et al., 2019) and symptoms of psychological distress (Cheng et al., 2014; Lallukka et al., 2008; Lunde et al., 2016; Skogstad et al., 2019; Virtanen & Kivimäki, 2012). Additionally, long working hours are more prevalent in the

U.S. and Asian countries (Virtanen et al., 2018; Virtanen & Kivimäki, 2012) when compared to European countries.

A significant proportion of employees in the U.S. work longer than 40 hours per week (Williams, 2001). The International Labor Organization ranked the U.S. as the fourth highest nation in terms of the proportion of workers who worked above 48 hours per week between 2004 and 2005 (Bannai et al., 2015). This prevalence of long working hours among U.S. employees is influenced by several factors, such as incentives for higher earnings, career needs, and strong cultural influences.

Research examining the relationship between working hours and psychological distress has produced mixed results. While some studies have found statistically significant associations between long working hours and psychological distress (Afonso et al., 2017; Li et al., 2019; Virtanen et al., 2011; Wong et al., 2019), others have reported no significant associations (Angrave & Charlwood, 2015; Lee et al., 2017; Rugulies et al., 2019). These differences in findings could be mainly attributed to challenges in study design and analysis, such as cross-sectional designs, reverse causality, and endogeneity.

Cross-sectional designs, which are unable to infer causality, may not account for mental health status at baseline, thereby confounding the relationship between working hours and psychological distress. Reverse causality may arise when part-time workers are included in the analysis, as part-time work could be due to pre-existing health problems such as psychological distress (De Raeve et al., 2009; Virtanen et al., 2011). In addition, while it is crucial to control for relevant mediators and confounders, it is also necessary to be cognizant of the endogeneity that exists in the relationship between working hours and psychological distress. Hence, using analytic methods such as fixed effects, which

considerably account for endogeneity, would be beneficial in addressing this challenge (Cameron & Trivedi, 2010; Mousteri et al., 2020).

Considering the ethical challenges inherent in conducting randomized controlled studies using long working hours as an exposure, various systematic reviews and meta-analyses have been performed in an effort to establish the relationship between working hours and the development of psychological distress (Bannai & Tamakoshi, 2014; Rivera et al., 2020; Rugulies et al., 2021; Theorell et al., 2015; Virtanen et al., 2018; Watanabe et al., 2016). However, many of these studies (Bannai & Tamakoshi, 2014; Rivera et al., 2020; Theorell et al., 2015) have relied heavily on published cross-sectional studies. On the other hand, (Watanabe et al., 2016) reviewed seven cohort studies and found an inconclusive or non-statistically significant relationship between long working hours and the onset of depressive symptoms. While the study had a heterogeneous mix of studies from various countries, none of the studies included in their analysis were from the U.S. due to the scarcity of published longitudinal studies examining the relationship between long working hours and the onset of psychological distress in the U.S. Additionally, (Virtanen et al., 2018) a meta-analysis of 10 published and 18 unpublished prospective cohort studies with individual participant data and found no significant association between long working hours and depressive symptoms in North American studies.

Recently, (Rugulies et al., 2021) a study conducted a systematic and meta-analytic review of 22 cohort studies and found inconclusive evidence for the effect of long working hours on the onset of depression. Another limitation in some existing prospective studies is establishing psychological distress status at baseline. For instance, the study conducted by Dembe & Yao (2016), which evaluated 32 years of work history

(1979 to 2009), did not measure baseline depression. The inability to measure depressive symptoms at baseline was due to limitations in the methodology used in assessing depressive symptoms and chronic illness by the dataset - NLSY79 (National Youth Longitudinal Survey, 1979). This resulted in a missed assessment of baseline depression since information on chronic diseases was collected when the participants of the survey turned 40 years.

Despite the abundance of studies examining long working hours in Asian countries such as Japan and South Korea, comparatively fewer studies have examined long working hours in the U.S. (Li et al., 2019). Hence, in cognizance of the high prevalence of long working hours, psychological distress, and a lack of longitudinal studies investigating the relationship between long working hours and psychological distress among U.S. workers, the objective of this study was to examine the relationship between long working hours and psychological distress using a nationally representative panel of full-time workers in the U.S. The objective was to determine if long working hours predict the future onset of psychological distress in U.S. full-time employees without symptoms of psychological distress at baseline while controlling for endogeneity.

We utilized a modified WHO logic model (Pega et al., 2021; Rugulies et al., 2021) in this study. This model is based on the idea that the relationship between risk factors and outcomes is complex and can be understood through a process-oriented approach (Rehfuess et al., 2018). It is an a priori model, meaning it is constructed before data is collected. Similar models have been previously employed in examining the relationship between risk factors, chronic diseases (Pega et al., 2021; Rugulies et al., 2021), and health behaviors (Pachito et al., 2021).

The conceptual model, shown in *Figure 2* (Pega et al., 2021; Rugulies et al., 2021), informs that impact of long working hours on psychological distress is mediated through two main causal pathways: psycho-physiological changes and health-behavioral changes. The psycho-physiological changes pathway posits that exposure to long working hours causes the release of excessive stress hormones, activating the hypothalamic-pituitary-adrenal (HPA) axis, leading to structural lesions and functional dysregulation of the adrenal systems (Kivimäki & Steptoe, 2018), and sleep disorders (Bannai & Tamakoshi, 2014; Kronfeld-Schor & Einat, 2012). In our study we used participants' chronic disease status as a representative of this mediator. The second pathway occurs through health-related behaviors such as physical inactivity, alcohol consumption, and the use of sleep medications (Pega et al., 2021; Rugulies et al., 2021). In our study we used participants' use of medications with sedative side effects as a representative of this mediator.

We hypothesize that persons working long hours will have a higher likelihood of developing psychological distress.

Furthermore, we controlled for possible confounding factors, such as age, gender, and Social Economic Status (SES) represented by various indicators, including marital status, family size, education, occupation, region, income, and receipt of Supplemental Nutrition Assistance Program benefits. Prior studies have shown that these factors have an effect on the relationship between long working hours and psychological distress. It is known that age, sex, and SES can be linked with psychological distress (Angrave & Charlwood, 2015; Bonde, 2008; Kessler, Berglund, et al., 2003), and it is important to

control for these factors in order to draw valid conclusions about the relationship between long working hours and psychological distress.

2.2. METHODS

2.2.1. Data Sources

We used data from the 2010-2019 Medical Expenditure Panel Survey (MEPS), a longitudinal national probability survey (Blewett, 2020; Quality, 2020). This survey is performed by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS). It gathers information on health services access, utilization, expenditures, and other health-related data for non-institutionalized civilians in the U.S. The sample for MEPS is drawn from respondents of the previous year's National Health Interview Survey (NHIS). MEPS uses a panel design with five rounds of interviews over two years, with data from the first two rounds collected in the first year and data from the remaining rounds collected in the second year.

The MEPS Household Component (MEPS-HC) commenced in 1996 and provides data on participant demographics, health and employment status, healthcare utilization, healthcare expenditures by payer, insurance coverage, and satisfaction with healthcare. MEPS and NHIS oversample minority groups such as African Americans and Hispanics to increase the precision of estimates. Response rates for MEPS range from 46-71% after accounting for nonresponse rates from NHIS. MEPS-HC can be used to produce national estimates and analyzed at the individual or event level.

MEPS also includes a Medical Provider Component (MEPS-MPC), which collects additional or replacement information for the MEPS-HC survey. In addition, the MEPS-MPC includes a pharmacy component that gathers medication details, including

the national drug code (NDC) and generic names. However, MEPS-MPC is not designed to produce national estimates, so we only weighted the MEPS-HC component of the study in the descriptive statistics.

2.2.2 IRB Approval Statement

This study received approval as exempt from the University of Louisville's Institutional Review Board (IRB # 21.0849). We used a publicly available, de-identified dataset for the research. It did not meet the definition of human subjects research under the common rule, so it was classified as Non-Human Subjects Research (NHSR).

2.2.3 Data Organization

We used a pooled sample design and applied listwise deletion to eliminate missing cases. The MEPS dataset consists of 20 files, so we used the refined and organized version of the MEPS surveys provided by the University of Minnesota's Integrated Public Use Microdata Series (IPUMS) to facilitate data management (Blewett, 2020). The IPUMS MEPS is funded by the National Institute of Child Health and Human Development (NICHD) and offers integrated data files for each year of the MEPS-HC survey, allowing the researcher to select specific variables before downloading the dataset.

We merged the IPUMS MEPS-HC with the prescription medicine event files in the MEPS Pharmacy component, which contain information on prescribed medications obtained or purchased by participating households. Each record represents a single prescribed medication reported for an individual within a survey round, which is

approximately 4 – 5 months between data collection periods. We downloaded prescription data files from 2010-2019. We merged them with the MEPS-HC component using the identifier variable "mepsid," which defines distinct households in the H.C. data set and pharmacy component. Thus, the mepsid enables linking the H.C. data and pharmacy component.

2.2.4 Dependent Variable

The dependent variable is psychological distress. It was recoded as a binary variable (Yes or No). The Kessler-6 (K6) scale was used in this study to identify individuals with psychological distress in the study population. The K6 is a tool for measuring general psychological distress in the community rather than a specific mental health disorder (Kabir, 2021; Kessler, Barker, et al., 2003). It is made up of six questions that ask respondents about their experiences of feelings such as nervousness, hopelessness, restlessness, depression, and perceived effort exertion and worthlessness, over the past 30 days, using a five-point Likert scale. Respective scores from each question are added to create a total K6 score ranging from 0 to 24. Respondents with a score less than five are considered to have no psychological distress; No, while those with a score of 5 or above are considered to have psychological distress; Yes (Kessler, Barker, et al., 2003). The K6 scale is valid and reliable (Kessler et al., 2002) and scores are correlated with anxiety and depression (Kubiak et al., 2012; Lace et al., 2020).

Also, the K6 scale has been validated using the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) and was determined to have good precision (estimated at the 99th percentile range of the population distribution) and consistent psychometric properties in several sociodemographic subgroups. It has also

been more effective than other scales, such as the General Health Questionnaire (GHQ), in identifying DSM-IV mood and anxiety disorders. The K6 scale has been successfully translated and used in various settings and cultures, maintaining a high level of internal consistency with a Cronbach's alpha greater than 0.80 (Easton et al., 2017).

Furthermore, we contacted the MEPS–AHRQ to obtain further information on how psychological distress was measured in the survey. MEPS-AHRQ informed our team that variable K6 is derived from the Self-Administered Questionnaire (SAQ), which is administered once each year in round 2 for the panel in its first year and round 4 for the panel in its second year. Thus, after reviewing the five rounds of the dataset, we reserved only round 2 and round 4 observations, with round 2 (year 1) representing the study's baseline. Individuals with a k6 sum of 5 or above in round 2 were excluded.

2.2.5 Primary Independent Variable

In this study, the primary independent variable is the number of hours worked per week by respondents 18 years or older with a current main job. The data for this variable was collected from the MEPS-HC survey and excluded unpaid travel time to and from work. We used 30 hours per week as a baseline because it is considered full-time employment in the U.S. and enables eligibility for employer-provided health insurance coverage (Carroll & Miller, 2019; Dembe & Yao, 2016).

Previous research has shown that individuals who work fewer hours, such as part-time workers, may have different health characteristics (such as underlying health conditions) or may be working fewer hours due to family responsibilities (Kivimäki et al., 2015; Li et al., 2019; Virtanen et al., 2012). Therefore, these groups of individuals who work fewer hours may not be appropriate comparators.

Number of work hours per week is a count variable in MEPS and was stratified into five distinct categories for this study: 30-35 hours per week (h/week), 36-40 h/week, 41-50 h/week, 51-60 h/week, and 61 h/week or more. This stratification provided an effort to identify the best threshold for long working hours in relation to the onset of psychological distress.

2.2.6 Covariates

The selection of covariates in this study was guided by a conceptual framework based on the World Health Organization's logic model described above. Age, marital status and family size were categorized into two groups: 18-64 years and 65 years or older (65 years representing a benchmark for transitioning to normal retirement age – including start of Medicare eligibility {Bairoliya, 2021 #1355}), married and unmarried (including divorced, widowed, and separated), two members or fewer, and greater than two members, respectively. While race was divided into three categories: White, Black, and other.

Education was divided into two categories: less than a college education and some college education or more. The occupation was divided into two categories: professional services (including management and financial occupations) and non-professional services (including jobs in the natural resources, leisure, trade, and related sectors).

Other socioeconomic factors included region, income, chronic disease status, and receipt of food stamps. The region was divided into four categories: Northeast, Midwest, South, and West. Income was divided into two categories: poor to low income (less than 100%-199% of the federal poverty line) and middle to high income (200% or more of the

federal poverty line). Chronic disease status and receipt of food stamps were recorded as binary variables (yes or no). Chronic diseases include a history of heart conditions and complications, cancer, arthritis, and asthma.

2.2.8 Sedative Medications and Medications with Sedative Side Effects:

Sedative and hypnotic medications, referred to as "sleep aids," are commonly used to induce or maintain sleep as they can suppress the central nervous system (Chong et al., 2013). It is not uncommon for individuals to use prescribed and controlled medications for their sedating side effects or recreationally. Other medical literature on the off-label use of medications not specifically intended for insomnia suggests that people may use various products with sedative properties to aid sleep. The widely referenced "Up to Date" peer-reviewed clinical practice reference includes a section on medications that can be used off-label for insomnia, such as certain antidepressants (Neubauer et al., 2021).

We utilized data from the prescription medicines event files of the Medical Expenditure Panel Survey (MEPS) pharmacy component to investigate the use of sleep aids and medications with sedative properties. We defined a prescription as any recorded instance of a specific medication and its corresponding supply frequency (Chen et al., 2020). The number of prescriptions was analyzed as a continuous quantitative variable. Utilizing the Multum Lexicon Therapeutic class Codes within MEPS, we identified medications classified as sleep aids. This classification system, integrated within the MEPS prescribed medicine files, represents the most recent categorization of medications available during data collection. Examples of medications classified as sleep aids include anxiolytics, sedatives, and hypnotics.

To identify medications with sedation as a side effect, we used Drug Facts and Comparisons®. This referential drug resource lists common or serious adverse effects of medications, such as drowsiness, dizziness, sluggishness, or heaviness (*Appendix 1*) (Comparisons eAnswers., 2021). This resource, produced by Wolters Kluwer Health, is a comprehensive compendium that provides access to various databases, modules, and medication reference tools for pharmacists and drug information experts (Grizzle et al., 2019; Roblek et al., 2015). It is widely considered a reliable source of drug information, with a completeness score of 95.8% and high rankings alongside other leading medication identifiers (Clauson et al., 2007; Jackevicius et al., 2019; Roblek et al., 2015). Additionally, Drug Facts and Comparisons® has also been found to have a sensitivity of 93% and a positive predictive value of 95.3% in identifying black box warnings (Cheng et al., 2010).

2.2.9 Study Population

We extracted available individuals that participated in the survey between 2010 and 2019 (panel 14 to 22) resulting in 193,750 unweighted individuals. Participants aged 18 years or older were then selected (142,716 individuals over the 10- year period). We then identified full time workers or respondents who worked 30 hours and above per week during the survey period, yielding 77,913 participants. In addition, participants with missing variables and rounds were excluded from this study, this further shrunk the sample to 33,414 respondents. Subsequently, individuals with no recorded psychological distress in the initial round (baseline) were then selected resulting the final sample of 27,562 individuals with 55,124 observations.

2.2.10 Data Analysis

The data were analyzed using Stata Statistical Software: Release 17 (StataCorp, 2021). Weights were applied to the MEPS-HC component to estimate descriptive statistics, taking into account the complex survey design of the MEPS, including the weight, clusters, and strata. Exploratory and descriptive statistics were used to examine the distribution of independent variables. The analysis of our main results was unweighted. However, following (Solon et al., 2015), we also conducted our analysis using sample weights and accounting for the complex survey design of the MEPS. The weighted results are reported in *Appendices 7 to 8*.

2.2.11 Statistical Analysis

We examined the effects of work hours on psychological distress in respondents. The sample sizes and longitudinal transitions across work hours groups (30-35 hours per week, 36-40 hours per week, 41-50 hours per week, 51-60 hours per week, and 61 hours per week or more) are detailed in *Appendices 3-4* of the paper.

Using a longitudinal model, with dependent variable represented by changes in psychological distress status, while the independent variable is working hours. Changes in psychological distress status (ΔPDS) is modeled as a function of changes in exposure to long working hours and changes in social economic variables. We employed a fixed-effect linear regression in modeling the relationship between working hours and the onset of psychological distress. Fixed-effects models take into account the correlations between the independent variables and the error terms specific to each unit in the model. A crucial benefit of using fixed effects is that it enables the ability to control for time-invariant confounding factors that have constant effects (Allison, 2009; Gunasekara et al., 2014).

Psychological distress is then modeled as a function of the individual's work hours and socioeconomic attributes using the following model:

$$PDS_{it} = \alpha + \beta_1 H_{it} + \beta_{2S} (X_{1,it} + X_{2,it} + \ldots + X_{S,it}) + t_t + \mu_i + \varepsilon_{it} \quad (1)$$

Where PDS_{it} is a measure of psychological distress for an individual at time t, β is the average effect of interest, H_{it} is a measure of working hours. $X_{1,it}, X_{2,it}, \ldots, X_{S,it}$ represents other time-varying demographic variables that could influence participants' psychological distress, including marital status, family size, occupation, income, and receipt of food stamps. μ_i are participant's specific effects and represents the use of fixed effects estimator, t_t represents a vector of year indicators, and ε_{it} is the random error term.

We examined the prevalent transitions across covariates and only included time-varying covariates with sufficient transitions (5% or more longitudinal changes between categories) during the survey period and shown in (*Appendix 5*). The covariates used in the fixed effect model include age, marital status, income, receipt of food stamps, family size, and occupation.

The fixed effects model enabled the investigation of the relationship between changes in psychological distress, changes in working hours, and other time-varying factors among individuals while controlling for constant individual characteristics. This approach was chosen as previous research and initial analysis suggested that pooled cross-sectional regression models may lead to biased results due to correlation with unobserved time-invariant characteristics (Angrave & Charlwood, 2015; Jindra et al., 2022; Wooden et al., 2009).

Furthermore, the choice of the fixed effect linear model was further influenced by our data which is a rare event data with less than 25 % percent of ones (individuals with psychological distress) as seen in the result section. Research informs that linear model yields more accurate predicted probabilities and results than logistic model (Timoneda, 2021). The analysis was conducted separately for each gender as prior studies suggests differences in vulnerability to psychological distress and work arrangement by gender (Ahn, 2018; Petrongolo, 2004). This decision was also influenced by the higher prevalence of psychological distress among females in the sample.

As a part of the sensitivity analyses, we employed crude fixed effect regressions to investigate the relationship between working hours and psychological distress. Additionally, we examined the within-person variation for the independent variable of working hours and other control variables.

2.3. RESULTS

2.3.1 Descriptive Statistics

Overall, the balanced sample comprised 27,562 full time workers in the United States individuals with 55,124 observations. We classified work hours into five distinct categories (30-35 h/week, 36-40 h/week, 41-50 h/week, 51-60 h/week, and ≥ 61 h/week), as presented in *Table 5*. Most of the respondents in our sample reported working between 36-40 h/week, representing 60.8% of the sample. On the other hand, the category of 66 or more hours per week had the smallest representation of the sample, at 2.7%. The majority of our sample consisted of individuals between the ages of 18 and 64 years (96%), with more than half of the participants identifying as male (57.7%).

By socioeconomic factors, the majority of the sample (80.3%) identified as White, with 11.1% identifying as Black and 8.6% identifying as Other. By marital status, 61.3% of the sample reported being married. Over half of the respondents had more than two family members in a household (52%). More than two-thirds of the respondents (67.7%) had at least a college education. Additionally, over half of the respondents worked in non-professional services (54.2%), with the largest representation of respondents being from the survey year 2015 (12.2%). The largest proportion of participants resided in the southern region of the U.S. (37.8%), followed by those living in the North Central-Midwest region (21.8%).

Most respondents in the sample (86.3%) were classified as middle to high-income earners, defined as those earning at least 200% and above the federal poverty threshold. In contrast, 13.7% of respondents were classified as poor to low-income earners, defined as those earning below 200% of the federal poverty threshold. Furthermore, over half of the respondents (53.8%) reported having a chronic disease. Additionally, 15.3% of the respondents reported using medications with sedative side effects, while 2.3% of the respondents reported using sedative prescriptions.

The prevalence of psychological distress among the respondents was 8.5%. In comparison to their representation in the sample, a higher prevalence of psychological distress was observed among females (48.4% vs. 42.3%) In comparison, men were 51.6% of those with psychological distress were men as compared to their 57.7% respective sample representation. Similar trends of higher prevalence of psychological distress versus respective sample representation were also found in the following covariates: non-professional services (75.6% vs. 74.2%), poor to low-income earners (17.9% vs. 13.7%),

food stamp recipients (5.8% vs. 4.1%), individuals with chronic diseases (59.6% vs. 53.2%), those using medications with sedative side effects (23.9% vs. 15.3%), and those using sedatives (5.7% vs. 2.3%).

2.3.2 Long Working Hours

The results of our study indicated a positive association between long working hours and the onset of psychological distress. In *Table 6*, the highest rate of onset was observed at 7% (95% Confidence Interval, CI=0.8%, 13.3%) for individuals working 61 hours or more per week, with the 30-35 h/week per week category as reference and statistical significance at $p < 0.05$. Furthermore, these relations are seen in *Figures 3* to *5*.

Respondents classified as middle to high-income earners exhibited a 1.6% (CI=0.5%, 2.7%) increase in the likelihood of developing psychological distress. Conversely, respondents who reported having greater than two members in their household were 2.4% (CI=-4.2%, -0.6%) less likely to develop psychological distress.

The results of our analysis by gender revealed a similar trend in the associations between working hours and the onset of psychological distress. Among male participants, we found that men working 51-60 hours per week were significantly associated with a 7.2% increase in the onset of psychological distress (CI=0.2%, 14.2%, $p < 0.05$). Additionally, positive associations ($p < 0.1$) were found between the 36-40 and 61 or more hours per week work hours categories, and the onset of psychological distress among men, associated with 5% (CI=-0.5%, 10.5%) and 8% (CI=-0.2%, 16.2%) increases respectively.

Among women participants, we found mixed but largely insignificant results. Specifically, working 61 or more hours per week was associated with a 9.4% (CI: -1.3%,

20.1%, $p < 0.1$) increase in the onset of psychological distress in women. However, we found negative associations between the 41-50 hours per week and the development of psychological distress, but they were largely statistically insignificant ($p > 0.1$).

2.3.3 Supplemental Analysis

Crude fixed-effects regression was conducted to examine the relationship between working hours and the onset of psychological distress without accounting for individual time-varying covariates. The results, presented in *Appendix 6*, indicate a consistent trend in the association between working hours and the development of psychological distress. Specifically, when using the 30-35 hours per week category as the reference, individuals working 66 or more hours per week were found to have a 7.3% (CI=1.1%, 13.5%) increase in the development of psychological distress, which was statistically significant at $p < 0.05$. Additionally, those who worked 36-40 hours per week were found to have a 3.7% (0.1%, 7.3%) increase in the onset of psychological distress, which was also significant at $p < 0.05$.

Additionally, following(Solon et al., 2015), we also conducted our analysis using sample weights and accounting for the complex survey design of the MEPS (*Appendices 7 to 8*). The analysis yielded similar results. Though the point estimates changed, the associations were similar to the unweighted results. The differences between the two sets (unweighted vs. weighted) were consistent with the observed heterogeneity in the treatment effects and the reported oversampling for minority groups in the MEPS (Quality, 2020; Schaller & Zerpa, 2019)

2.4. DISCUSSION

We examined long working hours as a predictor of psychological distress in a nationally representative sample of U.S. workers. The prevalence of psychological distress among the respondents was 8.5%. This is similar to the estimated global burden of mental illness at 10% (Collaborators, 2022).

We found that working 61 or more hours per week predicted the subsequent development of psychological distress while controlling for various confounding factors in the fixed effects model. This finding is consistent with prior research that reported a higher rate of psychological distress among individuals who work very high hours per week. For example, a study found that male school teachers in Japan working over 60 hours per week had 4.7 times increased odds of having psychological distress compared to those working 40 hours or less per week (Bannai et al., 2015).

Also, a study examining over 60,000 full-time employees in Australia, found that employees that worked 60 hours per week were associated with the highest odds for severe psychological distress (Hilton et al., 2009).Additionally, another study informed that Japanese white-collar employees working 80 hours or more weekly had a higher prevalence of psychological distress than those working 40 hours or less per week (Hino et al., 2015). Furthermore, the greatest gap in working time mismatch (preferred vs. actual work hours) has been reported in individuals working over 60 hours per week (Gerson & Jacobs, 2004).

Finding the ideal threshold of long working hours, the theoretical minimum level of exposure that would result in the lowest possible risk, has been previously debated (Murray et al., 2003; Rugulies et al., 2021; Virtanen et al., 2009). Interestingly, we found

that individuals who worked 36-40 hours per week had an increased likelihood of developing psychological distress compared to those who worked 30-35 h/week. This finding suggests the minimum level of exposure to long working hours could begin just above the standard weekly work hours for some individuals.

Additionally, underemployment may contribute to the risk of psychological distress, as individuals may experience decreased job satisfaction even if they are working fewer hours. Underemployment occurs when employees are not fully utilizing their qualifications and skills, either in terms of working hours or financial rewards. Prior research (Angrave & Charlwood, 2015) suggests that underemployed men and women working 35-40 h/week and less than 35 hours weekly, respectively, were associated with an increased risk of psychological distress.

Sex-stratified analyses revealed that working 61 h/week predicted a higher incidence of psychological distress in women (9.4%) compared to men (8.0%). The marginal statistical significance of the coefficient in the sex-stratified analyses suggests interpreting this result with caution. However, this weaker statistical significance could mainly have resulted from the relatively small number of samples in the sex-stratified analyses (*Appendices 3-4*). Compared to their representation in the sample, a higher prevalence of psychological distress was observed among females in our sample (48.4% vs. 42.3%). Prior studies have also reported a higher risk of the onset of symptoms of psychological distress among women working long hours (Dembe & Yao, 2016; Shields, 1999; Virtanen et al., 2011; Watanabe et al., 2016).

Women are more likely to work longer unpaid hours, including household chores, when compared to men, as reported in previous studies (Dembe & Yao, 2016; Watanabe

et al., 2016). Furthermore, women tend to experience more negative psychosocial work conditions that cumulatively contribute to poor health (Dembe & Yao, 2016; Denton et al., 2004; Watanabe et al., 2016).

We found that respondents with a greater number of individuals living in a household had a decreased likelihood of developing psychological distress. Previous studies (Grinde & Tambs, 2016; You & Henneberg, 2022) have suggested that larger family sizes can present social benefits such as a sense of belonging and support, which could have a protective and positive influence on mental health. On the other hand, studies (AMBREEN et al., 2016; Sobotka & Beaujouan, 2014) have also reported that larger families have a higher association with psychological distress. However, the relationship between psychological distress is multifaced and influenced by factors such as cultural identity and financial constraints.

Respondents categorized as middle to high-income earners had an increased risk of developing psychological distress. Middle to high-income earners are more likely to work longer hours and also in professional occupations, which may have further influenced the development of psychological distress in this group (Søvold et al., 2021).

Furthermore, we found that individuals in certain demographic groups had a higher prevalence of psychological distress compared to their representation in the sample. These groups included food stamp recipients, individuals with chronic diseases, and those using sedatives and medications with sedative side effects. The relationship between SES variables and psychological distress among employees has been widely studied and documented in the literature (Angrave & Charlwood, 2015; Bonde, 2008; Mousteri et al., 2020). Individuals with low SES are more likely to face

underemployment (Mousteri et al., 2020), financial difficulties (Koltai et al., 2018), and less psychosocial benefits from work (Angrave & Charlwood, 2015; Paul & Batinic, 2010), which can cumulatively contribute to an increased risk of psychological distress.

Respondents with chronic conditions (other than psychological distress), those using sedative medications, and medications with sedative side effects had a higher prevalence of psychological distress compared to their representative population. Prior research suggests that long working hours may increase the risk of chronic diseases, which in turn can contribute to psychological distress. Studies have linked long working hours to an increased risk of chronic diseases such as cardiovascular diseases, cancer, depression, diabetes, and arthritis (Dembe & Yao, 2016; Rivera et al., 2020). Additionally, long working hours can lead to fatigue and sleep deprivation, which can negatively impact mental health, potentially leading to the use of sedatives and medications with sedative properties.

Additionally, individuals with chronic conditions (excluding psychological distress) using sedative medications and medications with sedative side effects had a higher prevalence of psychological distress compared to their respective representative population. Prior studies inform that long working hours may increase the risk of chronic diseases, which can subsequently contribute to psychological distress (Dembe & Yao, 2016; Rivera et al., 2020). A study (Dembe & Yao, 2016) examined a longitudinal sample of 7,492 individuals over a 32-year period and found long working hours associated with an increased risk of developing chronic diseases such as cardiovascular diseases, cancer, depression, diabetes, and arthritis. Additionally, working long hours can lead to fatigue and sleep deprivation, which can negatively impact mental health (Bannai

et al., 2015; Bergs et al., 2018). This could influence an increase in the use of sedatives and medications with sedative side effects to aid sleep.

2.4.1. Policy and Theoretical Implications

This study provides evidence of the association between long working hours and the development of psychological distress in the U.S. labor force. If these associations are causal, the present findings suggest that more attention is needed in examining the influence of long working hours in the U.S. labor force. Despite large numbers of Americans working long hours, current regulations on working time arrangements in the U.S. are largely unregulated when compared to those in Europe (Gärtner et al., 2019; Yang et al., 2006). Few existing regulations covering working times mainly focus on the transportation sector and are primarily prescriptive rather than risk or performance-based (Gärtner et al., 2019).

Implementing interventions through national legislations and programs, such as the international labor standards on working time arrangements and working time limits (Pega et al., 2021) could help improve the overall well-being of U.S. workers. These interventions should aim to ensure that long working hours and overtime do not have negative effects on the health of workers (Landsbergis, 2018; Messenger, 2018).

Our findings suggest that the onset of psychological distress is more pronounced in individuals working very long hours. However, it is worth noting that the relationship between long working hours and psychological distress is not always straightforward. Some persons may be able to handle the requirements of long working hours without experiencing psychological distress, while others may be more vulnerable to the deleterious effects of long hours. Attributes such as an individual's coping resources, job

satisfaction, and support system may influence their ability to manage the demands of long working hours.

Additionally, there is a plausibility of increased risk for women working long hours. Therefore, it may be beneficial to further study and implement gender-specific and family-friendly interventions in mitigating the effects of long working hours. Some employers have already implemented targeted interventions for female employees working long hours(Campbell et al., 2002).

Employers can benefit from implementing measures to improve the health status of employees and provide better work hours. This can be achieved through interventions such as health and wellness promotion programs, work site screening for risk factors, and management of chronic conditions. Such measures can lead to improved performance and productivity, reduce workplace accidents caused by worker fatigue (Butler et al., 2009; Grzywacz et al., 2008), and decrease medical expenses and absenteeism due to illness (Baicker et al., 2010; Merrill et al., 2011). Furthermore, reducing long working hours can have a positive impact on employee health and well-being, which can ultimately lead to benefits for both the employer and the employee.

2.4.2 Limitations and Strengths

This study had several limitations. A limitation of this study is that it relied primarily on self-reported data, which may be subject to recall bias. However, the short intervals between rounds of data collection (4-5 months) may have minimized this bias, which is a common issue in population survey data (Kim, 2013).

Also, the dataset did not include information on several potential confounding variables such as the family history of psychological distress, external stressful life

events, and workplace psychosocial conditions limited the scope of our analysis to investigate the relationship between long working hours and psychological distress.

In addition, observations with missing covariates were excluded, which may lead to residual confounding by unmeasured covariates and selection bias. However, the short duration of measurement reduces the likelihood of missing psychological distress that could occur between the extended periods of the survey period. Also, the short duration of the survey period reduces the occurrence of healthy worker effect bias, which results from healthier workers remaining in the survey while less healthy workers drop out, creating a selection effect where the remaining employees are healthier than expected (Angrave & Charlwood, 2015; Dembe & Yao, 2016).

Our findings established a temporal relationship between long working hours and the onset of psychological distress by utilizing longitudinal data and excluding cases of baseline psychological distress among the workers. Additionally, the use of a representative sample of the working population allows for the generalization of findings to the larger population.

2.5. CONCLUSION

Overall, the result of this study suggests a relationship between working long hours and the onset of psychological distress. The highest risk was found in individuals who worked very long hours, and a risk increase was also observed among those who worked regular, standard hours per week when compared to those that worked fewer hours per week. This suggests that even slight increases in weekly work hours may lead to an increased risk of psychological distress for some individuals.

Consequently, the relationship between long working hours and psychological distress may be due to a combination of factors, such as sleep deprivation, underemployment, reduced social support and leisure time, and increased job strain and work-related stress.

Additionally, the study revealed gender differences in the risk of developing psychological distress among workers and found that social economic status may influence the onset of psychological distress among U.S. workers. Hence, it is crucial to consider the potential gender-specific effects of long working hours and explore the implementation of interventions that are tailored to the needs of female workers. Furthermore, factors such as income, chronic disease status, and the use of sleep aids were identified as relevant contributing factors.

It is important for individuals and organizations to be aware of the risks of long working hours on the development and prevalence of psychological distress and other negative health outcomes. Thereby taking informed steps to mitigate these risks through the implementation of policies that promote work-life balance and utilizing interventions that can help reduce work-related stress. Also, government and employers should implement interventions through laws and programs that promote a balance between work and personal life, decrease job-related stress, and improve and maintain the overall health and well-being of the population and employees.

Figure 2. Conceptual model of the possible causal relationship between exposure to long working hours and psychological distress (adapted from Pega et al., 2021; Rugulies et al., 2021)

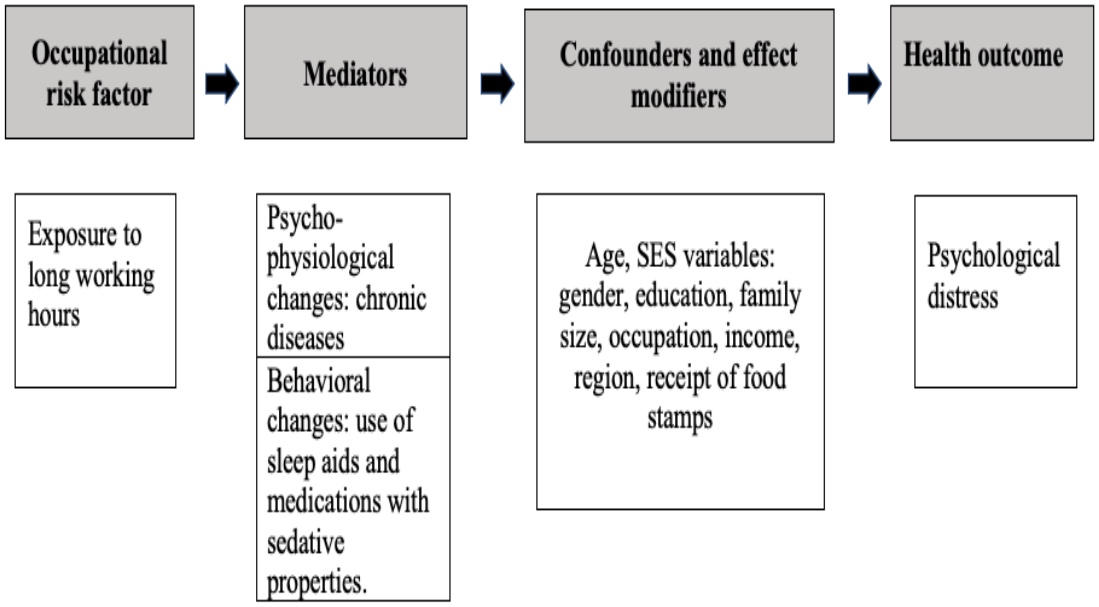


Table 5. Descriptive statistics of work hours and psychological distress.

Variables	Overall Frequency	Overall Weighted %	Psychological Distress	
			No (%)	Yes (%)
Weekly Working Hours				
30-35	2,903	8.4	0.9	9.4
36-40	16,695	52.6	4.8	57.4
41-50	5,221	20.0	1.9	21.9
51-60	1,990	7.7	0.7	8.3
≥ 61	753	2.7	0.2	3.0
Age (years)				
18-64	26,556	96.0	87.7	8.3
≥ 65	1,006	4.0	3.8	0.2
Sex				
Male	15,664	57.7	58.3	51.6
Female	11,898	42.3	41.7	48.4
Race				
White	19,866	80.3	80.4	80
Black	4,612	11.1	11.2	9.6
Other	3,084	8.6	8.4	10.3
Marital Status				
Married	16,221	61.3	62	53.7
Unmarried	11,341	38.7	38	46.3
Family Size				
≤ 2 Members	11,677	48.0	47.9	48.6
> 2 Members	15,885	52.0	52.1	51.4
Education				
Less than college	10,607	32.3	32.1	33.5
Some college or more	16,629	67.7	67.9	66.5
Occupation				
Professional services	10,796	45.8	46.0	43.0
Non-professional services	16,766	54.2	54.0	57.0

(continued)

Table 5. (Continued).

Variables	Overall Frequency	Overall Weighted %	Psychological Distress	
			No (%)	Yes (%)
Year				
2010	2,773	9.8	9.7	11.3
2011	3,529	11.7	11.6	13
2012	3,497	10.9	10.7	12.3
2013	3,009	10.0	9.9	10.3
2014	2,992	10.6	10.6	11
2015	3,206	12.2	12.3	11.4
2016	3,008	11.4	11.5	10
2017	2,895	12.0	12.2	9.3
2018	2,653	11.4	11.4	11.5
Region				
Northeast	4,169	17.5	17.7	15
North Central, Midwest	5,498	21.8	21.7	23.1
South	10,536	37.8	37.8	38.1
West	7,359	22.9	22.8	23.8
Income				
Poor to low income	5,876	13.7	13.3	17.9
Middle to high income	21,686	86.3	86.7	82.1
Receipt of food stamp				
No	25,682	95.9	96.1	94.2
Yes	1,880	4.1	3.9	5.8
Limitation				
No	25,007	90.2	90.4	84.8
Yes	2,555	9.8	9.6	15.2
Chronic Diseases				
No	13,318	46.2	46.8	40.4
Yes	14,244	53.8	53.2	59.6
Medication with Sedative Effects Use[†]				
No	23,344	84.7	85.5	76.1
Yes	4,218	15.3	14.5	23.9
Sedatives Use[†]				
No	26,930	97.7	98.0	94.3
Yes	632	2.3	2.0	5.7
Total	27,562	100	91.5	8.5

[†]= unweighted frequency

Table 6. Association Between long working Hours and the onset of psychological distress: Fixed effects regression analysis.

Variables	Overall	All Men	All Women
Work hours/week (30-35hrs/week - REF)			
36-40 h/week	0.036**	0.050*	0.023
	(0.000, 0.072)	(-0.005, 0.105)	(-0.025, 0.070)
41-50 h/week	0.029	0.048	0.007
	(-0.014, 0.072)	(-0.013, 0.109)	(-0.059, 0.073)
51-60 h/week	0.034	0.072**	-0.046
	(-0.017, 0.085)	(0.002, 0.142)	(-0.131, 0.040)
≥ 61 h/week	0.070**	0.080*	0.094*
	(0.008, 0.133)	(-0.002, 0.162)	(-0.013, 0.201)
Age (18-64years - REF)			
≥ 65 years	0.061***	0.068***	0.052**
	(0.030, 0.092)	(0.025, 0.111)	(0.008, 0.097)
Marital Status (Married - REF)			
Not married	-0.009	-0.015	0.002
	(-0.032, 0.014)	(-0.046, 0.015)	(-0.033, 0.037)
Family Size (≤ 2 Members REF)			
> 2 Members	-0.024***	-0.006	-0.046***
	(-0.042, -0.006)	(-0.028, 0.017)	(-0.075, -0.017)
Occupation (Natural resources - REF)			
Professional services	-0.029*	-0.021	-0.043
	(-0.060, 0.003)	(-0.057, 0.016)	(-0.098, 0.011)
Income (Poor to low income - REF)			
Middle to high income	0.016***	0.014**	0.019*
	(0.005, 0.027)	(0.001, 0.027)	(-0.000, 0.037)
Receipt of food stamp (No - REF)			
Yes	0.010	0.022*	-0.004
	(-0.009, 0.030)	(-0.000, 0.044)	(-0.036, 0.029)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Figure 3. Onset of psychological distress according to working hours from the fixed effects regression model of the overall sample.

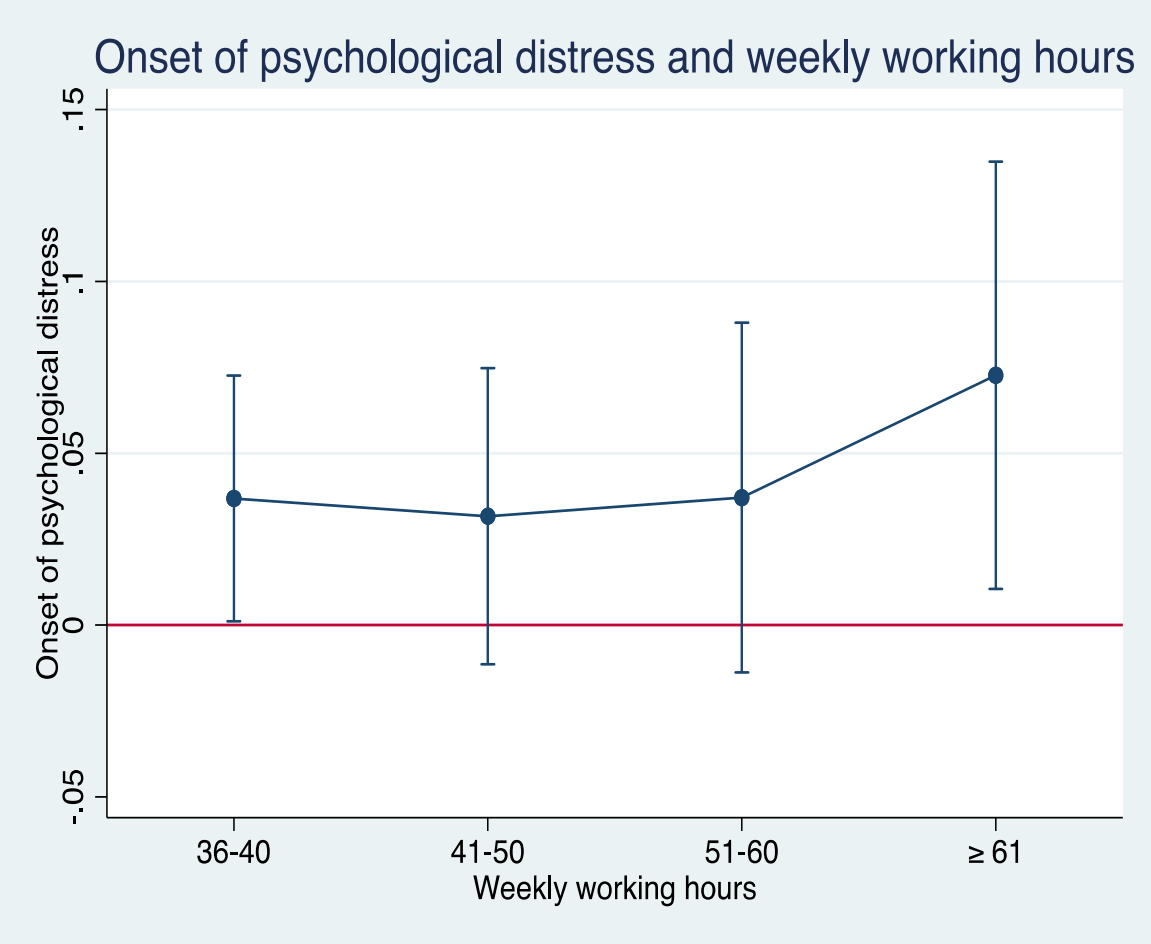


Figure 4. Onset of psychological distress according to working hours from the fixed effects regression model of all men sample.

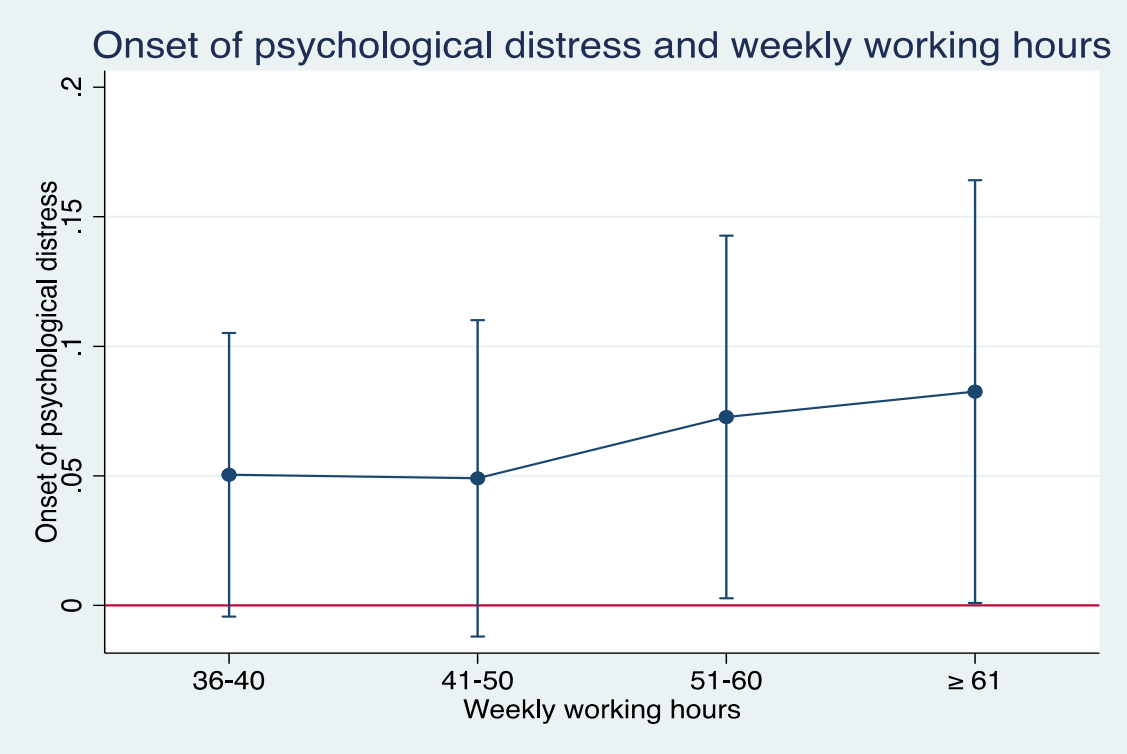
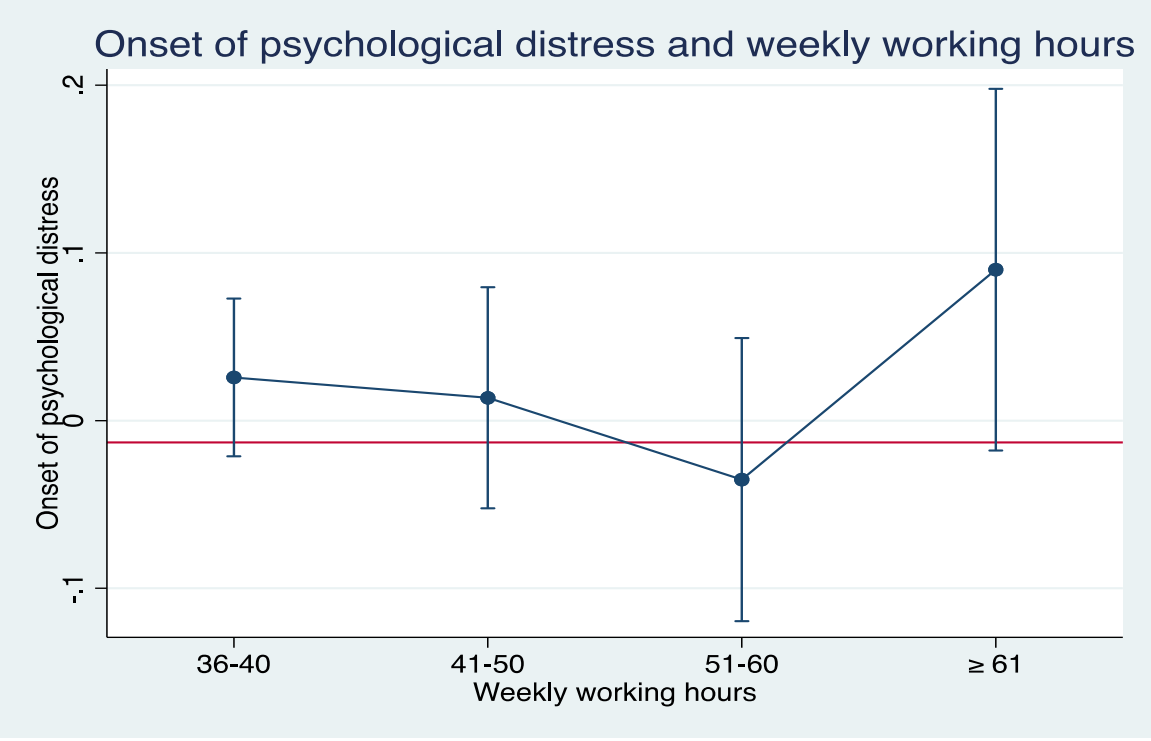


Figure 5. Onset of psychological distress according to working hours from the fixed effects regression model of all women sample.



CHAPTER THREE: ASSOCIATIONS BETWEEN WORKING HOURS, HEALTH CARE UTILIZATION, AND PRESCRIPTION MEDICATIONS WITH SEDATIVE SIDE EFFECTS.

3.0. OVERVIEW

OBJECTIVES:

Long working hours are associated with several chronic diseases and the use of sedative medications. This continuous prevalence and increase in long working hours are expected to influence the consistent rise in chronic diseases and subsequent reflection in healthcare use in the United States. However, there is a lack of literature examining the relationship between working hours, health care utilization, and the use of sedative medications in the U.S. Hence, we employed a nationally representative panel of full-time workers in the U.S. to examine these relationships.

METHODS:

This study utilized the 2010-2019 Medical Expenditure Panel Survey (MEPS) data. Prescription medications with sedation as a side effect were identified. Respondents' annual healthcare utilization information was identified in the longitudinal survey and utilized. Fixed-effect estimators were employed in modeling the relationship between working hours, health care utilization, and the use of prescription medications with sedative side effects.

RESULTS:

In total, the balanced sample was comprised of 43,993 full-time employees in the U.S. Individuals working 61 or more hours per week had the highest odds of using outpatient medical providers (adjusted Odds Ratio (aOR)=2.01, 95% confidence interval (CI) 1.04, 3.86, $p < 0.05$). Also, respondents working 36-40 hours per week were associated with increased use of outpatient medical providers (aOR=1.34, 95% CI=1.01, 1.78). Also, we found a similar pattern of associations between working hours and the use of outpatient services among individuals using medications with sedative properties.

CONCLUSION:

Our findings suggest that working hours are significantly associated with the use of outpatient services, with the highest odds in workers that worked 61 or more hours per week. Long working hours negatively impact the health status of individuals, which can reflect in the increased use of health care services. Implementing policies that encourage work-life balance and aid interventions that decrease work-related stress may help in mitigating risks associated with long work hours.

3.1. INTRODUCTION

Long working hours remain prevalent globally and, in the U.S. The International Labor Organization previously ranked the U.S. as the fourth highest nation in the proportion of workers who work overtime weekly (Bannai et al., 2015). This trend of long working hours in the U.S. is driven by several factors, such as motivations for increased wages, career development, and strong cultural influences (Li et al., 2019).

Overtime hours have been associated with an increase in negative health outcomes, including cardiovascular diseases (Cheng et al., 2014; Lunde et al., 2016; Skogstad et al., 2019) and mental ailments (Kim et al., 2016; Wong et al., 2019). Also, long working hours have been linked with a rise in risky health behaviors such as increased use of sleep medications (Ezekekwu et al., 2023), high alcohol use, and smoking (Bannai et al., 2015; Virtanen et al., 2015).

The increase in the incidence and prevalence of chronic diseases associated with long working hours is expected to reflect in the increased utilization of health resources among employees. Previous studies have reported long working hours associated with a decreased use of preventive health services among employees, mainly due to a decrease in the availability of time among overtime workers in countries like Canada and Korea (Fell et al., 2007). Preventive health services such as routine health checks and recommended vaccinations are crucial in maintaining the health of individuals, especially those with increased risk of chronic morbidities.

Furthermore, studies examining the associations between long working hours, health care utilization, and the use of medications in the U.S. is sparse. Thus, we utilized a nationally representative panel of full-time workers in the U.S. to examine the

relationship between working hours, health care utilization, and the use of medications with sedative side effects.

We utilized the Andersen health care utilization model in this study (Andersen, 1995). This model is relevant to our research as it posits that a person's health behavior and use of health care resources are influenced by enabling, predisposing, and needs factors.

Our conceptual model (Figure 6) explains that working hours influence the mutable population characteristics (specifically the need factors such as health status) and recurrently influence individuals' health behaviors. Work hours represent the work environment, which in turn is influenced by the occupation, and have been reported to influence the use of health services and changes in health behaviors, such as the use of sleep medication and alcohol consumption (Virtanen et al., 2015; Wong et al., 2019).

The population characteristics are composed of predisposing, enabling, need, and motivating factors. The predisposing construct represents individuals' conditions that influence their use of health services (Andersen & Newman, 1973; Andersen, 1995). This construct is primarily categorized into demographic and social factors, with demographic factors including age, gender, and race. In addition, an individual's social status within the community, including factors such as marital status, education, and occupation, is also an important component of the social structure that influences health service utilization.

Furthermore, the enabling factors represent the resources that are available to individuals, such as income, health insurance, and geographic location, which aids the utilization of health care services. An individual's insurance status plays a crucial role in

determining their use of health care services and obtaining prescription medications for sleep. However, it is important to note that health insurance is an outcome variable, as employee health insurance in the United States is typically only available to those working 30 or more hours per week (Carroll & Miller, 2019). The level of income is positively associated with access to health care. In addition, the need factor is measured by an individual's health limitations, representing a perceived need for health care services.

Motivating factors also play a role in the amount of time an individual spends working. Professionals and individuals with higher socioeconomic status may be motivated to work overtime due to the potential financial and career benefits. However, others may be compelled to work long hours due to financial difficulties, even if they earn meager wages. To assess motivation, family size and receipt of food stamps were employed as indicators. Large family sizes may result in increased financial demands, while receipt of food stamps suggests financial difficulties associated with food insecurity. Prior studies have utilized family size and receipt of food stamps as measures of financial strain (Bhattarai et al., 2005; Kabir, 2021).

3.2. METHODS

3.2.1 Data Sources

The data for this study was obtained from the Medical Expenditure Panel Survey (MEPS) conducted between 2010-2019. MEPS is a national probability survey carried out by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS) (Quality, 2020) . The survey collects health-related

information on non-institutionalized civilians in the U.S. by evaluating their access to health services, utilization, expenditures, and other relevant data. In creating a sample, MEPS identifies and records respondents from the previous year's National Health Interview Survey (NHIS). It utilizes a panel design with five interview rounds conducted over a two-year period, with the initial two rounds occurring in the first year and the remaining rounds in the second year.

The MEPS Household Component (MEPS-HC) began in 1996 and yields crucial data on participant demographics, health, and employment status, health care utilization and expenditures, insurance coverage, and satisfaction with health care. To improve the accuracy of estimates, MEPS and NHIS oversample minority groups such as African Americans and Hispanics. The response rates for MEPS range from 46-71% after adjusting for nonresponse rates from NHIS. MEPS-HC data can be utilized to generate national estimates and analyzed at both individual and event levels.

MEPS utilizes a Medical Provider Component (MEPS-MPC) that gathers supplementary or alternative data to the MEPS-HC survey. Furthermore, the MEPS-MPC includes a pharmacy component that collects medication information, including the national drug code (NDC) and generic names. However, the MEPS-MPC is not intended to generate national estimates; therefore, we only weighted the MEPS-HC component in the descriptive statistics of the study. However, following Solon et al. (2015), we also conducted our analysis using sample weights and accounting for the complex survey design of the MEPS. The weighted results are reported in *Appendices 6 to 8*.

3.2.2 IRB Approval Statement

The research conducted in this study received exemption approval from the Institutional Review Board (IRB # 21.0849) at the University of Louisville. We utilized a de-identified dataset that was publicly available. The study was classified as Non-Human Subjects Research (NHSR). since the dataset did not satisfy the definition of human subject research.

3.2.3 Data Organization

We utilized a pooled sample design and listwise deletion to remove missing observations. The MEPS dataset comprised 20 files; thus, to aid the data management, we used the University of Minnesota's Integrated Public Use Microdata Series (IPUMS). This series provides organized and refined data from the MEPS surveys (Blewett, 2020). The National Institute of Child Health and Human Development (NICHD) funds IPUMS MEPS, which enables researchers to select individual variables prior to downloading the dataset.

We combined the MEPS pharmacy component's prescription medicine event files with the IPUMS MEPS-HC via merging. The event files possess information on prescribed medications received or purchased by participating households. Every prescription record denotes a single prescribed medication registered for respondents within a survey round, estimated at 4-5 months between data collection periods. We downloaded the prescription data files from 2010-2019 and merged them with the MEPS-HC component using the identifier variable "mepsid," which distinguishes distinct households in the H.C. dataset and pharmacy component.

3.2.4 Dependent Variables

Information on the respondent's annual health care utilization was generated at the end of each year of the longitudinal survey. The total health care services use information of the respondents for the survey's first and second years was utilized. The dependent variables in the data were entered as count variables and were recoded into binary variables, which include annual outpatient visits, office-based visits, emergency department visits, hospital discharges, and dental visits.

The annual outpatient visits measure the total number of visits to outpatient medical providers during the year. It entails consultations with either physicians or non-physician providers in outpatient settings and clinics. Annual office-based visits measure the total number of visits to the medical of medical providers in office-based settings or clinics over the course of a year.

Furthermore, the annual emergency department visits to the emergency room reflect the total number of visits to the emergency room during the course of the year. Likewise, it includes encounters with both physicians and non-physician providers. At the same time, annual hospital discharges represent the total number of hospital discharges experienced by a respondent in a year, including both same-day discharges and hospitalizations lasting one or more nights before discharge. In addition, annual dental visits denote the respondent's total number of dental care consultations involving general dentists and orthodontists.

3.2.5 Primary Independent Variable

The number of hours worked per week by the respondents is the primary independent variable. Respondents aged 18 years and above with a current main job were selected. This information was gathered from the MEPS-HC survey, and it does not

include unpaid travel time to and from work. Individuals working 30 hours or more weekly were classified as full-time workers, similar to the U.S. regulation that enables eligibility for employer-provided health insurance coverage (Carroll & Miller, 2019; Dembe & Yao, 2016).

Previous studies inform that part-time workers and individuals working fewer hours may have different health characteristics, such as underlying health conditions, or may have work fewer hours due to family responsibilities (Kivimäki et al., 2015; Li et al., 2019; Virtanen et al., 2012). Hence, part-time workers or people working fewer times may not be appropriate comparators to standard and overtime workers. To identify the best threshold for long working hours, working hours were divided into five categories: 30-35 hours per week (h/week), 36-40 h/week, 41-50 h/week, 51-60 h/week, and 61 h/week or more.

3.2.6 Covariates

The covariate selection was guided by the Gelberg-Andersen behavioral health model, with predisposing factors such as age, race, marital status, family size, education, occupation, and panel year. Predisposing factors were categorized into distinct age groups of 18-26, 27-64, and ≥ 65 years; racial categories of White, Black, and other; marital status categories of married, divorced (including widowed and separated), and unmarried; and family size categories of ≤ 3, 4−6, and > 6 members. Education was recoded into two categories, less than college and some college or more, while the occupation was recoded into professional (including financial and administrative services) and non-professional services (including jobs in the natural resources, leisure, trade, and related sectors).

Enabling factors, such as region and income, were also considered. Health insurance status, as an outcome variable of working hours, was excluded to avoid multicollinearity. U.S. employees working 30 or more hours per week are eligible for employee health insurance. Thus, our study respondents are eligible for employee health insurance. The MEPS region variable was recoded into northeast, mid-west (including northcentral), south, and west. Income was recoded into poor to low income less than 100% - 199% of the federal poverty line) and middle to high-income 200% or more of the federal poverty line).

Motivating factors included receipt of food stamps and limitations. The receipt of food stamps was a binary variable. Limitation is a summary measure of the respondents, instrumental activities of daily living, functional and activity limitations. Also, it was recoded into a yes/no variable.

3.2.7. Sedative Medications and Medications with Sedative Side Effects

Sedative and hypnotic medications usually referred to as "sleep aids," are widely used to initiate or maintain sleep owing to their ability to suppress the central nervous system (Chong et al., 2013). The off-label use of medicines not specifically intended for treating insomnia is also prevalent, with certain antidepressants being among the drugs that can be used for this purpose (Neubauer et al., 2021). The medications used off-label are usually used for the sedating side effects and are sometimes used recreationally (Citrome, 2017; Eugene, 2020; Hägg et al., 2020).

To examine the use of medications with sedative properties, we analyzed data from the prescription medicines event files of the Medical Expenditure Panel Survey

(MEPS) pharmacy component. A prescription was defined as a recorded event of an individual medication (Chen et al., 2020).

Furthermore, we employed Facts and Comparisons®, a comprehensive compendium produced by Wolters Kluwer Health, to identify medications with sedative properties (Comparisons eAnswers., 2021). Facts and Comparisons® lists common or serious adverse effects of medications, such as dizziness, drowsiness, sluggishness, or heaviness. It has been widely considered a reliable source of drug information, with a completeness score of 95.8% and high rankings alongside other leading medication identifiers (Clauson et al., 2007; Jackevicius et al., 2019; Roblek et al., 2015). Also, this drug resource has been reported to have a sensitivity of 93% and a positive predictive value of 95.3% in identifying black box warnings (Cheng et al., 2010).

3.2.8. Study Population

Inclusion criteria for the study participants included being 18 years or older, participated in the survey between 2010 and 2019 (panels 14 to 22), and worked at least 30 hours per week. In contrast, the exclusion criteria included individuals who worked less than 30 hours per week (considered part-time workers) and respondents with missing variables.

3.2.9. Data Analysis

The Stata Statistical Software: Release 17 (StataCorp, 2021) was used to analyze that data. The MEPS-HC component was weighted to estimate descriptive statistics, accounting for the complex survey design of the MEPS, including weight, clusters, and strata, to enable the

generalizability of the study and correct estimation of effect size. Exploratory and descriptive statistics were employed to evaluate the distribution of independent variables.

3.2.10. Statistical Analysis

We investigated the effects of work hours on the use of health care resources in participants who transitioned between different work hour categories, including 30-35 hours per week, 36-40 hours per week, 41-50 hours per week, 51-60 hours per week, and 61 hours per week or more. The sample sizes and prevalence of transitions in these workhour categories are described in the Appendices of the paper.

Changes in health care utilization are modeled as a function of changes in exposure to long working hours and changes in social and economic variables. Fixed-effect estimator in modeling the relationship between working hours and health care utilization.

This estimator accounts for the interdependence among independent variables and error terms, which are unique to each unit within the model. An important benefit of employing fixed effects lies in its capability to adjust for time-invariant confounding factors with constant effects. (Allison, 2009; Gunasekara et al., 2014).

Health care utilization is then modeled as a function of the individual's work hours status and socioeconomic attributes using the following model:

$$HU_{it} = \alpha + \beta_1 H_{it} + \beta_{2S} (X_{1,it} + X_{2,it} + \ldots + X_{S,it}) + t_t + \mu_i + \varepsilon_{it} \quad (1)$$

Where HU_{it} is a measure of health care use for an individual at time t, β is the average effect of interest, H_{it} is a measure of changes in working hours. $X_{1,it}$, $X_{2,it}, \ldots, X_{S,it}$ represents other time-varying demographic variables that could influence participants

psychological distress including age, marital status, family size, occupation, income, and receipt of food stamps. μ_i are participant's specific effects and represents the use of fixed effects estimator, t_t represents a vector of year indicators, and ε_{it} is the random error term.

While the fixed effects logit model is defined by the logistic probability of HU_{it}:

$$Pr\ (HU_{it}=1) = \frac{exp\ (\alpha + \beta_1 H_{it} + \beta_{2s}\ (X_{1,it} + X_{2,it} + \cdots + X_{s,it}\ )}{1 + exp\ (\alpha + \beta_1 H_{it} + \beta_{2s}\ (X_{1,it} + X_{2,it} + \cdots + X_{s,it}\ )}$$

(2)

Where $HU_{it}=1$, represents health care use by an individual at time *t*.

The use of fixed effects modeling facilitated the examination of the association between changes in health care utilization, changes in working hours, and other time-varying factors within individuals while adjusting for consistent individual attributes. The fixed effects estimator was preferred based on prior literature and preliminary Analysis, which indicated that employing pooled cross-sectional regression models might produce distorted outcomes due to the association with unobserved time-invariant traits (Angrave & Charlwood, 2015; Jindra et al., 2022; Wooden et al., 2009). Fixed effects estimators were also used to investigate the association between working hours and health care utilization among participants using medications with sedative side effects.

3.3. RESULT

3.3.1. Descriptive Statistics

This balanced panel data for the analysis included 43,993 individuals with 87,986 observations. Weekly work hours was classified into five distinct categories (30-35 h/week, 36-40 h/week, 41-50 h/week, 51-60 h/week, and ≥ 61 h/week) as presented in *Table 7*.

Most of the participants in our analysis fell within the age range of 27 to 64 years (86.2%), with more than half of the participants male (56.1%). Majority of the sample identified as White (79.7%), while 11.3% identified as Black, and 9% as Other. Also, most of the respondents were married (59.5%), and the majority had some college or higher education (67.2%), while about half of the respondents had over two members living in a household. Non-professional services (55.3%) was the largest occupational category, and the survey years 2015 and 2016 had the highest weighted percentage (11.7%).

The largest proportion of the participants resided in the southern region of the U.S. (37.5%), followed by those living in the North Central-Midwest (21.9%), and the Northeast had the smallest proportion (17.5%). The majority of respondents were classified as middle to high-income earners (85.1%), earning 200% or more of the federal poverty threshold. On the other hand, 14.9% were classified as poor to low-income earners or earned below 200% of the federal poverty threshold. Less than 5% of the respondents reported receiving food stamps (4.7%), while most did not have any reported limitation. Additionally, 27.4% of the respondents reported using medications with sedative side effects.

By health care utilization, few of the workers in our analysis had one or more outpatient visits (14.9%), while most had at least one office-based visit (70.9%). The majority of the respondents (89.5%) had no visits to the emergency department during the survey period, and most had no recorded hospital discharge (95.3%). Also, 43.5% of the workers had one or more dental visits during the survey period.

3.3.2. Working Hours

The results of the fixed effects models for the association between working hours and health care utilization is shown in *Table 8*. Fixed regressions were conducted separately with the dependent variables: annual outpatient visits, office-based visits, emergency department visits, hospital discharges, and dental visits. We found significant results only with the annual outpatient visits. Individuals working 61 or more hours per week had the highest odds of using outpatient medical providers (adjusted Odds Ratio (aOR)=2.01, 95% confidence interval (CI)= 1.04, 3.86), with the 30-35 h/week per week category as a reference and statistical significance at $p < 0.05$. Also, respondents working 36-40 hours per week were associated with increased use of outpatient medical providers (aOR=1.34, 95% CI=1.01, 1.78) as compared to those working 30-35 hours per week. Also, we found dose-like response associations between working hours and outpatient use, as seen in Figure 7.

In addition, respondents aged 65 years and older had significantly increased odds (aOR=1.74, 95% CI=1.0, 3.0) of using outpatient services as compared to those 18-26 years of age. Also, respondents with limitation had increased odds (aOR=1.43, 95% CI=1.26, 1.63) of using outpatient services as compared to those without recorded limitation. On the other hand, employees with more than two family members living in a household had fewer odds of using outpatient medical providers as compared to those with less than two family members living in a household.

Furthermore, from the fixed logit marginal analysis (*Table 9 and Figure 8*), we found a similar dose-like response association between working hours and outpatient use. The predicted probability of using outpatient medical providers was greater (Predicted probability (PB)=0.07, 95% CI=0.00, 0.14, $p < 0.05$) for an individual that worked 61 or

more hours weekly as compared to one that worked less than 30-35 hours per week. Also, the predicted probability of using an outpatient medical provider was greater for an individual that worked 36-40 hours per week as compared to one that worked 30-35 hours per week, with $p < 0.05$. Furthermore, the logit marginal effects were comparable to the fixed linear effect regression of the Analysis. The fixed effect linear model yielded a similar dose-response association between working hours and outpatient use. It showed that individuals working 61 or more hours per week had the highest likelihood at 4.6% (95% CI=0.0%, 9.0%, $p < 0.05$), of using outpatient medical providers as compared the those working 30-35 hours per week. Similarly, individuals working 36-40 hours per week had a 2% (95% CI=0.0%, 4%, $p < 0.05$) increased likelihood of using outpatient medical provider services.

3.3.3 Health care Utilization Among Individuals Using Medications with Sedative Effects

The results of the fixed effects models for the association between working hours and health care utilization among respondents using medications with sedative side effects (*Table 10*) were similar to the fixed effects model results from the overall sample. Likewise, significant results only with the annual outpatient visits. Also, a dose response was found between working hours and outpatient use. However, only 36-40 h/week category were significant at $p < 0.01$, while the 41-50h/week (aOR=1.52, 95% CI=0.95, 2.43) and 51-55 h/week (aOR=1.89, 95% CI= 0.91, 3.89) categories were significant at $p < 0.1$. Also, the logit marginal results produced an increased predicted probability

(PB=0.13, 95% CI=0.04, 0.22) for an individual working 36-40 hours when compared to a respondent working 30-35 hours per week.

3.4 Supplemental Analysis

We carried out further analyses to delineate the pattern of visits for the outpatients' medical providers. Annual outpatient visits in the data are composed of mainly annual outpatient physician visits and annual outpatient non-physician visits. However, data for the annual outpatient non-physician visits were not available for the years 2017-2019. Thus, we were only able to further analyze annual outpatient physician visits that have full data records.

Fixed effects models were similarly utilized in examining the association between working hours and outpatient physician visits (*Appendices 4 and 7*). We found significant associations between working hours and outpatient physicians visits. This association was most pronounced between individuals working 61 hours or more per week and visits to outpatient physicians. The fixed effects logit model showed that participants working 61 or more hours per week had increased odds (aOR=5.04, 95% CI=0.95, 26.6, $p < 0.1$) of using outpatient services as compared to the participants working 30-35 hours per week. Also, the logit marginal effects and fixed linear models yielded similar associations significant at $p < 0.05$, for respondents working 61 or more hours per week as compared to those working 30-35 hours per week. Furthermore, fixed effects regression models and marginal analysis are shown in the *Appendices: 2 to 5*, for other dependent variables: office-based visits, emergency department visits, hospital discharges, and dental visits.

Additionally, following (Solon et al., 2015), we also conducted our analysis using sample weights and accounting for the complex survey design of the MEPS (*Appendices 6 to 8*). The analysis yielded similar results. Though the point estimates changed, the associations were similar to the unweighted results. The differences between the two sets (unweighted vs. weighted) were consistent with the observed heterogeneity in the treatment effects and the reported oversampling for minority groups in the MEPS (Quality, 2020; Schaller & Zerpa, 2019)

3.4. DISCUSSION

We found a high prevalence of the use of medications with sedative side effects among the respondents. Significant associations were also found between working hours and the use of outpatient medical services. Individuals working 61 or more hours per week had the highest odds of using outpatient medical providers. Previous research posits that the deleterious effects of long working hours are most pronounced in those working high overtime hours (Bannai et al., 2015).

Outpatient medical services include alcohol and drug abuse clinics; well-baby clinics; obesity clinics; eye, ear, nose, and throat clinics; family planning clinics; cardiology clinics; internal medicine departments; physical therapy clinics; and radiation therapy clinics. This high use of outpatient medical services in respondents working very long hours may be due the poor health status in individuals working long hours. Previous studies report that long working hours have been linked with an increase in chronic morbidities and negative health outcomes (Cheng et al., 2014; Lunde et al., 2016; Skogstad et al., 2019).

However, increased associations were also found among employees working 36-40 hours per week when compared to those working 30-35 hours per week. This indicates that for some people, the minimum threshold for extended work hours could begin slightly above the usual weekly work hours. Prior research has explored determining the optimal threshold for long working hours that would result in the lowest risk level (Murray et al., 2003; Rugulies et al., 2021; Virtanen et al., 2009).

We did not find significant associations between working hours and office-based visits, emergency department visits, hospital discharges, and dental visits. However, we found significant associations between working times and outpatient medical providers, which suggests that working time influences the use of outpatient medical services. Several literature reports that long working times negatively influence the use of primary and preventive health care services, including office-based services (Fell et al., 2007; Fukuoka et al., 2010; Sato et al., 2011; Seok et al., 2016).

A crucial rationale posited for this decreased use of primary health care services is the lack of time available to full-time workers who work overtime. A study (Seok et al., 2016) examining the relationship between long working hours and unmet health care needs among 8,369 Korean workers found "lack of time" as the most reported reason for unmet health care needs. Also, another study (Sato et al., 2011) reported that employees working very long hours have an increased likelihood of using health care resources with decreased time requirements.

A consistent pattern of associations was found between working hours and the use of outpatient services among respondents that used medications with sedative side effects. Previous research (Bush et al., 2009) examined the long-term effect of

employment on health care use among persons with severe mental illness and co-occurring disorders. They found that stable employment significantly decreases inpatient service use while increasing outpatient service use among the study participants. The association between working hours, use of outpatient services and medications with sedative effects might be part of a dynamic described as “psychiatrization”. Psychiatrization might boost medical interventions for individuals who have minor disturbances in well-being because they are subjected to overdiagnosis and overtreatment (Beeker et al., 2021; CDC, 2016).

In addition, we found that employed older participants in our analysis aged 65 years and older, and workers with limitation had significantly increased odds of using outpatients' medical services when compared to the workers aged 18-24, and those without limitation respectively. Older individuals have a higher likelihood of having chronic diseases with related increased need and use of health care services. Also, previous research examining utilization and expenditure of health care services using MEPS data, reported a similar trend in the highest prevalence of the use of health care services in individuals aged 65 years and above (Karimi et al., 2021).

3.4.1. Policy and Theoretical Implications

This study finds evidence of the association between long working hours and the use of outpatient services. Long working hours could influence deleterious health outcomes and is expected to reflect in the increased utilization of health resources among employees. Lack of time to access health care services could significantly increase the use of the more expensive and unsustainable services with decreased time requirement such as emergency departments and related services. The results of this study highlight

the importance of further investigating the impact of long working hours on the U.S. labor force.

Despite a significant number of workers in the U.S. reporting long work hours, regulations concerning working time mainly concentrate on the transportation industry and are primarily based on rules rather than being based on performance or risk (Gärtner et al., 2019; Yang et al., 2006).

Also, the high prevalence of the use of medications with sedative properties have several implications. Previous research has reported a potential link between sleep aid medications and increased mortality (Kivimäki et al., 2015; Kripke et al., 2012; Skogstad et al., 2019). Moreover, chronic use of these medications may elevate the risk of cognitive and psychomotor impairments, workplace and car accidents, and addiction (Kim et al., 2016; Mizoue et al., 2001). Therefore, the residual effects of sleep aids and the associated risks present potential hazards to both the workers who use them and the general public.

Interventions aimed at improving the well-being of U.S. workers can be implemented through national legislations and programs, such as international labor standards on working time arrangements and limits (Pega et al., 2021). These interventions should prioritize preventing negative health effects caused by long working hours (Landsbergis, 2018; Messenger, 2018).

Employers can also benefit from initiatives aimed at improving employee health and providing flexible work hours. These measures may include health and wellness programs, screening for risk factors at work sites, and management of chronic illnesses. Such interventions have the potential to enhance work performance and productivity,

reduce workplace accidents caused by fatigue (Butler et al., 2009; Grzywacz et al., 2008), and lower medical expenses and absenteeism due to illness (Baicker et al., 2010; Merrill et al., 2011). Furthermore, reducing long working hours may improve employee health and well-being, leading to benefits for both the employer and the employee.

3.4.2. Limitations and Strengths

Several limitations were identified in this study. Relying primarily on self-reported data on work hours may have introduced recall bias, although the short intervals between data collection rounds (4-5 months) may have helped to minimize this issue, which is common in population survey data (Kim, 2013). Also, excluding observations with missing covariates may have resulted in residual confounding and selection bias.

Despite these limitations, this study established a longitudinal association between long working hours and the use of outpatient services. The use of a representative sample of the working population allows for the generalization of our findings to the larger population. Also, the short duration of the survey may have helped minimize the likelihood of healthy worker effect bias, where healthier workers remain in the survey, creating a selection effect that biases the results (Angrave & Charlwood, 2015; Dembe & Yao, 2016; Kim, 2013).

3.5. CONCLUSION

This study examined the relationship between working hours, health care utilization, and the use of medications with sedative side effects. Our findings suggest that working hours are significantly associated with the use of outpatient services, with the highest odds in workers that worked 61 or more hours per week.

Also, we found a similar pattern of associations between working hours and the use of outpatient services in employees using medications with sedative properties. However, we did not find any significant association between working hours and the use of other health care resources, including office-based visits, emergency department visits, hospital discharges, and dental visits.

Awareness of the risks associated with long working hours is crucial for both individuals and organizations, as it can result in negative health outcomes. To mitigate these risks, it is essential to implement policies that promote work-life balance and utilize interventions that help reduce work-related stress.

CHAPTER FOUR: CONCLUSION

Long working hours have increased with the continuous attempts at meeting the needs of 24-hour service and globalized society. The increase in overtime hours has been associated with deleterious health outcomes such as cardiovascular diseases, symptoms of psychological distress, and health behaviors, including risky intake of alcohol and smoking.

Prior literature has established the relationship between long working hours and risky alcohol intake. Where workers working overtime consume copious amounts of alcohol in a bid to address the stress that results from the production of excessive stress hormones. Thus, the continuous prevalence and increase in long working hours among the U.S. working population are expected to influence the use of sedating medications, the incidence of chronic diseases, and subsequent reflection in healthcare use in the United States.

However, studies examining the influence of working hours on the use of sedating medications are lacking. This dissertation addressed crucial gaps in our current knowledge of the multi-dimensional relationship between working hours and health outcomes. The three-study approach advanced current knowledge of the interplay between long working hours, the use of sedating medications, and health service utilization.

The first study employed the Andersen healthcare utilization model to conceptualize the relationship between long working hours and the use of sleep aid medications, along with the use of medications with sedative properties. The study found that long working hours were significantly associated with increased use of sleep aids and medications with sedative properties. Also, among users of these medications, those working long hours had higher use when compared to those using and working fewer hours. Females had a higher likelihood of using sleep aids when compared to males. Some probable reasons provided for this association in females ranged from the higher predisposition to developing sleep disorder, extended work hour times arising from home chores, and peculiar physiological changes.

The positive association between overtime hours and the use of sedative medication raises implications in the known harmful effects of long-term use of sedating medication, including increased mortality and morbidity. Significant differences in the associations between long working hours and the use of sleep medications across socioeconomic groups. Individuals employed in professional services had the greatest probability of utilizing sleep medications. At the same time, respondents with large family sizes had a lower likelihood of using prescription sleep aids and medications with sedative properties, suggesting a possible protective factor from the family size.

The second study investigated the relationship between long working hours and psychological distress using a longitudinal approach. The study employed the WHO logic model (Pega et al., 2021; Rugulies et al., 2021) to operationalize this relationship. The model posits that overtime hours influence the onset of psychological distress through two causal pathways–psycho-physiological and health–behavioral pathways. This study

represents an improvement over previous research that relied on cross-sectional data and was plagued by problems of reverse causality. It examined whether full-time employees without psychological distress at the outset have a higher likelihood of experiencing psychological distress in the future if they work long hours.

The findings from this study suggest a relationship between working long hours and the onset of psychological distress. The highest risk was found in individuals who worked very long hours, and a risk increase was also observed among those who worked regular, standard hours per week when compared to those that worked fewer hours per week. Factors such as income, chronic disease status, and the use of sleep aids were identified as relevant contributing factors. Also, the study unveiled variations between genders regarding the likelihood of developing psychological distress in the workforce.

The third study of the dissertation evaluated longitudinal associations between working hours, health care utilization, and the use of sedative medications in the U.S. among a representative panel of full-time workers. This study employed the Andersen healthcare utilization model to conceptualize these various associations. Fixed effect estimators were utilized in modeling the relationship between working hours, the use of sedating medications, and health care services.

Contrary to one of the study's hypotheses, no significant association was found between working hours and the use of emergency department visits. However, the study findings suggest that working hours are significantly associated with the use of outpatient services, with the highest odds in workers that worked 61 or more hours per week. Further analyses revealed a more pronounced and similar pattern of associations between working hours and the use of outpatient services in respondents using sedating

medication. Outpatient medical services include alcohol and drug abuse clinics; well-baby clinics; obesity clinics; eye, ear, nose, and throat clinics; cardiology clinics; internal medicine departments; physical therapy clinics; and radiation therapy clinics.

Prior research posits that the most harmful effects of long working hours are most pronounced in those working high long working hours (Bannai et al., 2015). Thus, this high use of outpatient medical services in respondents suggests a poorer health status of individuals working very long hours. Outpatient medical services include alcohol and drug abuse clinics; well-baby clinics; obesity clinics; eye, ear, nose, and throat clinics; family planning clinics; cardiology clinics; internal medicine departments; physical therapy clinics; and radiation therapy clinics. This high use of outpatient medical services in respondents working very long hours may be due to the poor health status of individuals working long hours. Furthermore, older employees aged 65 years and over had the highest odds of using outpatient medical services. The high burden of chronic diseases in older individuals is a possible risk factor for high health care utilization.

Together, the findings from this dissertation offer a solid foundation of evidence and great insights into the associations between working hours, the use of sleep aids, and their negative impact on health outcomes. It provides a foundation of evidence that the deleterious effect of long working hours goes beyond risky alcohol consumption and smoking. It delineates the relationship between overtime hours, the use of sedating medications, the development of psychological distress, and the use of healthcare services.

Therefore, these findings can serve as a guiding tool for employers, health systems, and researchers in creating interventions and making recommendations

regarding work-based policies, with the ultimate aim of enhancing the health and well-being of employees. Despite a significant portion of Americans working extended hours, there is a lack of comprehensive regulations governing working time arrangements in the U.S. Knowledge of the risks associated with long working hours is crucial for both individuals and organizations, as it can result in negative health outcomes. Implementing policies that encourage work-life balance and aid interventions that decrease work-related stress may help in mitigating risks associated with long work hours.

4.1. FUTURE RESEARCH

This dissertation sets the stage for future follow-up and exploratory studies. The medications identified and used in these studies were confirmed prescribed medications and did not include over-the-counter (OTC) medications. Thus, future research will need to examine the relationship between working hours and the use of over-the-counter sedating medications. OTC medications are more accessible to individuals. Therefore, a higher prevalence of their use is expected.

This dissertation highlights the probable relations between long working hours, sleep disorders, and the use of sedating medications. Future research will build on this in further investigating the relationship between working hours, negative health outcomes of sedative use, and substance abuse disorders.

Also, in cognizance of external factors such as external stressful life events and workplace stressors having notable probabilities to influence the development of psychological distress individuals. Future studies will evaluate the relationship between working hours, external stressors, and the development of psychological distress.

Furthermore, future studies will need to examine the type of healthcare outpatient services that are most utilized on a granular level. Uncovering the specific types of outpatient services with the highest risk of use in relationship with long working hours will help proffer targeted interventions in addressing the healthcare needs of employees, especially those working overtime hours.

Figure 6. Conceptual framework depicting the association between working hours, the use of prescription medications with sedative side effects, and health care utilization (adapted from Aday & Andersen, 1974)

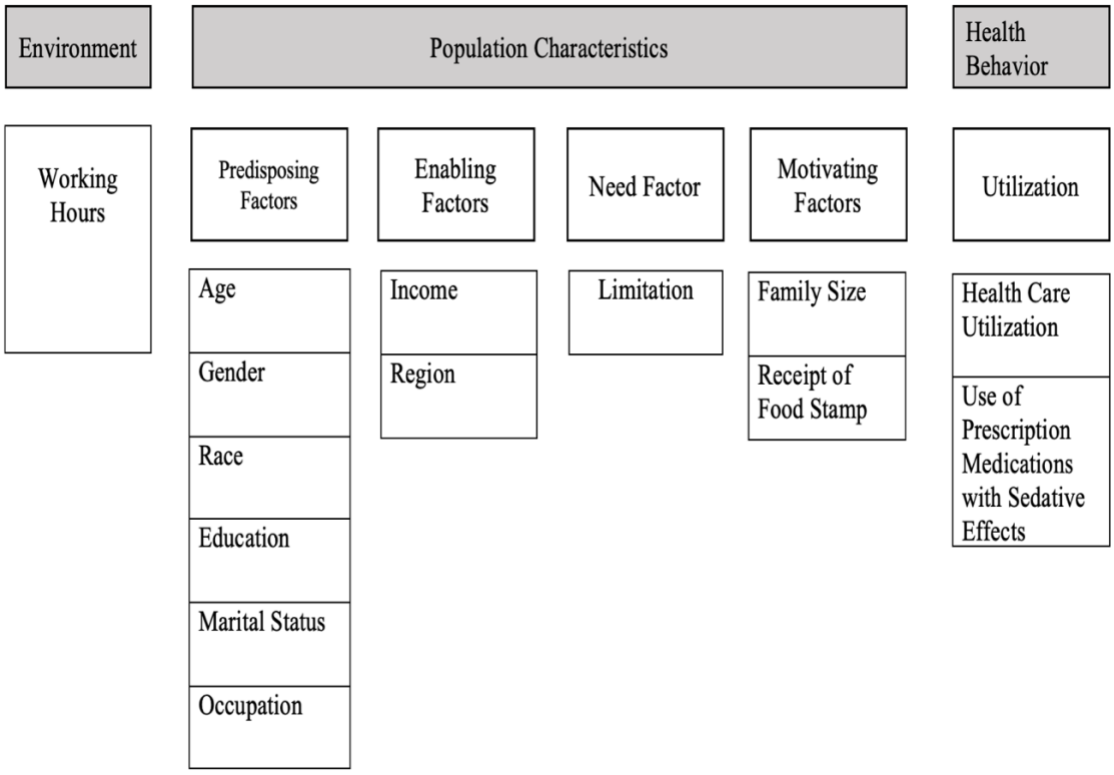


Table 7. Descriptive statistics of work hours and health care utilization.

			Weekly Working Hours				
Variables	**Overall Frequency**	**Overall Weighted %**	**30-35**	**36-40**	**41-50**	**51-60**	**≥ 61**
Age (years)							
18-26	8,211	9.3	16.8	9.9	6	5.6	5.6
27-64	76,185	86.2	75.1	85.9	90.6	90.3	88.8
≥ 65	3,590	4.5	8.1	4.2	3.4	4.1	5.5
Sex							
Male	48,531	56.1	39.7	53.4	62.4	71	76.7
Female	39,455	43.9	60.3	46.6	37.6	29	23.3
Race							
White	62,624	79.7	79.5	77.3	84.5	84	81.4
Black	15,300	11.3	12.5	12.8	8	9	8.9
Other	10,062	9	8	9.9	7.6	7	9.7
Marital Status							
Married	50,230	59.5	50.1	58.7	62.9	66.3	64.3
Unmarried	37,756	40.5	49.9	41.3	37.1	33.7	35.7
Family Size							
≤ 2 Members	37,349	48.7	49.5	47	51.8	51.3	51.7
> 2 Members	50,637	51.3	50.5	53	48.2	48.7	48.3
Education							
Less than college	35,650	32.8	37.6	35.1	26	27.6	34.3
Some college or more	52,336	67.2	62.4	64.9	74	72.4	65.7
Occupation							
Professional services	33,215	44.7	34.8	41.6	54.2	53.3	48.7
Non-professional services	54,771	55.3	65.2	58.4	45.8	46.7	51.3
Year							
2010	4,454	5.1	5	5.2	4.7	5.3	5.2
2011	9,972	10.7	11.2	10.9	10	10.5	12.4
2012	10,582	10.4	10.4	10.7	9.8	9.9	10.5
2013	9,809	10.6	10.6	11	10	10.2	9
2014	9,768	11	11.9	10.9	10.7	10.9	12.2
2015	10,382	11.3	11.4	11	11.8	12	12
2016	10,245	11.7	10.6	11.7	12.1	11.9	11.5
2017	9,437	11.7	11.6	11.5	12.2	11.9	10.9
2018	8,944	11.5	11.6	11.2	12.4	11.7	10.7
2019	4,393	5.9	5.6	5.9	6.3	5.6	5.6

(continued)

Table 7: (Continued).

Variables	Overall Frequency	Overall Weighted %	Weekly Working Hours				
			30-35	36-40	41-50	51-60	≥ 61
Region							
Northeast	13,549	17.5	20.0	17.2	17.3	18.1	14.8
North Central, Midwest	17,677	21.9	20.5	20.3	25.5	24.4	24.8
South	33,182	37.5	34.5	38.5	35.9	37.6	40.6
West	23,578	23.1	24.9	24.0	21.2	19.9	19.8
Income							
Poor to low income	19,887	14.9	30.0	15.9	8.0	8.5	10.0
Middle to high income	68,099	85.1	70.0	84.1	92.0	91.5	90.0
Receipt of food stamp							
No	81,139	95.3	90.6	94.8	97.6	97.6	97.2
Yes	6,847	4.7	9.4	5.2	2.4	2.4	2.8
Limitation							
No	78,359	88.3	85.8	88.6	88.9	88.1	87.2
Yes	9,627	11.7	14.2	11.4	11.1	11.9	12.8
Medication with Sedative Effects Use†							
No	63,918	72.7	72.1	73.3	70.2	73.4	75.3
Yes	24,068	27.4	27.9	26.7	29.8	26.6	24.7
Outpatient Visit							
No	76,675	85.1	84.7	85.6	84.1	85.1	85.1
≥ 1 visit	11,311	14.9	15.3	14.4	15.9	14.9	14.9
Office Based visit							
No	30,768	29.1	30.0	30.4	25.1	27.3	32.4
≥ 1 visit	57,218	70.9	70.0	69.6	74.9	72.7	67.6
ER visit							
No	78,777	89.5	87.9	89.4	90.2	90.6	89.2
≥ 1 visit	9,209	10.5	12.1	10.6	9.8	9.4	10.8
Hospital discharges							
No	84,200	95.3	94.8	95.3	95.2	95.8	95.2
≥ 1 discharge	3,786	4.7	5.2	4.7	4.8	4.2	4.8
Dental visit							
No	54,664	56.5	58.6	58.1	51.0	55.9	59.5
≥ 1 visit	33,322	43.5	41.4	41.9	49.0	44.1	40.5
Outpatient physician visit							
No	87,403	99.4	99.0	99.4	99.6	99.4	99.3
≥ 1 visit	583	0.6	1.0	0.6	0.4	0.6	0.7

†= Unweighted frequency

Table 8. Association Between Working Hours and Health Care Utilization: Fixed Effects Regression Analysis – Overall Sample

	Fixed Effect Logit Model – Overall sample				
Variables	**Outpatient**	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)					
36-40 h/week	1.342**	1.000	0.945	1.31	1.032
	(1.013, 1.779)	(0.824, 1.214)	(0.751, 1.190)	(0.904, 1.899)	(0.838, 1.272)
41-50 h/week	1.333	1.019	0.815	1.091	1.086
	(0.944, 1.884)	(0.791, 1.313)	(0.601, 1.106)	(0.682, 1.746)	(0.836, 1.411)
51-55 h/week	1.448	0.933	0.876	1.229	0.818
	(0.901, 2.328)	(0.673, 1.295)	(0.570, 1.346)	(0.598, 2.525)	(0.575, 1.166)
≥ 61 h/week	2.008**	0.992	0.886	1.007	1.011
	(1.044, 3.861)	(0.655, 1.503)	(0.514, 1.525)	(0.405, 2.509)	(0.631, 1.618)
Age (18-26years - REF)					
27-64 years	1.234	0.807*	0.744*	1.329	0.913
	(0.854, 1.783)	(0.646, 1.010)	(0.546, 1.014)	(0.822, 2.147)	(0.723, 1.154)
≥ 65 years	1.737**	0.612**	0.656	2.098*	0.763
	(1.006, 2.998)	(0.375, 0.999)	(0.365, 1.178)	(0.879, 5.007)	(0.487, 1.193)
Marital Status (Married - REF)					
Unmarried	0.952	1.184	0.946	0.679*	0.966
	(0.689, 1.315)	(0.940, 1.490)	(0.721, 1.240)	(0.438, 1.052)	(0.765, 1.220)
Family Size (≤ 2 Members - REF)					
> 2 Members	0.770***	0.758***	0.814**	0.867	0.917
	(0.648, 0.915)	(0.661, 0.870)	(0.693, 0.956)	(0.707, 1.064)	(0.801, 1.050)
Occupation (Non-professional - REF)					
Professional services	0.839	0.893	0.977	0.744	1.105
	(0.631, 1.114)	(0.729, 1.095)	(0.761, 1.255)	(0.497, 1.114)	(0.900, 1.357)
Income (Poor to low income - REF)					
middle to high income	0.903	1.000	1.016	0.671***	1.116**
	(0.781, 1.043)	(0.907, 1.103)	(0.898, 1.148)	(0.553, 0.815)	(1.003, 1.241)
Receipt of food stamp (No - REF)					
Yes	1.078	0.93	0.999	1.244*	0.955
	(0.877, 1.326)	(0.801, 1.080)	(0.838, 1.190)	(0.964, 1.607)	(0.807, 1.129)
Limitation (No - REF)					
Yes	1.431***	1.531***	1.361***	1.755***	1.159**
	(1.259, 1.627)	(1.329, 1.765)	(1.194, 1.551)	(1.456, 2.115)	(1.027, 1.309)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Table 9. Association Between working Hours and Outpatient Healthcare Services – Overall Sample

	Fixed Effects Regressions for Outpatient Healthcare Services – Overall Sample	
Variables	**Marginal Effect**	**Linear Model**
Work hours/week (30-35 h/week - REF)		
36-40 h/week	0.072**	0.020**
	(0.004, 0.141)	(0.000, 0.040)
41-50 h/week	0.071*	0.018
	(-0.013, 0.155)	(-0.008, 0.045)
51-55 h/week	0.091	0.024
	(-0.024, 0.205)	(-0.010, 0.058)
≥ 61 h/week	0.166**	0.046**
	(0.020, 0.313)	(0.001, 0.090)
Age (18-26years - REF)		
27-64 years	0.052	0.012
	(-0.038, 0.141)	(-0.009, 0.033)
≥ 65 years	0.133**	0.051*
	(0.008, 0.258)	(-0.000, 0.102)
Marital Status (Married - REF)		
Unmarried	-0.012	-0.005
	(-0.091, 0.067)	(-0.028, 0.017)
Family Size (≤ 2 Members - REF)		
> 2 Members	-0.064***	-0.023***
	(-0.106, -0.021)	(-0.038, -0.009)
Occupation (Non-professional - REF)		
Professional services	-0.043	-0.012
	(-0.112, 0.027)	(-0.033, 0.008)
Income (Poor to low income - REF)		
middle to high income	-0.025	-0.007
	(-0.060, 0.010)	(-0.016, 0.003)
Receipt of food stamp (No - REF)		
Yes	0.018	0.007
	(-0.031, 0.068)	(-0.009, 0.022)
Limitation (No - REF)		
Yes	0.086***	0.044***
	(0.055, 0.116)	(0.029, 0.060)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Figure 7. Use of outpatient services according to working hours from the fixed effects regression model of the overall sample.

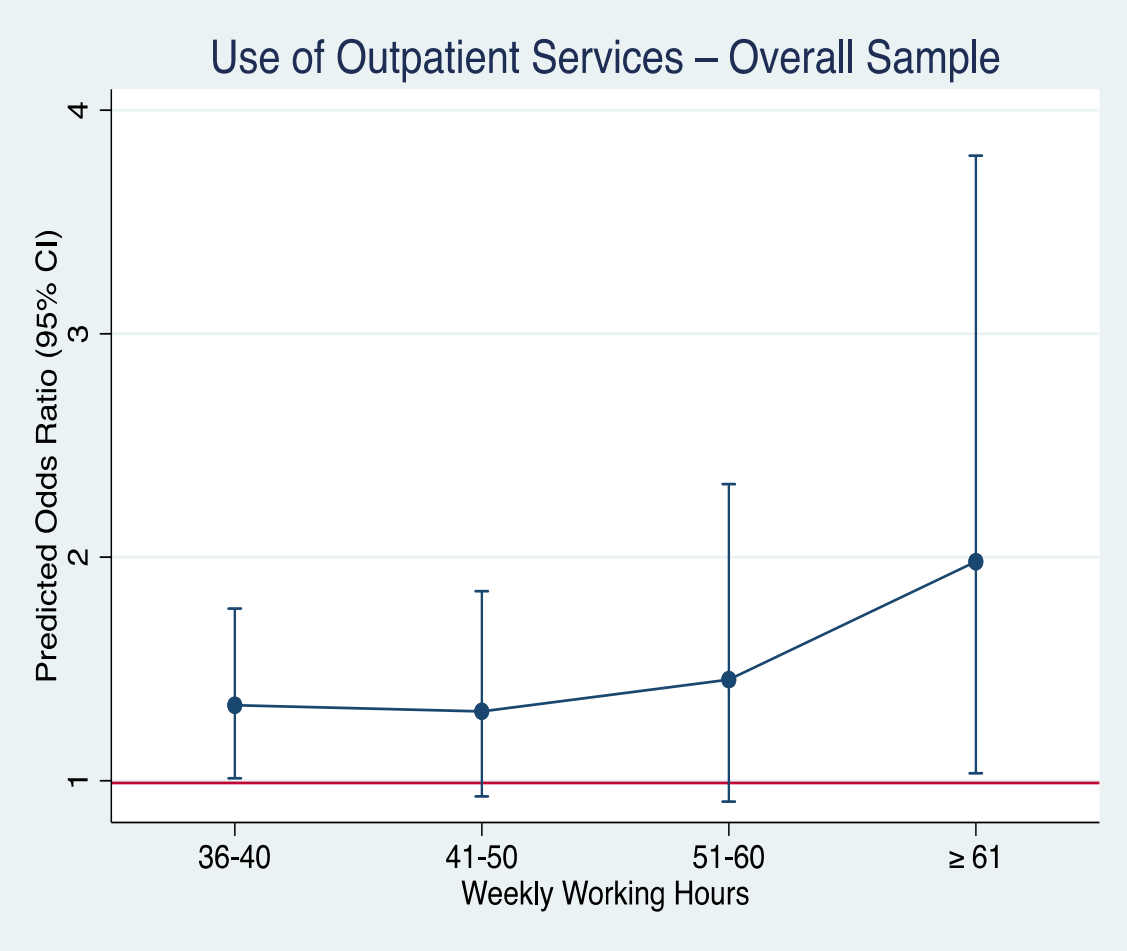
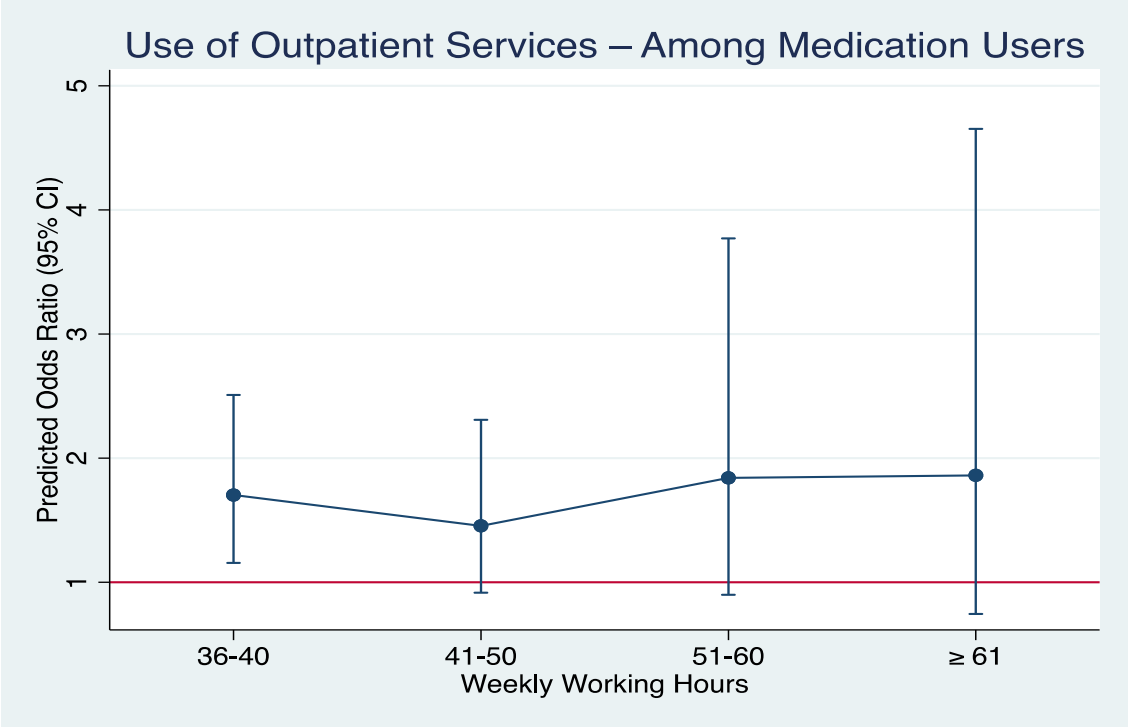


Table 10. Association Between working Hours and Health care Utilization: Fixed effects regression analysis – Among Medication Users

	Fixed Effect Logit Model – Among Medication Users		
Variables	**Logit Model**	**Marginal Effect**	**Linear Model**
Work hours/week (30-35 h/week - REF)			
36-40 h/week	1.715***	0.127***	0.069***
	(1.159, 2.539)	(0.039, 0.216)	(0.020, 0.118)
41-50 h/week	1.518*	0.099*	0.051
	(0.949, 2.426)	(-0.009, 0.208)	(-0.014, 0.115)
51-55 h/week	1.881*	0.148*	0.076
	(0.909, 3.892)	(-0.012, 0.307)	(-0.016, 0.169)
≥ 61 h/week	1.975	0.158	0.081
	(0.783, 4.983)	(-0.042, 0.358)	(-0.042, 0.204)
Age (18-26years - REF)			
27-64 years	1.403	0.08	0.036
	(0.796, 2.475)	(-0.050, 0.211)	(-0.024, 0.096)
≥ 65 years	2.833**	0.225***	0.146**
	(1.198, 6.698)	(0.069, 0.380)	(0.032, 0.260)
Marital Status (Married - REF)			
Unmarried	0.715	-0.077	-0.041
	(0.451, 1.135)	(-0.186, 0.033)	(-0.091, 0.009)
Family Size (≤ 2 Members REF)			
> 2 Members	0.784**	-0.055*	-0.036**
	(0.616, 0.998)	(-0.113, 0.002)	(-0.070, -0.003)
Occupation (Non-professional - REF)			
Professional services	1.022	0.005	0.002
	(0.682, 1.530)	(-0.087, 0.096)	(-0.048, 0.053)
Income (Poor to low income - REF)			
middle to high income	0.796**	-0.051**	-0.029**
	(0.647, 0.980)	(-0.099, -0.002)	(-0.056, -0.003)
Receipt of food stamp (No - REF)			
Yes	1.238	0.047	0.03
	(0.935, 1.641)	(-0.014, 0.109)	(-0.010, 0.069)
Limitation (No - REF)			
Yes	1.607***	0.105***	0.082***
	(1.362, 1.897)	(0.065, 0.146)	(0.054, 0.109)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Figure 8. Use of outpatient services according to working hours from the fixed effects regression model among users of medications with sedative side effects.



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APPENDICES

APPENDIX CHAPTER 1:

Appendix 1. Medications with sedative properties (Comparisons eAnswers., 2021).

Drug Facts And Comparisons

Acetaminophen and Codeine Oral
Acetaminophen, Caffeine, and Dihydrocodeine Oral
Alfentanil Injection
Alosetron Oral
ALPRAZolam Oral
Amitriptyline Oral
Ampicillin and Sulbactam Injection
ARIPiprazole Injection
ARIPiprazole Oral
Azelastine and Fluticasone Intranasal
Benzonatate Oral
Brexpiprazole Oral
Brivaracetam Injection
Brivaracetam Oral
Brompheniramine, Pseudoephedrine, and Dextromethorphan Oral
Buprenorphine Implant
Buprenorphine Injection
Buprenorphine Oral
Buprenorphine Transdermal
Butalbital, Acetaminophen, and Caffeine Oral
Cannabidiol Oral
Capecitabine Oral
Carbinoxamine Oral
Cenobamate Oral
Cetirizine Injection
Cetirizine Oral
Chlorpheniramine and Phenylephrine Oral
Chlorpheniramine, Phenylephrine, and Dextromethorphan Oral
Chlorpheniramine, Pseudoephedrine, and Codeine Oral
Chlorpheniramine, Pseudoephedrine, and Dextromethorphan Oral
CloBAZam Oral
Clonidine and Chlorthalidone Oral
CloNIDine Injection
CloNIDine Oral
CloNIDine Transdermal
CloZAPine Oral
Codeine and Chlorpheniramine Oral
Codeine Oral
Cyproheptadine Oral
Deutetrabenazine Oral
Dexchlorpheniramine Oral
DiphenhydrAMINE Injection
DiphenhydrAMINE Oral
Diphenoxylate and Atropine Oral
Doxepin Oral
Eluxadoline Oral
Esketamine Intranasal
Fenfluramine Oral
FentaNYL Buccal
FentaNYL Injection
FentaNYL Intranasal

FentaNYL Sublingual
FentaNYL Transdermal
Flibanserin Oral
Flucytosine Oral
Flurazepam Oral
Gabapentin Enacarbil Oral
Guaifenesin and Codeine Oral
GuanFACINE Oral
Haloperidol Injection
Haloperidol Oral
Hydrocodone and Acetaminophen Oral
Hydrocodone and Chlorpheniramine Oral
Hydrocodone and Homatropine Oral
Hydrocodone and Pseudoephedrine Oral
HYDROcodone Oral
HYDROmorphone Injection
HYDROmorphone Oral
HYDROmorphone Rectal
Isocarboxazid Oral
LevETIRAcetam Injection
LevETIRAcetam Oral
Lithium Oral
Lofexidine Oral
Loratadine Oral
LORazepam Injection
LORazepam Oral
Loxapine Inhalation
Loxapine Oral
Lumateperone Oral
Mecamylamine Oral
Meperidine Injection
Meperidine Oral
Methadone Injection
Methadone Oral
Methocarbamol Injection
Methocarbamol Oral
Methyldopa and Hydrochlorothiazide Oral
Methyldopa Oral
Methyldopate Injection
Methylphenidate Oral
Methylphenidate Transdermal
MetyraPONE Oral
MetyroSINE Oral
Midazolam Injection
Midazolam Intranasal
Midazolam Oral
Mitotane Oral
Morphine and Naltrexone Oral
Morphine Injection
Morphine Oral
Morphine Rectal
Nabilone Oral
Nadolol and Bendroflumethiazide Oral
Nadolol Oral
Nalbuphine Injection
Naltrexone Injection
Naltrexone Oral
Olanzapine and Samidorphan Oral
OLANZapine Injection
OLANZapine Oral
Oliceridine Injection
Ondansetron Injection

Ondansetron Oral
Oxaprozin Oral
Oxycodone and Acetaminophen Oral
Oxycodone and Aspirin Oral
OxyMORphone Injection
OxyMORphone Oral
Paliperidone Injection
Paliperidone Oral
Papaverine Injection
Pentazocine and Naloxone Oral
Pentazocine Injection
Perphenazine Oral
PHENobarbital Oral
Pimozide Oral
Pregabalin Oral
Promethazine and Codeine Oral
Promethazine and Phenylephrine Oral
Promethazine Injection
Promethazine Oral
Promethazine Rectal
Promethazine, Phenylephrine, and Codeine Oral
RisperiDONE Injection
RisperiDONE Oral
SUFentanil Injection
SUFentanil Oral
SUMAtriptan Injection
SUMAtriptan Intranasal
SUMAtriptan Oral
Suvorexant Oral
Tapentadol Oral
Tetrabenazine Oral
TiZANidine Oral
TraMADol Oral
Triazolam Oral
Valbenazine Oral
Vigabatrin Oral
Vilazodone Oral
Viloxazine Oral

N/B: Facts and Comparisons at the time had a search feature that enabled a whole database search for medications that have a side effect of interest.

Appendix 2a. Heckman Analysis for the Use of Prescription Sleep Aids and Medications with Sedative Properties: ≥ 36 h/week and ≥ 46 h/week

Variables	≥ 36 h/week				≥ 46 h/week			
	Use of Prescription Sleep Aids		Use of Medications with Sedative Properties		Use of Prescription Sleep Aids		Use of Medications with Sedative Properties	
Work hours/week	Sleep Aids	select	Sedative Properties	select	Sleep Aids	select	Sedative Properties	select
h/week	0.135	0.007	0.415	0.018	0.051	0.009	0.347	0.015
	(-0.362, 0.633)	(-0.036, 0.050)	(-0.902, 1.731)	(-0.010, 0.046)	(-0.426, 0.529)	(-0.026, 0.044)	(-0.813, 1.507)	(-0.008, 0.038)
27-64 years	3.101	0.356***	3.905	0.150***	3.132	0.357***	4.119	0.151***
	(-10.214, 16.415)	(0.291, 0.422)	(-4.788, 12.598)	(0.115, 0.186)	(-10.285, 16.549)	(0.291, 0.422)	(-5.103, 13.342)	(0.115, 0.187)
≥ 65 years	2.513	0.306***	5.868	0.244***	2.520	0.305***	6.150	0.242***
	(-8.970, 13.996)	(0.218, 0.394)	(-7.904, 19.641)	(0.191, 0.296)	(-9.025, 14.065)	(0.217, 0.394)	(-8.323, 20.622)	(0.190, 0.295)
Race (White - REF)								
Black	-2.996	-0.360***	-0.729	-0.011	-3.015	-0.360***	-0.732	-0.010
	(-16.358, 10.366)	(-0.404, -0.316)	(-1.692, 0.234)	(-0.035, 0.014)	(-16.467, 10.436)	(-0.404, -0.316)	(-1.735, 0.271)	(-0.035, 0.015)
Other	-1.854	-0.183***	-2.083	-0.074***	-1.861	-0.183***	-2.164	-0.074***
	(-8.623, 4.914)	(-0.238, -0.128)	(-6.375, 2.208)	(-0.108, -0.041)	(-8.668, 4.945)	(-0.238, -0.127)	(-6.661, 2.334)	(-0.108, -0.040)
Sex (Male - REF)								
Female	0.329	0.052***	0.140	0.008	0.331	0.053***	0.164	0.009
	(-1.606, 2.263)	(0.022, 0.082)	(-0.609, 0.889)	(-0.011, 0.027)	(-1.641, 2.302)	(0.023, 0.083)	(-0.654, 0.983)	(-0.011, 0.028)
Marital status (Married - REF)								
Divorced	0.469	0.057**	1.057	0.036**	0.475	0.057**	1.100	0.036**
	(-1.628, 2.566)	(0.021, 0.092)	(-1.001, 3.115)	(0.012, 0.060)	(-1.636, 2.587)	(0.021, 0.092)	(-1.072, 3.273)	(0.012, 0.060)
Unmarried	-0.011	0.012	-1.182	-0.053***	-0.009	0.012	-1.247	-0.053***
	(-0.596, 0.574)	(-0.027, 0.051)	(-4.237, 1.874)	(-0.078, -0.028)	(-0.602, 0.585)	(-0.027, 0.051)	(-4.469, 1.975)	(-0.078, -0.028)
Family size (≤ 3 Members REF)								
4-6 Members	-1.601	-0.191***	-3.066	-0.125***	-1.611	-0.191***	-3.225	-0.125***
	(-8.643, 5.442)	(-0.225, -0.157)	(-10.065, 3.934)	(-0.146, -0.103)	(-8.704, 5.483)	(-0.225, -0.157)	(-10.618, 4.168)	(-0.146, -0.103)
> 6 Members	-2.678	-0.375***	-5.962	-0.237***	-2.696	-0.375***	-6.247	-0.236***
	(-16.781, 11.424)	(-0.521, -0.230)	(-19.564, 7.641)	(-0.313, -0.161)	(-16.887, 11.495)	(-0.521, -0.229)	(-20.565, 8.072)	(-0.312, -0.160)

Education (Less than College - REF)								
Some college or more	0.662	0.103***	-0.024	-0.001	0.668	0.103***	-0.033	-0.002
	(-3.150, 4.474)	(0.072, 0.135)	(-0.634, 0.586)	(-0.021, 0.019)	(-3.160, 4.496)	(0.072, 0.134)	(-0.682, 0.615)	(-0.021, 0.018)
Occupation (Natural resources - REF)								
Hospitality services	0.308	0.013	0.869	0.041	0.291	0.012	0.872	0.039
	(-0.633, 1.249)	(-0.069, 0.096)	(-1.883, 3.621)	(-0.009, 0.091)	(-0.644, 1.226)	(-0.070, 0.095)	(-1.937, 3.681)	(-0.011, 0.089)
Trade	0.675	0.056	1.322	0.050*	0.671	0.056	1.376	0.049*
	(-1.493, 2.843)	(-0.016, 0.127)	(-1.767, 4.412)	(0.005, 0.094)	(-1.512, 2.854)	(-0.016, 0.127)	(-1.870, 4.621)	(0.005, 0.093)
Professional services	1.217	0.126***	1.782	0.077***	1.226	0.127***	1.887	0.078***
	(-3.467, 5.901)	(0.063, 0.190)	(-2.704, 6.268)	(0.038, 0.117)	(-3.504, 5.956)	(0.063, 0.190)	(-2.870, 6.644)	(0.038, 0.117)
Manufacturing	0.987	0.100**	1.311	0.063**	1.000	0.101**	1.426	0.064**
	(-2.774, 4.747)	(0.030, 0.171)	(-2.458, 5.081)	(0.019, 0.107)	(-2.809, 4.809)	(0.031, 0.171)	(-2.636, 5.487)	(0.020, 0.108)
Other	0.851	0.100**	1.532	0.074***	0.862	0.100**	1.650	0.075***
	(-2.873, 4.575)	(0.035, 0.164)	(-2.757, 5.820)	(0.034, 0.114)	(-2.912, 4.636)	(0.036, 0.165)	(-2.941, 6.240)	(0.035, 0.115)
Year (2010 - REF)								
2011	0.129	-0.020	-1.959	-0.106***	0.130	-0.020	-2.089	-0.106***
	(-0.821, 1.078)	(-0.082, 0.042)	(-7.907, 3.989)	(-0.146, -0.066)	(-0.825, 1.085)	(-0.082, 0.042)	(-8.366, 4.188)	(-0.146, -0.066)
2012	-0.160	-0.073*	-3.415	-0.165***	-0.164	-0.073*	-3.618	-0.165***
	(-2.906, 2.586)	(-0.135, -0.011)	(-12.609, 5.780)	(-0.205, -0.125)	(-2.927, 2.598)	(-0.135, -0.011)	(-13.318, 6.082)	(-0.205, -0.125)
2013	0.090	-0.040	-1.971	-0.100***	0.086	-0.039	-2.091	-0.100***
	(-1.481, 1.661)	(-0.103, 0.023)	(-7.587, 3.646)	(-0.141, -0.060)	(-1.491, 1.664)	(-0.103, 0.024)	(-8.011, 3.830)	(-0.140, -0.059)
2014	-0.177	-0.026	-2.302	-0.113***	-0.178	-0.026	-2.445	-0.113***
	(-1.296, 0.943)	(-0.088, 0.036)	(-8.629, 4.025)	(-0.153, -0.073)	(-1.307, 0.951)	(-0.088, 0.036)	(-9.131, 4.242)	(-0.153, -0.073)
2015	-0.400	-0.058	-2.000	-0.097***	-0.404	-0.058	-2.125	-0.097***
	(-2.595, 1.796)	(-0.120, 0.005)	(-7.452, 3.451)	(-0.137, -0.057)	(-2.617, 1.809)	(-0.120, 0.005)	(-7.892, 3.642)	(-0.137, -0.057)
2016	-0.243	-0.050	-2.228	-0.114***	-0.243	-0.050	-2.368	-0.114***
	(-2.175, 1.689)	(-0.113, 0.013)	(-8.607, 4.151)	(-0.155, -0.073)	(-2.186, 1.699)	(-0.113, 0.013)	(-9.099, 4.364)	(-0.154, -0.073)
2017	0.371	-0.003	-1.997	-0.114***	0.373	-0.003	-2.143	-0.114***
	(-0.250, 0.992)	(-0.066, 0.060)	(-8.361, 4.367)	(-0.155, -0.072)	(-0.254, 0.999)	(-0.066, 0.060)	(-8.873, 4.588)	(-0.155, -0.072)
2018	0.316	0.003	-1.756	-0.104***	0.318	0.003	-1.892	-0.104***

	(-0.305, 0.938)	(-0.060, 0.066)	(-7.600, 4.088)	(-0.146, -0.063)	(-0.309, 0.944)	(-0.060, 0.066)	(-8.078, 4.295)	(-0.146, -0.063)
2019	0.695	0.091**	-0.214	-0.021	0.696	0.091**	-0.249	-0.022
	(-2.701, 4.090)	(0.028, 0.155)	(-1.952, 1.523)	(-0.064, 0.022)	(-2.719, 4.111)	(0.027, 0.155)	(-2.099, 1.601)	(-0.065, 0.021)
Region (Northeast - REF)								
North central, Midwest	0.071		0.150		0.074		0.151	
	(-0.236, 0.378)		(-0.511, 0.811)		(-0.235, 0.383)		(-0.548, 0.850)	
South	0.030		0.075		0.034		0.077	
	(-0.262, 0.323)		(-0.543, 0.693)		(-0.261, 0.329)		(-0.576, 0.730)	
West	-0.232		-0.123		-0.229		-0.121	
	(-0.545, 0.081)		(-0.786, 0.541)		(-0.545, 0.086)		(-0.823, 0.580)	
Income (Poor to low income - REF)								
Middle to high income	0.049	0.020	-0.091	-0.004	0.059	0.020	-0.085	-0.004
	(-0.773, 0.871)	(-0.021, 0.060)	(-0.901, 0.718)	(-0.029, 0.021)	(-0.767, 0.885)	(-0.021, 0.060)	(-0.931, 0.762)	(-0.029, 0.021)
Receipt of food stamp (No - REF)								
YES	0.568	0.045	2.230	0.086***	0.557	0.045	2.314	0.085***
	(-1.160, 2.296)	(-0.011, 0.101)	(-2.634, 7.094)	(0.051, 0.120)	(-1.168, 2.281)	(-0.011, 0.101)	(-2.767, 7.395)	(0.050, 0.119)
Health status (Excellent - REF)								
Good	1.489	0.179***	4.617	0.183***	1.500	0.179***	4.858	0.183***
	(-5.162, 8.139)	(0.135, 0.224)	(-5.889, 15.123)	(0.157, 0.210)	(-5.206, 8.205)	(0.135, 0.224)	(-6.244, 15.960)	(0.157, 0.210)
Fair	3.124	0.318***	10.311	0.409***	3.143	0.318***	10.831	0.410***
	(-8.612, 14.860)	(0.261, 0.375)	(-12.394, 33.017)	(0.373, 0.446)	(-8.687, 14.973)	(0.261, 0.375)	(-13.156, 34.817)	(0.373, 0.446)
Poor	4.403	0.470***	15.086	0.585***	4.433	0.470***	15.806	0.585***
	(-12.837, 21.643)	(0.361, 0.579)	(-16.544, 46.715)	(0.507, 0.663)	(-12.938, 21.804)	(0.361, 0.579)	(-17.600, 49.212)	(0.507, 0.663)
Lambda	8.386		30.596		8.461		32.377	
	(-34.820, 51.593)		(-47.237, 108.430)		(-35.067, 51.988)		(-49.835, 114.589)	

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference; Instrumenting on Region

Appendix 2b. Heckman Analysis for the Use of Prescription Sleep Aids and Medications with Sedative Properties: ≥ 56 h/week and ≥ 66 h/week

Variables	≥ 56 h/week				≥ 66 h/week			
	Use of Prescription Sleep Aids		**Use of Medications with Sedative Properties**		**Use of Prescription Sleep Aids**		**Use of Medications with Sedative Properties**	
Work hours/week	Sleep Aids	select	Sedative Properties	select	Sleep Aids	select	Sedative Properties	select
h/week	0.826 (-1.573, 3.225)	0.060* (0.006, 0.114)	1.649 (-1.833, 5.131)	0.056** (0.020, 0.092)	0.451 (-1.062, 1.964)	0.037 (-0.061, 0.136)	0.693 (-1.651, 3.038)	0.020 (-0.045, 0.085)
Age (18-26years - REF)								
27-64 years	3.270 (-10.825, 17.366)	0.356*** (0.290, 0.422)	4.181 (-5.098, 13.460)	0.151*** (0.115, 0.186)	2.874 (-9.241, 14.989)	0.357*** (0.291, 0.423)	4.046 (-5.016, 13.108)	0.152*** (0.116, 0.187)
≥ 65 years	2.617 (-9.475, 14.710)	0.304*** (0.216, 0.392)	6.227 (-8.296, 20.749)	0.241*** (0.189, 0.294)	2.289 (-8.117, 12.695)	0.305*** (0.217, 0.393)	6.011 (-8.159, 20.182)	0.242*** (0.190, 0.295)
Race (White - REF)								
Black	-3.178 (-17.353, 10.997)	-0.360*** (-0.404, -0.316)	-0.747 (-1.781, 0.286)	-0.010 (-0.035, 0.014)	-2.756 (-14.897, 9.386)	-0.360*** (-0.404, -0.316)	-0.734 (-1.723, 0.256)	-0.010 (-0.035, 0.014)
Other	-1.958 (-9.136, 5.220)	-0.183*** (-0.238, -0.128)	-2.207 (-6.757, 2.344)	-0.074*** (-0.108, -0.040)	-1.736 (-7.888, 4.415)	-0.183*** (-0.238, -0.128)	-2.132 (-6.557, 2.292)	-0.074*** (-0.108, -0.040)
Sex (Male - REF)								
Female	0.396 (-1.764, 2.556)	0.055*** (0.025, 0.085)	0.216 (-0.660, 1.093)	0.010 (-0.010, 0.029)	0.298 (-1.474, 2.070)	0.052*** (0.022, 0.082)	0.139 (-0.618, 0.895)	0.008 (-0.012, 0.027)
Marital status (Married - REF)								
Divorced	0.491 (-1.720, 2.702)	0.056** (0.021, 0.092)	1.108 (-1.072, 3.288)	0.035** (0.012, 0.059)	0.435 (-1.472, 2.342)	0.057** (0.021, 0.092)	1.081 (-1.046, 3.209)	0.036** (0.012, 0.060)
Unmarried	-0.001 (-0.639, 0.637)	0.013 (-0.026, 0.051)	-1.265 (-4.503, 1.973)	-0.053*** (-0.078, -0.028)	-0.015 (-0.552, 0.522)	0.012 (-0.026, 0.051)	-1.220 (-4.383, 1.943)	-0.053*** (-0.078, -0.028)
Family size (≤ 3 Members REF)								
4-6 Members	-1.692 (-9.150, 5.767)	-0.190*** (-0.224, -0.156)	-3.283 (-10.727, 4.162)	-0.124*** (-0.146, -0.103)	-1.474 (-7.869, 4.921)	-0.191*** (-0.225, -0.156)	-3.153 (-10.389, 4.082)	-0.125*** (-0.146, -0.103)
> 6 Members	-2.837	-0.374***	-6.359	-0.236***	-2.420	-0.375***	-6.119	-0.236***

	(-17.758, 12.084)	(-0.520, -0.228)	(-20.792, 8.074)	(-0.312, -0.160)	(-15.230, 10.390)	(-0.521, -0.229)	(-20.149, 7.912)	(-0.312, -0.161)
Education (Less than College - REF)								
Some college or more	0.706	0.103***	-0.035	-0.001	0.600	0.104***	-0.013	-0.001
	(-3.314, 4.725)	(0.071, 0.134)	(-0.696, 0.626)	(-0.021, 0.018)	(-2.875, 4.075)	(0.072, 0.135)	(-0.641, 0.615)	(-0.021, 0.019)
Occupation (Natural resources - REF)								
Hospitality services	0.350	0.015	0.946	0.040	0.284	0.013	0.844	0.038
	(-0.696, 1.397)	(-0.067, 0.097)	(-1.977, 3.869)	(-0.010, 0.090)	(-0.561, 1.129)	(-0.070, 0.095)	(-1.876, 3.565)	(-0.012, 0.088)
Trade	0.741	0.058	1.461	0.051*	0.633	0.056	1.341	0.049*
	(-1.663, 3.145)	(-0.013, 0.130)	(-1.919, 4.841)	(0.007, 0.095)	(-1.342, 2.609)	(-0.016, 0.127)	(-1.803, 4.485)	(0.004, 0.093)
Professional services	1.322	0.129***	1.974	0.079***	1.133	0.126***	1.832	0.077***
	(-3.748, 6.392)	(0.065, 0.192)	(-2.909, 6.857)	(0.039, 0.119)	(-3.129, 5.396)	(0.063, 0.190)	(-2.782, 6.447)	(0.037, 0.117)
Manufacturing	1.090	0.104**	1.534	0.067**	0.933	0.102**	1.396	0.064**
	(-3.039, 5.218)	(0.034, 0.175)	(-2.701, 5.768)	(0.023, 0.111)	(-2.522, 4.388)	(0.031, 0.172)	(-2.574, 5.367)	(0.020, 0.108)
Other	0.945	0.103**	1.735	0.076***	0.784	0.100**	1.594	0.074***
	(-3.119, 5.008)	(0.038, 0.167)	(-2.979, 6.449)	(0.036, 0.116)	(-2.612, 4.180)	(0.036, 0.165)	(-2.853, 6.041)	(0.034, 0.114)
Year (2010 - REF)								
2011	0.123	-0.020	-2.146	-0.106***	0.138	-0.020	-2.035	-0.106***
	(-0.889, 1.136)	(-0.083, 0.042)	(-8.491, 4.199)	(-0.147, -0.066)	(-0.730, 1.007)	(-0.083, 0.042)	(-8.186, 4.116)	(-0.146, -0.066)
2012	-0.191	-0.073*	-3.693	-0.165***	-0.112	-0.073*	-3.528	-0.165***
	(-3.094, 2.711)	(-0.135, -0.010)	(-13.464, 6.079)	(-0.204, -0.125)	(-2.608, 2.383)	(-0.135, -0.011)	(-13.026, 5.970)	(-0.205, -0.125)
2013	0.075	-0.039	-2.131	-0.100***	0.115	-0.040	-2.035	-0.100***
	(-1.578, 1.727)	(-0.102, 0.024)	(-8.088, 3.827)	(-0.140, -0.059)	(-1.309, 1.539)	(-0.103, 0.024)	(-7.832, 3.761)	(-0.140, -0.059)
2014	-0.193	-0.026	-2.501	-0.113***	-0.163	-0.026	-2.379	-0.113***
	(-1.388, 1.003)	(-0.088, 0.036)	(-9.246, 4.244)	(-0.153, -0.073)	(-1.183, 0.857)	(-0.088, 0.036)	(-8.916, 4.158)	(-0.153, -0.073)
2015	-0.424	-0.058	-2.174	-0.097***	-0.366	-0.058	-2.065	-0.097***
	(-2.755, 1.907)	(-0.120, 0.005)	(-7.995, 3.647)	(-0.137, -0.057)	(-2.361, 1.630)	(-0.120, 0.005)	(-7.694, 3.564)	(-0.137, -0.057)
2016	-0.259	-0.050	-2.415	-0.114***	-0.209	-0.050	-2.298	-0.114***
	(-2.295, 1.778)	(-0.113, 0.014)	(-9.189, 4.359)	(-0.154, -0.073)	(-1.956, 1.539)	(-0.113, 0.013)	(-8.872, 4.276)	(-0.154, -0.073)
2017	0.382	-0.003	-2.187	-0.113***	0.378	-0.003	-2.072	-0.113***
	(-0.281, 1.044)	(-0.066, 0.061)	(-8.954, 4.579)	(-0.155, -0.072)	(-0.185, 0.941)	(-0.066, 0.060)	(-8.642, 4.499)	(-0.155, -0.072)
2018	0.323	0.003	-1.934	-0.104***	0.317	0.003	-1.827	-0.104***
	(-0.343, 0.989)	(-0.060, 0.066)	(-8.159, 4.291)	(-0.146, -0.063)	(-0.248, 0.883)	(-0.060, 0.066)	(-7.866, 4.212)	(-0.146, -0.063)
2019	0.746	0.091**	-0.261	-0.022	0.636	0.092**	-0.231	-0.021

	(-2.855, 4.346)	(0.028, 0.155)	(-2.142, 1.620)	(-0.065, 0.021)	(-2.454, 3.725)	(0.028, 0.156)	(-2.030, 1.568)	(-0.064, 0.022)
Region (Northeast - REF)								
North central, Midwest	0.064		0.143		0.072		0.151	
	(-0.264, 0.393)		(-0.571, 0.857)		(-0.207, 0.350)		(-0.531, 0.833)	
South	0.030		0.075		0.033		0.076	
	(-0.283, 0.343)		(-0.592, 0.742)		(-0.233, 0.299)		(-0.561, 0.713)	
West	-0.223		-0.120		-0.227		-0.122	
	(-0.558, 0.112)		(-0.837, 0.596)		(-0.511, 0.057)		(-0.806, 0.563)	
Income (Poor to low income - REF)								
Middle to high income	0.049	0.019	-0.100	-0.004	0.048	0.020	-0.058	-0.003
	(-0.795, 0.892)	(-0.021, 0.059)	(-0.966, 0.765)	(-0.029, 0.021)	(-0.715, 0.811)	(-0.020, 0.060)	(-0.866, 0.750)	(-0.028, 0.022)
Receipt of food stamp (No - REF)								
YES	0.563	0.044	2.339	0.084***	0.516	0.044	2.258	0.085***
	(-1.230, 2.355)	(-0.012, 0.100)	(-2.754, 7.433)	(0.050, 0.119)	(-1.027, 2.060)	(-0.012, 0.100)	(-2.700, 7.216)	(0.050, 0.119)
Health status (Excellent - REF)								
Good	1.604	0.180***	4.963	0.184***	1.374	0.179***	4.749	0.183***
	(-5.487, 8.695)	(0.136, 0.224)	(-6.246, 16.172)	(0.157, 0.210)	(-4.674, 7.421)	(0.135, 0.224)	(-6.104, 15.603)	(0.156, 0.210)
Fair	3.302	0.319***	11.036	0.409***	2.917	0.318***	10.591	0.409***
	(-9.168, 15.773)	(0.262, 0.376)	(-13.140, 35.211)	(0.373, 0.446)	(-7.744, 13.579)	(0.261, 0.375)	(-12.856, 34.039)	(0.373, 0.445)
Poor	4.655	0.470***	16.073	0.585***	4.105	0.470***	15.485	0.585***
	(-13.634, 22.943)	(0.361, 0.579)	(-17.579, 49.726)	(0.507, 0.663)	(-11.563, 19.773)	(0.361, 0.579)	(-17.200, 48.170)	(0.507, 0.663)
Lambda	8.986		33.075		7.625		31.591	
	(-36.846, 54.817)		(-49.800, 115.951)		(-31.646, 46.896)		(-48.865, 112.048)	

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference; Instrumenting on Region

Appendix 3a. Regressions for Use of Prescription Sleep Aids: ≥ 36 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 36 h/week	0.005	0.007	1.01	0.001	0.084
	(-0.014, 0.024)	(-0.031, 0.045)	(0.923, 1.106)	(-0.005, 0.006)	(-0.115, 0.283)
Age (18-26years - REF)					
27-64 years	0.104***	0.305***	2.206***	0.034***	0.522**
	(0.080, 0.128)	(0.255, 0.356)	(1.897, 2.565)	(0.030, 0.039)	(0.188, 0.856)
≥ 65 years	0.069***	0.253***	1.995***	0.029***	0.293
	(0.033, 0.105)	(0.181, 0.325)	(1.644, 2.420)	(0.020, 0.037)	(-0.132, 0.718)
Race (White - REF)					
Black	-0.127***	-0.313***	0.456***	-0.037***	-0.407***
	(-0.144, -0.109)	(-0.349, -0.277)	(0.413, 0.505)	(-0.040, -0.033)	(-0.628, -0.186)
Other	-0.087***	-0.171***	0.687***	-0.021***	-0.546***
	(-0.109, -0.064)	(-0.218, -0.123)	(0.609, 0.775)	(-0.026, -0.015)	(-0.811, -0.281)
Sex (Male - REF)					
Female	0.012	0.043**	1.108**	0.006**	-0.042
	(-0.001, 0.025)	(0.017, 0.070)	(1.041, 1.180)	(0.002, 0.009)	(-0.177, 0.093)
Marital status (Married - REF)					
Divorced	0.029***	0.053**	1.127**	0.007**	0.068
	(0.012, 0.045)	(0.021, 0.085)	(1.047, 1.212)	(0.003, 0.011)	(-0.090, 0.226)
Unmarried	0.002	0.009	1.034	0.002	-0.098
	(-0.015, 0.019)	(-0.026, 0.043)	(0.954, 1.121)	(-0.003, 0.006)	(-0.275, 0.078)
Family size (≤ 3 Members REF)					
4-6 Members	-0.072***	-0.171***	0.670***	-0.021***	-0.237**
	(-0.086, -0.058)	(-0.200, -0.142)	(0.623, 0.720)	(-0.025, -0.018)	(-0.397, -0.077)
> 6 Members	-0.101***	-0.308***	0.437***	-0.037***	0.043
	(-0.151, -0.051)	(-0.419, -0.198)	(0.311, 0.615)	(-0.048, -0.027)	(-0.714, 0.800)
Education (Less than College - REF)					
Some college or more	0.026***	0.087***	1.237***	0.012***	-0.074
	(0.013, 0.040)	(0.059, 0.114)	(1.158, 1.321)	(0.008, 0.015)	(-0.217, 0.069)
Occupation (Natural resources - REF)					
Hospitality services	0.021	0.018	1.033	0.002	0.214
	(-0.013, 0.055)	(-0.052, 0.088)	(0.866, 1.232)	(-0.007, 0.010)	(-0.173, 0.600)
Trade	0.033*	0.057	1.114	0.005	0.277
	(0.003, 0.063)	(-0.004, 0.118)	(0.956, 1.297)	(-0.002, 0.013)	(-0.057, 0.610)
Professional services	0.061***	0.120***	1.301***	0.014***	0.317*
	(0.034, 0.088)	(0.066, 0.175)	(1.137, 1.490)	(0.008, 0.021)	(0.023, 0.611)
Manufacturing	0.046**	0.091**	1.221**	0.011**	0.27
	(0.016, 0.076)	(0.030, 0.151)	(1.051, 1.418)	(0.003, 0.018)	(-0.058, 0.597)
Other	0.039**	0.091**	1.231**	0.011**	0.139

	(0.012, 0.067)	(0.036, 0.146)	(1.073, 1.412)	(0.004, 0.018)	(-0.161, 0.439)
Year (2010 - REF)					
2011	0.011	-0.008	0.964	-0.002	0.271
	(-0.017, 0.038)	(-0.064, 0.047)	(0.847, 1.097)	(-0.010, 0.005)	(-0.009, 0.551)
2012	-0.004	-0.051	0.856*	-0.009*	0.359*
	(-0.031, 0.023)	(-0.106, 0.003)	(0.751, 0.975)	(-0.016, -0.001)	(0.076, 0.642)
2013	0.009	-0.021	0.922	-0.005	0.370*
	(-0.019, 0.036)	(-0.077, 0.035)	(0.808, 1.051)	(-0.012, 0.003)	(0.085, 0.656)
2014	-0.005	-0.02	0.953	-0.003	0.006
	(-0.033, 0.022)	(-0.075, 0.036)	(0.837, 1.084)	(-0.010, 0.005)	(-0.274, 0.287)
2015	-0.019	-0.049	0.885	-0.007	0.01
	(-0.046, 0.008)	(-0.104, 0.006)	(0.777, 1.009)	(-0.014, 0.001)	(-0.273, 0.293)
2016	-0.012	-0.041	0.896	-0.006	0.112
	(-0.039, 0.016)	(-0.097, 0.015)	(0.785, 1.022)	(-0.014, 0.001)	(-0.174, 0.399)
2017	0.022	0.011	0.985	-0.001	0.393**
	(-0.007, 0.050)	(-0.046, 0.068)	(0.864, 1.123)	(-0.009, 0.007)	(0.109, 0.677)
2018	0.018	0.013	0.996	0	0.293*
	(-0.011, 0.046)	(-0.044, 0.070)	(0.874, 1.134)	(-0.008, 0.008)	(0.010, 0.576)
2019	0.033*	0.083**	1.192**	0.011**	0.048
	(0.003, 0.063)	(0.024, 0.141)	(1.047, 1.358)	(0.003, 0.020)	(-0.234, 0.330)
Region (Northeast - REF)					
North central, Midwest	0.028**	0.059**	1.151**	0.008**	0.072
	(0.008, 0.049)	(0.018, 0.101)	(1.045, 1.268)	(0.003, 0.014)	(-0.139, 0.282)
South	0.015	0.034	1.09	0.005	0.033
	(-0.004, 0.035)	(-0.005, 0.073)	(0.994, 1.196)	(-0.000, 0.010)	(-0.169, 0.234)
West	-0.01	0.004	1.036	0.002	-0.232*
	(-0.031, 0.010)	(-0.037, 0.045)	(0.939, 1.143)	(-0.003, 0.007)	(-0.447, -0.016)
Income (Poor to low income - REF)					
Middle to high income	0.002	0.015	1.043	0.002	-0.091
	(-0.015, 0.019)	(-0.021, 0.050)	(0.958, 1.135)	(-0.002, 0.007)	(-0.280, 0.097)
Receipt of food stamp (No - REF)					
YES	0.029*	0.047	1.093	0.005	0.25
	(0.005, 0.052)	(-0.004, 0.098)	(0.971, 1.230)	(-0.002, 0.013)	(-0.015, 0.515)
Health status (Excellent - REF)					
Good	0.058***	0.154***	1.466***	0.019***	0.202
	(0.040, 0.075)	(0.118, 0.191)	(1.331, 1.615)	(0.015, 0.023)	(-0.011, 0.416)
Fair	0.156***	0.307***	1.949***	0.037***	0.852***
	(0.132, 0.181)	(0.257, 0.358)	(1.728, 2.198)	(0.030, 0.044)	(0.588, 1.116)
Poor	0.258***	0.470***	2.611***	0.061***	1.069***
	(0.204, 0.313)	(0.359, 0.581)	(2.104, 3.241)	(0.043, 0.080)	(0.606, 1.532)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 3b. Regressions for the Use of Prescription Medications with Sedative Properties: ≥ 36 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 36 h/week	0.017	0.022	1.028	0.006	0.02
	(-0.034, 0.068)	(-0.014, 0.057)	(0.983, 1.076)	(-0.004, 0.016)	(-0.104, 0.144)
Age (18-26years - REF)					
27-64 years	0.294***	0.235***	1.290***	0.054***	0.521***
	(0.230, 0.359)	(0.192, 0.278)	(1.215, 1.369)	(0.042, 0.067)	(0.350, 0.693)
≥ 65 years	0.382***	0.339***	1.500***	0.089***	0.499***
	(0.285, 0.479)	(0.271, 0.406)	(1.377, 1.635)	(0.070, 0.108)	(0.262, 0.737)
Race (White - REF)					
Black	-0.201***	-0.088***	0.974	-0.006	-0.502***
	(-0.248, -0.154)	(-0.121, -0.056)	(0.934, 1.016)	(-0.015, 0.003)	(-0.615, -0.388)
Other	-0.215***	-0.138***	0.893***	-0.025***	-0.452***
	(-0.277, -0.153)	(-0.181, -0.095)	(0.844, 0.945)	(-0.037, -0.013)	(-0.609, -0.294)
Sex (Male - REF)					
Female	-0.007	0.003	1.013	0.003	-0.038
	(-0.042, 0.029)	(-0.022, 0.029)	(0.981, 1.045)	(-0.004, 0.010)	(-0.125, 0.049)
Marital status (Married - REF)					
Divorced	0.158***	0.086***	1.061**	0.013**	0.301***
	(0.114, 0.203)	(0.055, 0.118)	(1.020, 1.103)	(0.004, 0.022)	(0.196, 0.406)
Unmarried	-0.054*	-0.061***	0.919***	-0.019***	-0.022
	(-0.100, -0.008)	(-0.092, -0.029)	(0.882, 0.957)	(-0.028, -0.010)	(-0.136, 0.091)
Family size (≤ 3 Members REF)					
4-6 Members	-0.233***	-0.184***	0.816***	-0.045***	-0.331***
	(-0.271, -0.194)	(-0.211, -0.158)	(0.788, 0.845)	(-0.052, -0.037)	(-0.428, -0.235)
> 6 Members	-0.436***	-0.344***	0.681***	-0.082***	-0.709***
	(-0.571, -0.300)	(-0.433, -0.255)	(0.600, 0.774)	(-0.107, -0.056)	(-1.076, -0.343)
Education (Less than College - REF)					
Some college or more	0.001	0	0.999	0	-0.001
	(-0.036, 0.038)	(-0.026, 0.025)	(0.968, 1.032)	(-0.007, 0.007)	(-0.089, 0.088)
Occupation (Natural resources - REF)					
Hospitality services	0.045	0.045	1.069	0.014	-0.023
	(-0.047, 0.137)	(-0.019, 0.109)	(0.984, 1.161)	(-0.003, 0.032)	(-0.252, 0.206)
Trade	0.138***	0.089**	1.083*	0.017*	0.236*
	(0.056, 0.219)	(0.032, 0.145)	(1.007, 1.165)	(0.002, 0.033)	(0.034, 0.438)
Professional services	0.118**	0.102***	1.135***	0.028***	0.09
	(0.045, 0.191)	(0.052, 0.153)	(1.063, 1.211)	(0.014, 0.042)	(-0.091, 0.271)

Manufacturing	0.045	0.060*	1.103**	0.021**	-0.067
	(-0.037, 0.126)	(0.004, 0.116)	(1.026, 1.186)	(0.006, 0.037)	(-0.268, 0.134)
Other	0.06	0.075**	1.130***	0.027***	-0.078
	(-0.014, 0.134)	(0.024, 0.126)	(1.057, 1.207)	(0.012, 0.041)	(-0.262, 0.105)
Year (2010 - REF)					
2011	-0.001	-0.076**	0.841***	-0.039***	0.324***
	(-0.076, 0.074)	(-0.130, -0.023)	(0.787, 0.898)	(-0.054, -0.024)	(0.146, 0.501)
2012	-0.112**	-0.165***	0.764***	-0.060***	0.16
	(-0.186, -0.039)	(-0.217, -0.113)	(0.716, 0.815)	(-0.075, -0.046)	(-0.017, 0.338)
2013	-0.036	-0.087**	0.851***	-0.037***	0.178*
	(-0.111, 0.040)	(-0.140, -0.033)	(0.796, 0.908)	(-0.052, -0.022)	(0.000, 0.357)
2014	-0.058	-0.106***	0.834***	-0.041***	0.133
	(-0.133, 0.016)	(-0.159, -0.054)	(0.781, 0.891)	(-0.056, -0.026)	(-0.044, 0.310)
2015	-0.065	-0.097***	0.855***	-0.036***	0.084
	(-0.139, 0.009)	(-0.149, -0.044)	(0.801, 0.912)	(-0.050, -0.021)	(-0.092, 0.260)
2016	-0.035	-0.098***	0.830***	-0.042***	0.226*
	(-0.110, 0.041)	(-0.151, -0.044)	(0.777, 0.887)	(-0.057, -0.027)	(0.047, 0.405)
2017	0.046	-0.066*	0.831***	-0.042***	0.450***
	(-0.031, 0.123)	(-0.120, -0.011)	(0.777, 0.889)	(-0.057, -0.027)	(0.267, 0.632)
2018	0.068	-0.05	0.844***	-0.038***	0.482***
	(-0.009, 0.145)	(-0.105, 0.005)	(0.789, 0.903)	(-0.054, -0.023)	(0.299, 0.665)
2019	0.061	0.01	0.965	-0.008	0.237*
	(-0.020, 0.141)	(-0.047, 0.068)	(0.900, 1.035)	(-0.024, 0.008)	(0.050, 0.424)
Region (Northeast - REF)					
North central, Midwest	0.075**	0.050*	1.044	0.01	0.146*
	(0.019, 0.131)	(0.011, 0.090)	(0.993, 1.097)	(-0.002, 0.021)	(0.009, 0.283)
South	0.039	0.029	1.029	0.006	0.075
	(-0.013, 0.092)	(-0.008, 0.066)	(0.982, 1.078)	(-0.004, 0.017)	(-0.053, 0.202)
West	-0.060*	-0.03	0.983	-0.004	-0.128
	(-0.116, -0.004)	(-0.069, 0.009)	(0.935, 1.033)	(-0.015, 0.007)	(-0.265, 0.010)
Income (Poor to low income - REF)					
Middle to high income	-0.003	-0.003	0.993	-0.002	0.008
	(-0.049, 0.043)	(-0.036, 0.029)	(0.953, 1.035)	(-0.011, 0.008)	(-0.105, 0.121)
Receipt of food stamp (No - REF)					
YES	0.218***	0.154***	1.149***	0.031***	0.369***
	(0.154, 0.282)	(0.107, 0.201)	(1.086, 1.216)	(0.018, 0.044)	(0.216, 0.522)
Health status (Excellent - REF)					
Good	0.308***	0.258***	1.355***	0.064***	0.504***
	(0.260, 0.356)	(0.226, 0.290)	(1.295, 1.417)	(0.055, 0.073)	(0.374, 0.633)
Fair	0.932***	0.678***	1.957***	0.150***	1.404***
	(0.865, 0.998)	(0.630, 0.727)	(1.844, 2.076)	(0.137, 0.163)	(1.241, 1.566)
Poor	1.842***	1.200***	2.593***	0.219***	2.694***
	(1.695, 1.990)	(1.072, 1.329)	(2.288, 2.938)	(0.189, 0.249)	(2.386, 3.002)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 4a. Regressions for the Use of Prescription Sleep Aids: ≥ 46 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 46 h/week	0.002	0.006	1.015	0.001	-0.013
	(-0.014, 0.017)	(-0.025, 0.037)	(0.943, 1.092)	(-0.003, 0.005)	(-0.173, 0.147)
Age (18-26years - REF)					
27-64 years	0.104***	0.306***	2.206***	0.034***	0.530**
	(0.081, 0.128)	(0.255, 0.356)	(1.897, 2.564)	(0.030, 0.039)	(0.196, 0.864)
≥ 65 years	0.069***	0.252***	1.993***	0.028***	0.285
	(0.033, 0.105)	(0.181, 0.324)	(1.642, 2.418)	(0.020, 0.037)	(-0.139, 0.709)
Race (White - REF)					
Black	-0.126***	-0.313***	0.457***	-0.037***	-0.405***
	(-0.144, -0.109)	(-0.349, -0.277)	(0.413, 0.505)	(-0.040, -0.033)	(-0.627, -0.184)
Other	-0.086***	-0.171***	0.687***	-0.021***	-0.544***
	(-0.109, -0.063)	(-0.218, -0.123)	(0.610, 0.775)	(-0.026, -0.015)	(-0.809, -0.279)
Sex (Male - REF)					
Female	0.012	0.044**	1.109**	0.006**	-0.048
	(-0.001, 0.025)	(0.017, 0.070)	(1.042, 1.181)	(0.002, 0.009)	(-0.184, 0.089)
Marital status (Married - REF)					
Divorced	0.029***	0.053**	1.127**	0.007**	0.071
	(0.012, 0.045)	(0.021, 0.085)	(1.047, 1.212)	(0.003, 0.011)	(-0.087, 0.229)
Unmarried	0.002	0.009	1.034	0.002	-0.097
	(-0.015, 0.019)	(-0.026, 0.043)	(0.954, 1.121)	(-0.003, 0.006)	(-0.274, 0.079)
Family size (≤ 3 Members REF)					
4-6 Members	-0.072***	-0.171***	0.670***	-0.021***	-0.235**
	(-0.086, -0.058)	(-0.200, -0.142)	(0.623, 0.720)	(-0.025, -0.018)	(-0.395, -0.075)
> 6 Members	-0.101***	-0.308***	0.437***	-0.037***	0.046
	(-0.151, -0.051)	(-0.419, -0.198)	(0.311, 0.615)	(-0.048, -0.027)	(-0.711, 0.803)
Education (Less than College - REF)					
Some college or more	0.026***	0.087***	1.236***	0.012***	-0.072
	(0.013, 0.040)	(0.059, 0.114)	(1.158, 1.320)	(0.008, 0.015)	(-0.215, 0.072)
Occupation (Natural resources - REF)					
Hospitality services	0.02	0.017	1.032	0.002	0.2
	(-0.014, 0.054)	(-0.052, 0.087)	(0.865, 1.231)	(-0.007, 0.010)	(-0.185, 0.585)
Trade	0.033*	0.057	1.114	0.005	0.27
	(0.003, 0.063)	(-0.004, 0.118)	(0.956, 1.298)	(-0.002, 0.013)	(-0.063, 0.603)
Professional services	0.061***	0.121***	1.302***	0.014***	0.316*

	(0.034, 0.088)	(0.066, 0.175)	(1.137, 1.491)	(0.008, 0.021)	(0.022, 0.610)
Manufacturing	0.046**	0.091**	1.222**	0.011**	0.273
	(0.016, 0.076)	(0.031, 0.152)	(1.052, 1.419)	(0.003, 0.018)	(-0.054, 0.601)
Other	0.039**	0.092**	1.232**	0.011**	0.139
	(0.012, 0.067)	(0.037, 0.147)	(1.074, 1.414)	(0.004, 0.018)	(-0.161, 0.440)
Year (2010 - REF)					
2011	0.011	-0.008	0.964	-0.002	0.273
	(-0.017, 0.038)	(-0.064, 0.048)	(0.847, 1.097)	(-0.010, 0.005)	(-0.007, 0.553)
2012	-0.004	-0.051	0.856*	-0.009*	0.359*
	(-0.031, 0.023)	(-0.106, 0.004)	(0.751, 0.975)	(-0.016, -0.001)	(0.076, 0.642)
2013	0.009	-0.021	0.922	-0.005	0.368*
	(-0.019, 0.036)	(-0.077, 0.035)	(0.808, 1.051)	(-0.012, 0.003)	(0.083, 0.654)
2014	-0.005	-0.02	0.953	-0.003	0.006
	(-0.033, 0.022)	(-0.075, 0.036)	(0.837, 1.084)	(-0.010, 0.005)	(-0.274, 0.287)
2015	-0.019	-0.049	0.885	-0.007	0.009
	(-0.046, 0.008)	(-0.104, 0.006)	(0.777, 1.009)	(-0.014, 0.001)	(-0.274, 0.292)
2016	-0.012	-0.041	0.896	-0.006	0.114
	(-0.039, 0.016)	(-0.096, 0.015)	(0.786, 1.022)	(-0.014, 0.001)	(-0.173, 0.400)
2017	0.022	0.011	0.985	-0.001	0.394**
	(-0.007, 0.050)	(-0.046, 0.068)	(0.864, 1.122)	(-0.009, 0.007)	(0.110, 0.678)
2018	0.018	0.013	0.996	0	0.295*
	(-0.011, 0.046)	(-0.044, 0.070)	(0.874, 1.134)	(-0.008, 0.007)	(0.011, 0.578)
2019	0.033*	0.082**	1.192**	0.011**	0.044
	(0.003, 0.063)	(0.024, 0.141)	(1.046, 1.358)	(0.003, 0.020)	(-0.238, 0.326)
Region (Northeast - REF)					
North central, Midwest	0.028**	0.060**	1.151**	0.008**	0.075
	(0.008, 0.049)	(0.018, 0.101)	(1.045, 1.268)	(0.003, 0.014)	(-0.136, 0.285)
South	0.016	0.034	1.091	0.005	0.037
	(-0.004, 0.035)	(-0.004, 0.073)	(0.995, 1.196)	(-0.000, 0.010)	(-0.165, 0.238)
West	-0.01	0.004	1.037	0.002	-0.229*
	(-0.031, 0.011)	(-0.037, 0.045)	(0.940, 1.144)	(-0.003, 0.007)	(-0.444, -0.014)
Income (Poor to low income - REF)					
Middle to high income	0.002	0.015	1.042	0.002	-0.082
	(-0.015, 0.019)	(-0.020, 0.051)	(0.958, 1.134)	(-0.002, 0.007)	(-0.270, 0.105)
Receipt of food stamp (No - REF)					
YES	0.028*	0.047	1.093	0.005	0.239
	(0.005, 0.052)	(-0.004, 0.098)	(0.971, 1.230)	(-0.002, 0.012)	(-0.024, 0.503)
Health status (Excellent - REF)					
Good	0.058***	0.154***	1.467***	0.019***	0.201
	(0.040, 0.075)	(0.118, 0.191)	(1.331, 1.616)	(0.015, 0.023)	(-0.013, 0.415)
Fair	0.156***	0.307***	1.949***	0.037***	0.850***
	(0.132, 0.181)	(0.257, 0.358)	(1.728, 2.199)	(0.030, 0.044)	(0.585, 1.114)
Poor	0.258***	0.470***	2.611***	0.061***	1.069***
	(0.204, 0.313)	(0.359, 0.581)	(2.104, 3.241)	(0.043, 0.080)	(0.606, 1.532)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 4b. Regressions for the Use of Medications with Sedative Properties: ≥ 46 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 46 h/week	0.015	0.016	1.023	0.005	0
	(-0.027, 0.058)	(-0.014, 0.047)	(0.985, 1.063)	(-0.003, 0.014)	(-0.104, 0.104)
Age (18-26years - REF)					
27-64 years	0.295***	0.236***	1.291***	0.055***	0.523***
	(0.231, 0.359)	(0.193, 0.279)	(1.217, 1.371)	(0.042, 0.067)	(0.352, 0.694)
≥ 65 years	0.381***	0.337***	1.498***	0.088***	0.498***
	(0.284, 0.478)	(0.269, 0.404)	(1.374, 1.632)	(0.069, 0.107)	(0.261, 0.735)
Race (White - REF)					
Black	-0.200***	-0.088***	0.975	-0.006	-0.501***
	(-0.248, -0.153)	(-0.120, -0.056)	(0.935, 1.016)	(-0.015, 0.004)	(-0.615, -0.388)
Other	-0.214***	-0.137***	0.894***	-0.025***	-0.451***
	(-0.277, -0.152)	(-0.180, -0.094)	(0.845, 0.945)	(-0.037, -0.012)	(-0.608, -0.294)
Sex (Male - REF)					
Female	-0.006	0.004	1.014	0.003	-0.039
	(-0.042, 0.030)	(-0.021, 0.029)	(0.982, 1.047)	(-0.004, 0.010)	(-0.127, 0.049)
Marital status (Married - REF)					
Divorced	0.158***	0.086***	1.061**	0.013**	0.301***
	(0.114, 0.203)	(0.055, 0.118)	(1.020, 1.102)	(0.004, 0.022)	(0.196, 0.406)
Unmarried	-0.054*	-0.060***	0.919***	-0.019***	-0.022
	(-0.100, -0.008)	(-0.092, -0.028)	(0.882, 0.957)	(-0.028, -0.010)	(-0.136, 0.091)
Family size (≤ 3 Members REF)					
4-6 Members	-0.233***	-0.184***	0.816***	-0.045***	-0.331***
	(-0.271, -0.194)	(-0.211, -0.158)	(0.788, 0.845)	(-0.052, -0.037)	(-0.428, -0.235)
> 6 Members	-0.435***	-0.343***	0.682***	-0.081***	-0.708***
	(-0.570, -0.299)	(-0.432, -0.254)	(0.600, 0.775)	(-0.106, -0.056)	(-1.075, -0.342)
Education (Less than College - REF)					
Some college or more	0.001	-0.001	0.999	0	-0.001
	(-0.036, 0.037)	(-0.027, 0.025)	(0.967, 1.032)	(-0.007, 0.007)	(-0.089, 0.088)
Occupation (Natural resources - REF)					
Hospitality services	0.043	0.042	1.066	0.014	-0.026
	(-0.049, 0.135)	(-0.021, 0.106)	(0.982, 1.157)	(-0.004, 0.032)	(-0.254, 0.202)
Trade	0.137***	0.088**	1.083*	0.017*	0.234*
	(0.056, 0.219)	(0.032, 0.145)	(1.007, 1.165)	(0.002, 0.033)	(0.032, 0.436)
Professional services	0.118**	0.102***	1.136***	0.028***	0.089

	(0.046, 0.191)	(0.052, 0.153)	(1.064, 1.212)	(0.014, 0.042)	(-0.092, 0.270)
Manufacturing	0.046	0.062*	1.106**	0.022**	-0.066
	(-0.035, 0.128)	(0.006, 0.118)	(1.028, 1.189)	(0.006, 0.038)	(-0.267, 0.135)
Other	0.061	0.076**	1.131***	0.027***	-0.078
	(-0.012, 0.135)	(0.025, 0.127)	(1.059, 1.209)	(0.013, 0.041)	(-0.262, 0.105)
Year (2010 - REF)					
2011	-0.001	-0.076**	0.841***	-0.039***	0.324***
	(-0.076, 0.074)	(-0.129, -0.023)	(0.788, 0.898)	(-0.054, -0.024)	(0.146, 0.502)
2012	-0.112**	-0.165***	0.764***	-0.060***	0.161
	(-0.186, -0.038)	(-0.216, -0.113)	(0.716, 0.815)	(-0.075, -0.046)	(-0.017, 0.338)
2013	-0.035	-0.086**	0.851***	-0.037***	0.178
	(-0.111, 0.040)	(-0.140, -0.033)	(0.797, 0.909)	(-0.052, -0.022)	(-0.000, 0.356)
2014	-0.058	-0.106***	0.834***	-0.041***	0.133
	(-0.133, 0.016)	(-0.159, -0.054)	(0.781, 0.890)	(-0.056, -0.026)	(-0.044, 0.310)
2015	-0.065	-0.097***	0.854***	-0.036***	0.084
	(-0.139, 0.009)	(-0.149, -0.044)	(0.801, 0.912)	(-0.050, -0.021)	(-0.092, 0.260)
2016	-0.035	-0.098***	0.830***	-0.042***	0.227*
	(-0.110, 0.041)	(-0.151, -0.044)	(0.777, 0.887)	(-0.057, -0.027)	(0.048, 0.406)
2017	0.046	-0.066*	0.831***	-0.042***	0.450***
	(-0.031, 0.123)	(-0.120, -0.011)	(0.776, 0.888)	(-0.057, -0.027)	(0.267, 0.632)
2018	0.068	-0.05	0.844***	-0.039***	0.482***
	(-0.010, 0.145)	(-0.105, 0.004)	(0.788, 0.902)	(-0.054, -0.023)	(0.299, 0.664)
2019	0.061	0.01	0.965	-0.008	0.237*
	(-0.020, 0.141)	(-0.047, 0.068)	(0.900, 1.034)	(-0.024, 0.008)	(0.050, 0.423)
Region (Northeast - REF)					
North central, Midwest	0.075**	0.051*	1.044	0.01	0.147*
	(0.019, 0.132)	(0.011, 0.090)	(0.994, 1.098)	(-0.001, 0.021)	(0.010, 0.284)
South	0.04	0.03	1.031	0.007	0.076
	(-0.012, 0.093)	(-0.006, 0.067)	(0.984, 1.080)	(-0.004, 0.017)	(-0.052, 0.203)
West	-0.059*	-0.029	0.984	-0.003	-0.127
	(-0.115, -0.003)	(-0.068, 0.010)	(0.937, 1.035)	(-0.014, 0.007)	(-0.264, 0.010)
Income (Poor to low income - REF)					
Middle to high income	-0.003	-0.003	0.994	-0.001	0.01
	(-0.049, 0.043)	(-0.035, 0.030)	(0.954, 1.035)	(-0.010, 0.008)	(-0.102, 0.122)
Receipt of food stamp (No - REF)					
YES	0.217***	0.153***	1.148***	0.031***	0.367***
	(0.153, 0.281)	(0.106, 0.200)	(1.085, 1.214)	(0.018, 0.044)	(0.214, 0.520)
Health status (Excellent - REF)					
Good	0.308***	0.258***	1.355***	0.064***	0.503***
	(0.260, 0.356)	(0.227, 0.290)	(1.296, 1.417)	(0.055, 0.073)	(0.374, 0.633)
Fair	0.932***	0.678***	1.957***	0.150***	1.403***
	(0.865, 0.998)	(0.630, 0.727)	(1.844, 2.076)	(0.137, 0.163)	(1.241, 1.566)
Poor	1.842***	1.200***	2.593***	0.219***	2.694***
	(1.695, 1.990)	(1.072, 1.329)	(2.288, 2.938)	(0.189, 0.249)	(2.386, 3.002)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 5a. Regressions for the Use of Prescription Sleep Aid: ≥ 66 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 66 h/week	0.026	0.039	1.077	0.004	0.21
	(-0.019, 0.070)	(-0.050, 0.128)	(0.879, 1.320)	(-0.008, 0.017)	(-0.232, 0.652)
Age (18-26years - REF)					
27-64 years	0.104***	0.306***	2.207***	0.034***	0.527**
	(0.081, 0.128)	(0.255, 0.356)	(1.898, 2.566)	(0.030, 0.039)	(0.194, 0.861)
≥ 65 years	0.069***	0.252***	1.992***	0.028***	0.277
	(0.033, 0.104)	(0.180, 0.324)	(1.642, 2.417)	(0.020, 0.037)	(-0.148, 0.701)
Race (White - REF)					
Black	-0.127***	-0.313***	0.456***	-0.037***	-0.402***
	(-0.144, -0.109)	(-0.349, -0.277)	(0.413, 0.505)	(-0.040, -0.033)	(-0.624, -0.181)
Other	-0.086***	-0.171***	0.687***	-0.021***	-0.547***
	(-0.109, -0.064)	(-0.218, -0.123)	(0.609, 0.775)	(-0.026, -0.015)	(-0.812, -0.282)
Sex (Male - REF)					
Female	0.012	0.044**	1.109**	0.006**	-0.042
	(-0.001, 0.025)	(0.017, 0.070)	(1.042, 1.181)	(0.002, 0.009)	(-0.177, 0.094)
Marital status (Married - REF)					
Divorced	0.029***	0.053**	1.127**	0.007**	0.07
	(0.012, 0.045)	(0.021, 0.085)	(1.047, 1.212)	(0.003, 0.011)	(-0.088, 0.229)
Unmarried	0.002	0.009	1.034	0.002	-0.095
	(-0.015, 0.019)	(-0.025, 0.043)	(0.954, 1.121)	(-0.003, 0.007)	(-0.272, 0.081)
Family size (≤ 3 Members REF)					
4-6 Members	-0.072***	-0.171***	0.670***	-0.021***	-0.235**
	(-0.086, -0.058)	(-0.200, -0.142)	(0.623, 0.721)	(-0.025, -0.018)	(-0.395, -0.075)
> 6 Members	-0.101***	-0.308***	0.437***	-0.037***	0.053
	(-0.151, -0.051)	(-0.419, -0.198)	(0.311, 0.615)	(-0.048, -0.027)	(-0.705, 0.810)
Education (Less than College - REF)					
Some college or more	0.027***	0.087***	1.237***	0.012***	-0.071
	(0.013, 0.040)	(0.060, 0.115)	(1.159, 1.321)	(0.008, 0.016)	(-0.214, 0.072)
Occupation (Natural resources - REF)					
Hospitality services	0.02	0.018	1.033	0.002	0.201
	(-0.013, 0.054)	(-0.052, 0.087)	(0.866, 1.232)	(-0.007, 0.010)	(-0.184, 0.586)
Trade	0.033*	0.057	1.115	0.006	0.27
	(0.003, 0.063)	(-0.004, 0.118)	(0.957, 1.298)	(-0.002, 0.013)	(-0.063, 0.603)
Professional services	0.061***	0.121***	1.302***	0.014***	0.314*
	(0.034, 0.088)	(0.066, 0.175)	(1.137, 1.491)	(0.008, 0.021)	(0.020, 0.608)

Manufacturing	0.047**	0.092**	1.224**	0.011**	0.274
	(0.017, 0.077)	(0.031, 0.152)	(1.053, 1.421)	(0.003, 0.018)	(-0.054, 0.601)
Other	0.040**	0.092**	1.232**	0.011**	0.135
	(0.012, 0.067)	(0.036, 0.147)	(1.074, 1.414)	(0.004, 0.018)	(-0.165, 0.435)
Year (2010 - REF)					
2011	0.011	-0.008	0.963	-0.002	0.269
	(-0.017, 0.038)	(-0.064, 0.047)	(0.847, 1.096)	(-0.010, 0.005)	(-0.011, 0.549)
2012	-0.004	-0.051	0.856*	-0.009*	0.360*
	(-0.031, 0.023)	(-0.106, 0.003)	(0.751, 0.975)	(-0.016, -0.001)	(0.077, 0.643)
2013	0.009	-0.021	0.922	-0.005	0.369*
	(-0.019, 0.036)	(-0.077, 0.035)	(0.808, 1.051)	(-0.012, 0.003)	(0.084, 0.655)
2014	-0.005	-0.02	0.953	-0.003	0.004
	(-0.033, 0.022)	(-0.075, 0.036)	(0.837, 1.084)	(-0.010, 0.005)	(-0.277, 0.284)
2015	-0.019	-0.049	0.886	-0.007	0.006
	(-0.046, 0.009)	(-0.104, 0.006)	(0.778, 1.009)	(-0.014, 0.001)	(-0.277, 0.289)
2016	-0.011	-0.04	0.897	-0.006	0.112
	(-0.039, 0.016)	(-0.096, 0.016)	(0.786, 1.023)	(-0.014, 0.001)	(-0.174, 0.399)
2017	0.022	0.011	0.985	-0.001	0.396**
	(-0.007, 0.050)	(-0.046, 0.068)	(0.865, 1.123)	(-0.009, 0.007)	(0.112, 0.680)
2018	0.018	0.013	0.996	0	0.296*
	(-0.011, 0.046)	(-0.044, 0.070)	(0.875, 1.135)	(-0.008, 0.008)	(0.012, 0.579)
2019	0.033*	0.083**	1.192**	0.011**	0.047
	(0.003, 0.063)	(0.024, 0.141)	(1.047, 1.358)	(0.003, 0.020)	(-0.235, 0.329)
Region (Northeast - REF)					
North central, Midwest	0.028**	0.060**	1.151**	0.008**	0.072
	(0.008, 0.049)	(0.018, 0.101)	(1.045, 1.269)	(0.003, 0.014)	(-0.138, 0.283)
South	0.015	0.034	1.091	0.005	0.035
	(-0.004, 0.035)	(-0.005, 0.073)	(0.994, 1.196)	(-0.000, 0.010)	(-0.166, 0.236)
West	-0.01	0.004	1.036	0.002	-0.227*
	(-0.031, 0.011)	(-0.037, 0.045)	(0.939, 1.143)	(-0.003, 0.007)	(-0.441, -0.012)
Income (Poor to low income - REF)					
Middle to high income	0.002	0.015	1.043	0.002	-0.083
	(-0.015, 0.019)	(-0.020, 0.051)	(0.959, 1.135)	(-0.002, 0.007)	(-0.270, 0.104)
Receipt of food stamp (No - REF)					
YES	0.028*	0.046	1.092	0.005	0.233
	(0.005, 0.052)	(-0.005, 0.097)	(0.970, 1.229)	(-0.002, 0.012)	(-0.031, 0.497)
Health status (Excellent - REF)					
Good	0.058***	0.154***	1.466***	0.019***	0.204
	(0.040, 0.075)	(0.118, 0.191)	(1.331, 1.616)	(0.015, 0.023)	(-0.010, 0.417)
Fair	0.156***	0.307***	1.948***	0.037***	0.853***
	(0.132, 0.181)	(0.256, 0.358)	(1.727, 2.197)	(0.030, 0.044)	(0.589, 1.117)
Poor	0.258***	0.470***	2.610***	0.061***	1.073***
	(0.204, 0.313)	(0.359, 0.581)	(2.103, 3.239)	(0.043, 0.080)	(0.610, 1.537)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 5b. Regressions for the Use of Medications with Sedative Properties: ≥ 66 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 66 h/week	0.11	0.058	1.034	0.007	0.244
	(-0.011, 0.230)	(-0.028, 0.144)	(0.930, 1.149)	(-0.016, 0.031)	(-0.043, 0.531)
Age (18-26years - REF)					
27-64 years	0.295***	0.237***	1.293***	0.055***	0.522***
	(0.231, 0.359)	(0.193, 0.280)	(1.218, 1.372)	(0.043, 0.067)	(0.351, 0.693)
≥ 65 years	0.380***	0.336***	1.498***	0.088***	0.494***
	(0.283, 0.477)	(0.269, 0.404)	(1.374, 1.633)	(0.069, 0.107)	(0.257, 0.731)
Race (White - REF)					
Black	-0.201***	-0.088***	0.974	-0.006	-0.502***
	(-0.248, -0.154)	(-0.121, -0.056)	(0.934, 1.016)	(-0.015, 0.003)	(-0.615, -0.388)
Other	-0.215***	-0.138***	0.893***	-0.025***	-0.452***
	(-0.277, -0.153)	(-0.180, -0.095)	(0.844, 0.945)	(-0.037, -0.013)	(-0.609, -0.295)
Sex (Male - REF)					
Female	-0.005	0.004	1.012	0.003	-0.034
	(-0.041, 0.030)	(-0.022, 0.029)	(0.980, 1.045)	(-0.004, 0.010)	(-0.121, 0.053)
Marital status (Married - REF)					
Divorced	0.158***	0.086***	1.061**	0.013**	0.301***
	(0.114, 0.203)	(0.055, 0.118)	(1.020, 1.103)	(0.004, 0.022)	(0.196, 0.406)
Unmarried	-0.054*	-0.060***	0.919***	-0.019***	-0.021
	(-0.099, -0.008)	(-0.092, -0.028)	(0.882, 0.957)	(-0.028, -0.010)	(-0.134, 0.093)
Family size (≤ 3 Members REF)					
4-6 Members	-0.232***	-0.184***	0.816***	-0.045***	-0.330***
	(-0.271, -0.194)	(-0.211, -0.157)	(0.788, 0.845)	(-0.052, -0.037)	(-0.427, -0.233)
> 6 Members	-0.435***	-0.343***	0.682***	-0.081***	-0.707***
	(-0.571, -0.300)	(-0.432, -0.254)	(0.600, 0.774)	(-0.107, -0.056)	(-1.074, -0.341)
Education (Less than College - REF)					
Some college or more	0.002	0	1	0	0.001
	(-0.035, 0.038)	(-0.026, 0.026)	(0.968, 1.033)	(-0.007, 0.007)	(-0.087, 0.090)
Occupation (Natural resources - REF)					
Hospitality services	0.044	0.043	1.065	0.014	-0.019
	(-0.047, 0.136)	(-0.021, 0.106)	(0.981, 1.156)	(-0.004, 0.031)	(-0.247, 0.209)

Trade	0.139***	0.088**	1.082*	0.017*	0.240*
	(0.057, 0.220)	(0.032, 0.145)	(1.006, 1.164)	(0.001, 0.033)	(0.038, 0.442)
Professional services	0.119**	0.102***	1.134***	0.028***	0.094
	(0.046, 0.192)	(0.052, 0.153)	(1.063, 1.211)	(0.014, 0.042)	(-0.087, 0.275)
Manufacturing	0.048	0.063*	1.105**	0.022**	-0.058
	(-0.033, 0.130)	(0.006, 0.119)	(1.028, 1.189)	(0.006, 0.038)	(-0.259, 0.143)
Other	0.062	0.076**	1.130***	0.027***	-0.074
	(-0.012, 0.136)	(0.025, 0.127)	(1.058, 1.207)	(0.012, 0.041)	(-0.257, 0.110)
Year (2010 - REF)					
2011	-0.002	-0.077**	0.841***	-0.039***	0.323***
	(-0.077, 0.073)	(-0.130, -0.023)	(0.787, 0.898)	(-0.054, -0.024)	(0.145, 0.501)
2012	-0.112**	-0.165***	0.764***	-0.060***	0.161
	(-0.186, -0.038)	(-0.216, -0.113)	(0.716, 0.815)	(-0.075, -0.046)	(-0.016, 0.338)
2013	-0.035	-0.086**	0.851***	-0.037***	0.180*
	(-0.110, 0.040)	(-0.140, -0.033)	(0.797, 0.909)	(-0.052, -0.022)	(0.002, 0.358)
2014	-0.058	-0.106***	0.834***	-0.041***	0.134
	(-0.133, 0.016)	(-0.159, -0.053)	(0.781, 0.891)	(-0.056, -0.026)	(-0.044, 0.311)
2015	-0.065	-0.096***	0.855***	-0.036***	0.085
	(-0.139, 0.010)	(-0.149, -0.044)	(0.801, 0.912)	(-0.050, -0.021)	(-0.091, 0.261)
2016	-0.034	-0.097***	0.831***	-0.042***	0.229*
	(-0.109, 0.042)	(-0.150, -0.044)	(0.777, 0.887)	(-0.057, -0.027)	(0.049, 0.408)
2017	0.047	-0.065*	0.831***	-0.042***	0.451***
	(-0.030, 0.123)	(-0.120, -0.011)	(0.777, 0.889)	(-0.057, -0.027)	(0.269, 0.634)
2018	0.068	-0.05	0.844***	-0.038***	0.483***
	(-0.009, 0.145)	(-0.105, 0.005)	(0.789, 0.903)	(-0.054, -0.023)	(0.300, 0.666)
2019	0.061	0.01	0.965	-0.008	0.238*
	(-0.019, 0.142)	(-0.047, 0.068)	(0.900, 1.035)	(-0.024, 0.008)	(0.051, 0.424)
Region (Northeast - REF)					
North central, Midwest	0.075**	0.051*	1.045	0.01	0.146*
	(0.019, 0.132)	(0.012, 0.091)	(0.994, 1.098)	(-0.001, 0.021)	(0.010, 0.283)
South	0.04	0.03	1.031	0.007	0.075
	(-0.013, 0.092)	(-0.007, 0.067)	(0.984, 1.080)	(-0.004, 0.017)	(-0.053, 0.203)
West	-0.059*	-0.029	0.984	-0.004	-0.127
	(-0.115, -0.003)	(-0.068, 0.010)	(0.936, 1.034)	(-0.014, 0.007)	(-0.264, 0.010)
Income (Poor to low income - REF)					
Middle to high income	-0.002	-0.002	0.995	-0.001	0.008
	(-0.048, 0.044)	(-0.034, 0.031)	(0.956, 1.037)	(-0.010, 0.008)	(-0.104, 0.120)
Receipt of food stamp (No - REF)					
YES	0.217***	0.153***	1.147***	0.031***	0.365***
	(0.153, 0.281)	(0.105, 0.200)	(1.084, 1.214)	(0.018, 0.044)	(0.212, 0.518)
Health status (Excellent - REF)					
Good	0.308***	0.258***	1.355***	0.064***	0.505***
	(0.260, 0.356)	(0.226, 0.290)	(1.295, 1.417)	(0.055, 0.073)	(0.375, 0.634)
Fair	0.931***	0.678***	1.956***	0.150***	1.403***
	(0.864, 0.998)	(0.629, 0.726)	(1.843, 2.075)	(0.137, 0.163)	(1.241, 1.566)
Poor	1.842***	1.200***	2.592***	0.219***	2.694***
	(1.694, 1.989)	(1.071, 1.329)	(2.287, 2.937)	(0.189, 0.249)	(2.386, 3.002)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Weighted Results

Appendix 6. Bivariate Analysis

Variables	Use of Prescription Sleep Aid			Use of Prescription Medications with Sedative Properties		
	Yes			Yes		
	%	X	*P*	%	X	*P*
Part 1: Work Hour Categories						
≥ 36 hours/week						
30-35	10.9	4.5	0.245	11.4	1.6	0.256
≥ 36	89.1			88.6		
≥ 46 hours/week						
31-45	77.5	2.8	0.394	78.3	0.0	0.899
≥ 46	22.5			21.7		
≥ 56 hours/week						
31-55	91.6	7.5	0.016	92.3	7.8	0.030
≥ 56	8.4			7.7		
≥ 66 hours/week						
31-65	97.3	8.8	0.058	97.7	3.0	0.270
≥ 66	2.7			2.3		
Part 2: Predisposing Factors						
Age (years)						
18-26	4.1	174.5	0.001	7.2	208.5	0.000
27-64	90.2			86.3		
≥ 65	5.6			6.4		
Race						
White	90.3	199.0	0.000	84.2	30.9	0.000
Black	5.4			10.1		
Other	4.3			5.7		
Sex						
Male	41.9	16.5	0.024	44.2	1.9	0.282
Female	58.1			55.8		
Marital Status						
Married	55.5	92.9	0.000	57.3	156.9	0.000
Divorced	24.8			22.0		
Unmarried	19.7			20.7		
Family Size						
0 - 3 members	80.3	136.8	0.000	76.2	148.2	0.000
4 - 6 members	19.3			23.1		
> 6 members	0.4			0.7		
Education Level						
Less than College	28.5	29.4	0.008	32.5	12.1	0.001
Some College or more	71.6			67.5		

Appendix 6. (Continued)

Variables	Use of Prescription Sleep Aid			Use of Prescription Medications with Sedative Properties		
	Yes			Yes		
	%	X	*P*	%	X	*P*
Occupation						
Natural resources	5.6	62.3	0.006	6.6	8.8	0.351
Hospitality services	5.0			5.8		
Trade	10.0			11.2		
Professional services	43.9			39.6		
Manufacturing	10.7			11.1		
Other	24.7			25.8		
Year						
2010	10.3	45.2	0.014	10.4	68.9	0.013
2011	11.1			10.5		
2012	9.7			10.0		
2013	9.5			9.9		
2014	11.4			10.9		
2015	9.8			10.7		
2016	10.5			10.1		
2017	9.4			9.4		
2018	8.3			9.1		
2019	10.2			8.9		
Part 3: Enabling Factors						
Region						
Northeast	13.5	21.9	0.073	14.5	26.5	0.001
North Central/Midwest	26.2			24.6		
South	38.7			40.0		
West	21.6			20.8		
Income						
Poor to low income	14.1	10.9	0.055	16.0	3.6	0.031
Middle to high income	86.0			84.1		
No	94.6	2.2	0.539	93.6	30.4	0.003
Yes	5.4			6.4		
Part 4: Need Factors						
Health Status						
Excellent	10.4	151.7	0.001	11.5	788.4	0.000
Good	75.5			74.3		
Fair	12.2			12.4		
Poor	2.0			1.7		

Appendix 7a. Regressions for the Use of Prescription Sleep Aids: ≥ 56 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 56 h/week	0.062*	0.090*	1.165*	0.010*	0.483**
	(0.017, 0.106)	(0.013, 0.167)	(1.014, 1.338)	(0.000, 0.020)	(0.200, 0.767)
Age (18-26years - REF)					
27-64 years	0.115***	0.334***	2.322***	0.039***	0.355
	(0.082, 0.148)	(0.228, 0.439)	(1.933, 2.791)	(0.033, 0.045)	(-0.022, 0.732)
≥ 65 years	0.068**	0.256***	1.990***	0.030***	0.064
	(0.039, 0.097)	(0.191, 0.320)	(1.564, 2.531)	(0.019, 0.040)	(-0.208, 0.336)
Race (White - REF)					
Black	-0.136***	-0.331***	0.442***	-0.039***	-0.389*
	(-0.149, -0.123)	(-0.388, -0.275)	(0.392, 0.498)	(-0.044, -0.035)	(-0.767, -0.011)
Other	-0.107***	-0.219**	0.618***	-0.027***	-0.671***
	(-0.141, -0.073)	(-0.330, -0.108)	(0.532, 0.717)	(-0.033, -0.020)	(-0.837, -0.506)
Sex (Male - REF)					
Female	0.014	0.032	1.068	0.004	0.058
	(-0.023, 0.050)	(-0.014, 0.077)	(0.991, 1.150)	(-0.001, 0.009)	(-0.403, 0.518)
Marital status (Married - REF)					
Divorced	0.044***	0.084***	1.204***	0.012***	0.047
	(0.036, 0.052)	(0.060, 0.107)	(1.102, 1.316)	(0.006, 0.018)	(-0.183, 0.277)
Unmarried	0	0.022	1.072	0.004	-0.21
	(-0.015, 0.014)	(-0.020, 0.065)	(0.974, 1.179)	(-0.002, 0.010)	(-0.487, 0.068)
Family size (≤ 3 Members REF)					
4-6 Members	-0.067***	-0.157***	0.697***	-0.021***	-0.161
	(-0.070, -0.065)	(-0.174, -0.140)	(0.639, 0.761)	(-0.025, -0.016)	(-0.380, 0.058)
> 6 Members	-0.103**	-0.284***	0.486***	-0.036***	0.034
	(-0.166, -0.041)	(-0.356, -0.211)	(0.321, 0.734)	(-0.051, -0.021)	(-1.205, 1.273)
Education (Less than college - REF)					
Some college or more	0.013	0.054**	1.137**	0.008**	-0.081**
	(-0.001, 0.028)	(0.025, 0.084)	(1.051, 1.231)	(0.003, 0.013)	(-0.115, -0.046)
Occupation (Natural resources - REF)					
Hospitality services	0.04	0.066	1.166	0.008	0.175

	(-0.006, 0.087)	(-0.130, 0.262)	(0.948, 1.433)	(-0.003, 0.020)	(-0.185, 0.535)
Trade	0.033	0.06	1.121	0.006	0.238
	(-0.076, 0.142)	(-0.181, 0.301)	(0.927, 1.355)	(-0.004, 0.016)	(-0.248, 0.725)
Professional services	0.074*	0.153*	1.406***	0.020***	0.221
	(0.008, 0.139)	(0.008, 0.298)	(1.195, 1.653)	(0.011, 0.029)	(-0.178, 0.620)
Manufacturing	0.042	0.088	1.216*	0.011*	0.188*
	(-0.003, 0.087)	(-0.044, 0.221)	(1.015, 1.456)	(0.001, 0.021)	(0.043, 0.333)
Other	0.034*	0.085	1.222*	0.011*	0.032
	(0.002, 0.066)	(-0.048, 0.217)	(1.037, 1.440)	(0.002, 0.020)	(-0.178, 0.242)
Year (2010 - REF)					
2011	0.022	0.014	1.013	0.001	0.274
	(-0.044, 0.089)	(-0.064, 0.091)	(0.869, 1.180)	(-0.009, 0.011)	(-0.370, 0.919)
2012	0.007	-0.039***	0.875	-0.008	0.475*
	(-0.009, 0.023)	(-0.042, -0.036)	(0.744, 1.028)	(-0.018, 0.002)	(0.159, 0.790)
2013	0.005	-0.033	0.903	-0.006	0.351
	(-0.071, 0.081)	(-0.105, 0.040)	(0.769, 1.060)	(-0.016, 0.004)	(-0.485, 1.187)
2014	0.008	-0.002	0.986	-0.001	0.123
	(-0.037, 0.053)	(-0.019, 0.014)	(0.845, 1.152)	(-0.011, 0.009)	(-0.752, 0.997)
2015	-0.009	-0.046*	0.885	-0.008	0.21
	(-0.054, 0.036)	(-0.089, -0.003)	(0.759, 1.032)	(-0.017, 0.002)	(-0.702, 1.123)
2016	0.003	-0.004	0.977	-0.002	0.169
	(-0.036, 0.043)	(-0.024, 0.016)	(0.835, 1.142)	(-0.012, 0.009)	(-0.632, 0.970)
2017	0.007	-0.030**	0.9	-0.007	0.395***
	(-0.003, 0.017)	(-0.047, -0.013)	(0.770, 1.051)	(-0.016, 0.003)	(0.274, 0.517)
2018	-0.018	-0.076**	0.814**	-0.012**	0.276
	(-0.064, 0.029)	(-0.122, -0.031)	(0.699, 0.947)	(-0.022, -0.003)	(-0.218, 0.771)
2019	0.026	0.066	1.138	0.009	0.075
	(-0.027, 0.079)	(-0.003, 0.134)	(0.977, 1.327)	(-0.002, 0.019)	(-0.401, 0.550)
Region (Northeast - REF)					
North central, Midwest	0.052***	0.102***	1.248***	0.013***	0.210**
	(0.041, 0.062)	(0.075, 0.128)	(1.110, 1.403)	(0.006, 0.020)	(0.089, 0.332)
South	0.041***	0.077***	1.183**	0.010**	0.216
	(0.029, 0.054)	(0.056, 0.099)	(1.059, 1.323)	(0.004, 0.016)	(-0.032, 0.465)
West	0.026	0.063	1.162*	0.009*	0.054
	(-0.039, 0.091)	(-0.057, 0.183)	(1.033, 1.307)	(0.002, 0.015)	(-0.300, 0.408)
Income (Poor to low income - REF)					
Middle to high income	-0.003	-0.003	0.997	0	-0.048

	(-0.018, 0.012)	(-0.063, 0.057)	(0.900, 1.104)	(-0.007, 0.006)	(-0.323, 0.226)
Receipt of food stamp (No - REF)					
YES	0.036	0.042	1.068	0.004	0.368**
	(-0.038, 0.109)	(-0.100, 0.185)	(0.921, 1.239)	(-0.005, 0.014)	(0.178, 0.558)
Health status (Excellent - REF)					
Good	0.067***	0.164***	1.469***	0.021***	0.255*
	(0.057, 0.077)	(0.140, 0.187)	(1.303, 1.656)	(0.015, 0.026)	(0.087, 0.424)
Fair	0.189***	0.321***	1.906***	0.039***	1.085***
	(0.158, 0.220)	(0.252, 0.391)	(1.646, 2.207)	(0.030, 0.048)	(0.746, 1.424)
Poor	0.290**	0.490***	2.589***	0.066***	1.226***
	(0.162, 0.418)	(0.313, 0.666)	(1.999, 3.353)	(0.042, 0.090)	(1.012, 1.439)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF=reference

Appendix 7b. Regressions for the Use of Prescription Medications with Sedative Properties: ≥ 56 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 56 h/week	0.157*	0.098*	1.079*	0.017*	0.301*
	(0.025, 0.289)	(0.027, 0.170)	(1.004, 1.160)	(0.001, 0.033)	(0.020, 0.582)
Age (18-26years - REF)					
27-64 years	0.256***	0.223***	1.287***	0.054***	0.373*
	(0.221, 0.291)	(0.180, 0.266)	(1.194, 1.388)	(0.039, 0.070)	(0.060, 0.687)
≥ 65 years	0.328*	0.314**	1.466***	0.084***	0.345
	(0.111, 0.546)	(0.167, 0.460)	(1.317, 1.632)	(0.060, 0.107)	(-0.061, 0.751)
Race (White - REF)					
Black	-0.263***	-0.117***	0.963	-0.008	-0.648***
	(-0.288, -0.237)	(-0.133, -0.102)	(0.916, 1.012)	(-0.019, 0.003)	(-0.698, -0.598)
Other	-0.289***	-0.188***	0.855***	-0.034***	-0.589***
	(-0.325, -0.253)	(-0.225, -0.151)	(0.797, 0.916)	(-0.049, -0.019)	(-0.659, -0.518)
Sex (Male - REF)					
Female	0.007	0.005	1.007	0.002	0.003
	(-0.015, 0.029)	(-0.015, 0.025)	(0.969, 1.047)	(-0.007, 0.010)	(-0.101, 0.108)
Marital status (Married - REF)					
Divorced	0.174***	0.097***	1.068**	0.015**	0.325***
	(0.145, 0.202)	(0.080, 0.113)	(1.018, 1.120)	(0.004, 0.026)	(0.259, 0.392)
Unmarried	-0.057	-0.068	0.907***	-0.021***	-0.001
	(-0.196, 0.082)	(-0.160, 0.023)	(0.863, 0.954)	(-0.032, -0.010)	(-0.236, 0.233)
Family size (≤ 3 Members REF)					
4-6 Members	-0.217***	-0.177***	0.823***	-0.043***	-0.294***
	(-0.246, -0.188)	(-0.200, -0.154)	(0.787, 0.859)	(-0.052, -0.033)	(-0.350, -0.237)
> 6 Members	-0.457***	-0.367**	0.659***	-0.088***	-0.662***
	(-0.591, -0.324)	(-0.527, -0.207)	(0.562, 0.772)	(-0.119, -0.057)	(-0.883, -0.441)
Education (Less than college - REF)					
Some college or more	-0.023	-0.015	0.986	-0.003	-0.027
	(-0.057, 0.010)	(-0.035, 0.006)	(0.947, 1.026)	(-0.012, 0.006)	(-0.113, 0.059)

Occupation (Natural resources - REF)					
Hospitality services	0.02	0.051	1.109*	0.023*	-0.181
	(-0.345, 0.385)	(-0.191, 0.294)	(1.001, 1.229)	(0.000, 0.045)	(-0.843, 0.481)
Trade	0.051	0.049	1.073	0.015	-0.009
	(-0.340, 0.442)	(-0.169, 0.267)	(0.979, 1.175)	(-0.005, 0.035)	(-0.946, 0.928)
Professional services	0.047	0.069	1.123**	0.025**	-0.119
	(-0.260, 0.355)	(-0.088, 0.227)	(1.035, 1.218)	(0.008, 0.043)	(-0.889, 0.650)
Manufacturing	-0.032	0.023	1.087	0.018	-0.281
	(-0.356, 0.292)	(-0.179, 0.224)	(0.994, 1.190)	(-0.001, 0.038)	(-0.905, 0.343)
Other	-0.016	0.04	1.118**	0.025**	-0.303
	(-0.286, 0.253)	(-0.119, 0.199)	(1.030, 1.214)	(0.007, 0.042)	(-0.940, 0.335)
Year (2010 - REF)					
2011	0.025	-0.031	0.907*	-0.022*	0.277***
	(-0.033, 0.083)	(-0.080, 0.017)	(0.838, 0.982)	(-0.040, -0.004)	(0.247, 0.308)
2012	-0.079*	-0.115***	0.831***	-0.042***	0.130***
	(-0.133, -0.026)	(-0.153, -0.078)	(0.766, 0.900)	(-0.060, -0.024)	(0.087, 0.173)
2013	-0.002	-0.060*	0.878**	-0.029**	0.234*
	(-0.086, 0.082)	(-0.104, -0.016)	(0.809, 0.952)	(-0.048, -0.011)	(0.012, 0.455)
2014	0.022	-0.051	0.879**	-0.029**	0.289
	(-0.164, 0.208)	(-0.122, 0.020)	(0.811, 0.953)	(-0.047, -0.011)	(-0.231, 0.809)
2015	-0.021	-0.057	0.897**	-0.025**	0.15
	(-0.171, 0.129)	(-0.145, 0.031)	(0.829, 0.970)	(-0.043, -0.007)	(-0.164, 0.464)
2016	-0.035	-0.079	0.868***	-0.032***	0.162**
	(-0.121, 0.051)	(-0.158, 0.000)	(0.802, 0.940)	(-0.050, -0.014)	(0.097, 0.228)
2017	-0.016	-0.095**	0.826***	-0.043***	0.304*
	(-0.046, 0.014)	(-0.130, -0.059)	(0.761, 0.896)	(-0.061, -0.025)	(0.081, 0.528)
2018	0.017	-0.084*	0.822***	-0.044***	0.407***
	(-0.065, 0.099)	(-0.154, -0.014)	(0.759, 0.890)	(-0.062, -0.026)	(0.339, 0.475)
2019	0.005	-0.015	0.956	-0.01	0.12
	(-0.130, 0.140)	(-0.111, 0.081)	(0.881, 1.038)	(-0.029, 0.009)	(-0.136, 0.376)
Region (Northeast - REF)					
North central, Midwest	0.129***	0.093***	1.089**	0.019**	0.230***
	(0.101, 0.158)	(0.071, 0.115)	(1.025, 1.157)	(0.005, 0.032)	(0.211, 0.249)
South	0.124***	0.091***	1.088**	0.019**	0.226***
	(0.088, 0.160)	(0.069, 0.113)	(1.027, 1.153)	(0.006, 0.031)	(0.143, 0.309)
West	0.008	0.022	1.036	0.008	-0.013
	(-0.056, 0.072)	(-0.011, 0.055)	(0.974, 1.101)	(-0.006, 0.021)	(-0.156, 0.131)

Income (Poor to low income - REF)					
Middle to high income	-0.02	-0.019	0.976	-0.005	-0.016
	(-0.043, 0.003)	(-0.047, 0.010)	(0.927, 1.028)	(-0.017, 0.006)	(-0.054, 0.022)
Receipt of food stamp (No - REF)					
YES	0.308***	0.213***	1.203***	0.042***	0.483**
	(0.211, 0.406)	(0.169, 0.256)	(1.120, 1.293)	(0.025, 0.059)	(0.200, 0.766)
Health status (Excellent - REF)					
Good	0.361***	0.303***	1.412***	0.073***	0.590***
	(0.314, 0.408)	(0.253, 0.354)	(1.336, 1.493)	(0.062, 0.084)	(0.497, 0.683)
Fair	1.075***	0.783***	2.113***	0.168***	1.586***
	(1.009, 1.140)	(0.731, 0.834)	(1.962, 2.275)	(0.151, 0.184)	(1.378, 1.795)
Poor	1.856***	1.224***	2.638***	0.223***	2.696***
	(1.791, 1.922)	(1.181, 1.266)	(2.264, 3.075)	(0.186, 0.260)	(2.422, 2.970)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 8a. Regressions for Use of Prescription Sleep Aids: ≥ 36 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 36 h/week	0.029	0.023	1.036	0.002	0.047
	(-0.036, 0.095)	(-0.001, 0.048)	(0.966, 1.111)	(-0.002, 0.006)	(-0.028,0.122)
Age (18-26years - REF)					
27-64 years	0.115***	0.334***	2.323***	0.039***	0.347
	(0.082, 0.148)	(0.229, 0.439)	(1.716, 3.145)	(0.029, 0.049)	(-0.020, 0.714)
≥ 65 years	0.071**	0.261***	1.999***	0.030***	0.159
	(0.040, 0.101)	(0.198, 0.324)	(1.594, 2.508)	(0.024, 0.036)	(-0.030, 0.348)
Race (White - REF)					
Black	-0.136***	-0.331***	0.442***	-0.039***	-0.381*
	(-0.148, -0.123)	(-0.388, -0.274)	(0.371, 0.527)	(-0.046, -0.033)	(-0.750, -0.012)
Other	-0.107***	-0.219**	0.617**	-0.027**	-0.658***
	(-0.143, -0.072)	(-0.332, -0.105)	(0.458, 0.833)	(-0.041, -0.013)	(-0.793, -0.522)
Sex (Male - REF)					
Female	0.011	0.027	1.058	0.004	0.034
	(-0.026, 0.048)	(-0.019, 0.073)	(0.980, 1.143)	(-0.001, 0.008)	(-0.430, 0.498)
Marital status (Married - REF)					
Divorced	0.045***	0.084***	1.207***	0.012***	0.035
	(0.037, 0.053)	(0.060, 0.109)	(1.132, 1.286)	(0.008, 0.016)	(-0.176, 0.246)
Unmarried	0	0.022	1.07	0.004	-0.217
	(-0.014, 0.013)	(-0.020, 0.063)	(0.952, 1.203)	(-0.003, 0.011)	(-0.501, 0.066)
Family size (≤ 3 Members REF)					
4-6 Members	-0.067***	-0.157***	0.697***	-0.021***	-0.173
	(-0.070, -0.064)	(-0.175, -0.139)	(0.657, 0.740)	(-0.024, -0.017)	(-0.383, 0.037)
> 6 Members	-0.104**	-0.285***	0.486***	-0.036***	-0.019
	(-0.170, -0.038)	(-0.362, -0.208)	(0.446, 0.529)	(-0.040, -0.032)	(-1.348, 1.309)
Education (Less than college - REF)					
Some college or more	0.013	0.055**	1.138**	0.008**	-0.076***
	(-0.000, 0.027)	(0.026, 0.084)	(1.060, 1.222)	(0.004, 0.012)	(-0.099, -0.053)
Occupation (Natural resources - REF)					

Hospitality services	0.04	0.064	1.164	0.008	0.143
	(-0.003, 0.084)	(-0.129, 0.257)	(0.713, 1.898)	(-0.018, 0.035)	(-0.214, 0.500)
Trade	0.031	0.057	1.115	0.006	0.208
	(-0.078, 0.140)	(-0.184, 0.298)	(0.652, 1.906)	(-0.023, 0.035)	(-0.276, 0.692)
Professional services	0.071*	0.149*	1.398*	0.020*	0.165
	(0.010, 0.133)	(0.009, 0.289)	(1.020, 1.914)	(0.003, 0.036)	(-0.173, 0.503)
Manufacturing	0.037	0.08	1.201	0.01	0.113
	(-0.006, 0.080)	(-0.049, 0.210)	(0.873, 1.653)	(-0.006, 0.027)	(-0.127, 0.354)
Other	0.031*	0.079	1.213	0.011	-0.035
	(0.001, 0.061)	(-0.049, 0.208)	(0.877, 1.678)	(-0.006, 0.028)	(-0.280, 0.210)
Year (2010 - REF)					
2011	0.023	0.014	1.014	0.001	0.28
	(-0.045, 0.091)	(-0.065, 0.094)	(0.894, 1.151)	(-0.007, 0.009)	(-0.363, 0.922)
2012	0.008	-0.039***	0.875***	-0.008***	0.484**
	(-0.011, 0.026)	(-0.039, -0.038)	(0.858, 0.892)	(-0.009, -0.007)	(0.200, 0.768)
2013	0.005	-0.033	0.901	-0.006	0.358
	(-0.073, 0.083)	(-0.108, 0.042)	(0.800, 1.016)	(-0.014, 0.001)	(-0.486, 1.201)
2014	0.009	-0.002	0.987	-0.001	0.136
	(-0.039, 0.056)	(-0.016, 0.013)	(0.911, 1.068)	(-0.006, 0.004)	(-0.751, 1.024)
2015	-0.009	-0.047*	0.885	-0.008	0.198
	(-0.055, 0.036)	(-0.090, -0.003)	(0.756, 1.036)	(-0.017, 0.002)	(-0.723, 1.120)
2016	0.003	-0.005	0.975	-0.002	0.159
	(-0.037, 0.043)	(-0.025, 0.015)	(0.880, 1.080)	(-0.008, 0.005)	(-0.632, 0.950)
2017	0.007	-0.031**	0.898**	-0.007**	0.379***
	(-0.004, 0.017)	(-0.049, -0.013)	(0.862, 0.937)	(-0.009, -0.004)	(0.288, 0.470)
2018	-0.018	-0.077**	0.813**	-0.012**	0.265
	(-0.064, 0.029)	(-0.122, -0.032)	(0.746, 0.885)	(-0.017, -0.007)	(-0.202, 0.732)
2019	0.026	0.065	1.138*	0.009*	0.077
	(-0.027, 0.079)	(-0.002, 0.133)	(1.008, 1.285)	(0.000, 0.018)	(-0.373, 0.528)
Region (Northeast - REF)					
North central, Midwest	0.052***	0.103***	1.250***	0.013***	0.219**
	(0.043, 0.061)	(0.077, 0.129)	(1.180, 1.324)	(0.010, 0.017)	(0.119, 0.319)
South	0.041***	0.078***	1.183***	0.010***	0.221
	(0.028, 0.053)	(0.055, 0.100)	(1.117, 1.254)	(0.007, 0.013)	(-0.020, 0.462)
West	0.025	0.063	1.162	0.009	0.047
	(-0.040, 0.090)	(-0.058, 0.183)	(0.904, 1.494)	(-0.006, 0.024)	(-0.299, 0.392)
Income (Poor to low income - REF)					

Middle to high income	-0.003	-0.003	0.998	0	-0.055
	(-0.017, 0.011)	(-0.062, 0.056)	(0.869, 1.145)	(-0.009, 0.008)	(-0.320, 0.210)
Receipt of food stamp (No - REF)					
YES	0.037	0.045	1.072	0.004	0.417**
	(-0.039, 0.114)	(-0.102, 0.193)	(0.758, 1.516)	(-0.018, 0.027)	(0.218, 0.617)
Health status (Excellent - REF)					
Good	0.066***	0.162***	1.465***	0.020***	0.232*
	(0.057, 0.075)	(0.141, 0.183)	(1.382, 1.552)	(0.018, 0.023)	(0.070, 0.394)
Fair	0.189***	0.320***	1.903***	0.039***	1.071**
	(0.158, 0.219)	(0.253, 0.388)	(1.593, 2.275)	(0.026, 0.051)	(0.717, 1.424)
Poor	0.290**	0.488***	2.587***	0.066**	1.182***
	(0.161, 0.420)	(0.309, 0.667)	(1.921, 3.486)	(0.035, 0.097)	(0.985, 1.379)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 8b. Regressions for the Use of Prescription Medications with Sedative Properties: ≥ 36 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 36 h/week	0.071	0.056	1.062	0.013	0.092
	(-0.073, 0.214)	(0.078, 0.114)	(0.966, 1.168)	(-0.007, 0.034)	(-0.174, 0.359)
Age (18-26years - REF)					
27-64 years	0.255***	0.222***	1.284***	0.054***	0.374*
	(0.221, 0.290)	(0.180, 0.263)	(1.170, 1.409)	(0.034, 0.073)	(0.070, 0.679)
≥ 65 years	0.336*	0.321**	1.474***	0.085***	0.369
	(0.120, 0.552)	(0.176, 0.466)	(1.277, 1.702)	(0.054, 0.116)	(-0.057, 0.796)
Race (White - REF)					
Black	-0.262***	-0.117***	0.963**	-0.008**	-0.646***
	(-0.288, -0.236)	(-0.133, -0.102)	(0.945, 0.981)	(-0.013, -0.004)	(-0.694, -0.598)
Other	-0.290***	-0.188***	0.854***	-0.034***	-0.589***
	(-0.325, -0.254)	(-0.226, -0.151)	(0.825, 0.885)	(-0.042, -0.027)	(-0.662, -0.516)
Sex (Male - REF)					
Female	0	0.002	1.005	0.001	-0.014
	(-0.023, 0.023)	(-0.024, 0.027)	(0.957, 1.055)	(-0.010, 0.012)	(-0.115, 0.086)
Marital status (Married - REF)					
Divorced	0.176***	0.098***	1.069***	0.015***	0.327***
	(0.147, 0.204)	(0.081, 0.115)	(1.045, 1.093)	(0.010, 0.020)	(0.261, 0.393)
Unmarried	-0.058	-0.068	0.908*	-0.021*	-0.005
	(-0.197, 0.082)	(-0.160, 0.024)	(0.827, 0.996)	(-0.042, -0.001)	(-0.241, 0.232)
Family size (≤ 3 Members REF)					
4-6 Members	-0.217***	-0.177***	0.823***	-0.043***	-0.295***
	(-0.245, -0.189)	(-0.198, -0.156)	(0.815, 0.831)	(-0.045, -0.041)	(-0.349, -0.241)
> 6 Members	-0.459***	-0.369**	0.658**	-0.088**	-0.668***
	(-0.582, -0.336)	(-0.525, -0.213)	(0.533, 0.811)	(-0.129, -0.047)	(-0.881, -0.456)
Education (Less than college - REF)					

Some college or more	-0.023	-0.015	0.985	-0.003	-0.026
	(-0.055, 0.008)	(-0.035, 0.005)	(0.959, 1.012)	(-0.009, 0.003)	(-0.112, 0.059)
Occupation (Natural resources - REF)					
Hospitality services	0.022	0.055	1.116	0.024	-0.183
	(-0.341, 0.385)	(-0.180, 0.291)	(0.906, 1.374)	(-0.022, 0.070)	(-0.883, 0.516)
Trade	0.048	0.049	1.072	0.015	-0.014
	(-0.342, 0.437)	(-0.168, 0.265)	(0.941, 1.222)	(-0.013, 0.044)	(-0.963, 0.935)
Professional services	0.042	0.067	1.121*	0.025*	-0.129
	(-0.257, 0.342)	(-0.085, 0.219)	(1.028, 1.223)	(0.006, 0.044)	(-0.892, 0.634)
Manufacturing	-0.045	0.014	1.079	0.017	-0.306
	(-0.357, 0.267)	(-0.184, 0.212)	(0.909, 1.281)	(-0.021, 0.054)	(-0.887, 0.276)
Other	-0.024	0.036	1.114	0.024	-0.316
	(-0.286, 0.238)	(-0.119, 0.190)	(0.995, 1.247)	(-0.001, 0.048)	(-0.938, 0.305)
Year (2010 - REF)					
2011	0.027	-0.03	0.908*	-0.022*	0.280***
	(-0.034, 0.088)	(-0.081, 0.020)	(0.848, 0.972)	(-0.038, -0.006)	(0.245, 0.315)
2012	-0.079*	-0.115***	0.831***	-0.042***	0.130***
	(-0.136, -0.021)	(-0.154, -0.075)	(0.785, 0.879)	(-0.055, -0.029)	(0.086, 0.174)
2013	-0.003	-0.060*	0.878**	-0.030**	0.233*
	(-0.091, 0.085)	(-0.105, -0.016)	(0.825, 0.934)	(-0.043, -0.016)	(0.002, 0.463)
2014	0.023	-0.05	0.880***	-0.029***	0.289
	(-0.167, 0.213)	(-0.124, 0.023)	(0.870, 0.890)	(-0.032, -0.026)	(-0.235, 0.814)
2015	-0.02	-0.057	0.897*	-0.025*	0.149
	(-0.170, 0.130)	(-0.144, 0.030)	(0.825, 0.975)	(-0.044, -0.006)	(-0.163, 0.461)
2016	-0.036	-0.080*	0.868*	-0.032*	0.160**
	(-0.122, 0.050)	(-0.158, -0.001)	(0.780, 0.966)	(-0.056, -0.008)	(0.096, 0.223)
2017	-0.017	-0.095**	0.826**	-0.043**	0.304*
	(-0.047, 0.014)	(-0.132, -0.058)	(0.753, 0.905)	(-0.064, -0.022)	(0.081, 0.526)
2018	0.017	-0.084*	0.822**	-0.044**	0.405***
	(-0.066, 0.099)	(-0.154, -0.014)	(0.735, 0.920)	(-0.069, -0.019)	(0.342, 0.468)
2019	0.006	-0.014	0.957	-0.01	0.12
	(-0.129, 0.141)	(-0.111, 0.082)	(0.861, 1.064)	(-0.034, 0.014)	(-0.135, 0.375)
Region (Northeast - REF)					
North central, Midwest	0.130***	0.093***	1.088**	0.019**	0.235***
	(0.098, 0.162)	(0.067, 0.118)	(1.052, 1.125)	(0.011, 0.026)	(0.216, 0.253)
South	0.122***	0.089***	1.086***	0.018***	0.224**

	(0.085, 0.159)	(0.069, 0.109)	(1.073, 1.098)	(0.016, 0.021)	(0.132, 0.316)
West	0.006	0.02	1.033*	0.007*	-0.017
	(-0.057, 0.069)	(-0.014, 0.054)	(1.006, 1.061)	(0.001, 0.013)	(-0.152, 0.118)
Income (Poor to low income - REF)					
Middle to high income	-0.022	-0.022	0.972	-0.006	-0.016
	(-0.044, 0.001)	(-0.055, 0.012)	(0.922, 1.026)	(-0.018, 0.006)	(-0.069, 0.037)
Receipt of food stamp (No - REF)					
YES	0.314***	0.218***	1.209**	0.043**	0.497**
	(0.213, 0.414)	(0.172, 0.264)	(1.125, 1.299)	(0.027, 0.060)	(0.235, 0.759)
Health status (Excellent - REF)					
Good	0.359***	0.302***	1.411***	0.073***	0.584***
	(0.308, 0.410)	(0.249, 0.355)	(1.335, 1.492)	(0.062, 0.084)	(0.487, 0.682)
Fair	1.074***	0.783***	2.113***	0.168***	1.583***
	(1.006, 1.143)	(0.729, 0.837)	(2.033, 2.196)	(0.160, 0.176)	(1.375, 1.791)
Poor	1.856***	1.224***	2.639***	0.223***	2.692***
	(1.790, 1.922)	(1.183, 1.265)	(2.475, 2.815)	(0.206, 0.240)	(2.418, 2.965)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 9a. Regressions for the Use of Prescription Sleep Aids: ≥ 46 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 46 h/week	0.006	0.013	1.033	0.002	-0.005
	(-0.020, 0.031)	(-0.035, 0.061)	(0.911, 1.171)	(-0.006, 0.010)	(-0.056, 0.047)
Age (18-26years - REF)					
27-64 years	0.116***	0.335***	2.324***	0.039***	0.372*
	(0.084, 0.148)	(0.231, 0.438)	(1.722, 3.136)	(0.030, 0.049)	(0.011, 0.734)
≥ 65 years	0.069**	0.259***	1.993***	0.030***	0.13
	(0.039, 0.100)	(0.197, 0.321)	(1.596, 2.489)	(0.024, 0.036)	(-0.040, 0.301)
Race (White - REF)					
Black	-0.135***	-0.330***	0.442***	-0.039***	-0.376*
	(-0.148, -0.123)	(-0.386, -0.274)	(0.372, 0.526)	(-0.046, -0.033)	(-0.747, -0.006)
Other	-0.107***	-0.218**	0.618**	-0.026**	-0.653***
	(-0.142, -0.072)	(-0.332, -0.105)	(0.458, 0.835)	(-0.041, -0.012)	(-0.797, -0.508)
Sex (Male - REF)					
Female	0.01	0.028	1.061	0.004	0.021
	(-0.029, 0.049)	(-0.022, 0.077)	(0.975, 1.154)	(-0.002, 0.009)	(-0.461, 0.504)
Marital status (Married - REF)					
Divorced	0.045***	0.084***	1.206***	0.012***	0.046
	(0.037, 0.053)	(0.061, 0.107)	(1.134, 1.283)	(0.008, 0.016)	(-0.173, 0.264)
Unmarried	-0.001	0.022	1.07	0.004	-0.216
	(-0.015, 0.014)	(-0.020, 0.064)	(0.951, 1.205)	(-0.003, 0.011)	(-0.477, 0.045)
Family size (≤ 3 Members REF)					
4-6 Members	-0.068***	-0.157***	0.697***	-0.021***	-0.169
	(-0.070, -0.065)	(-0.175, -0.140)	(0.658, 0.739)	(-0.024, -0.017)	(-0.378, 0.040)
> 6 Members	-0.103*	-0.284***	0.486***	-0.036***	-0.003
	(-0.170, -0.036)	(-0.363, -0.205)	(0.444, 0.532)	(-0.040, -0.032)	(-1.315, 1.308)
Education (Less than college - REF)					
Some college or more	0.014*	0.055**	1.137**	0.008**	-0.073**
	(0.001, 0.027)	(0.028, 0.081)	(1.064, 1.215)	(0.004, 0.012)	(-0.099, -0.047)

Occupation (Natural resources - REF)					
Hospitality services	0.038	0.061	1.16	0.008	0.101
	(-0.007, 0.082)	(-0.133, 0.256)	(0.707, 1.902)	(-0.019, 0.035)	(-0.306, 0.507)
Trade	0.03	0.056	1.115	0.006	0.196
	(-0.078, 0.138)	(-0.184, 0.297)	(0.654, 1.902)	(-0.023, 0.034)	(-0.277, 0.668)
Professional services	0.071*	0.149*	1.399*	0.020*	0.165
	(0.009, 0.134)	(0.008, 0.290)	(1.020, 1.919)	(0.003, 0.036)	(-0.168, 0.498)
Manufacturing	0.038	0.082	1.205	0.01	0.126
	(-0.004, 0.081)	(-0.046, 0.211)	(0.881, 1.649)	(-0.006, 0.027)	(-0.099, 0.352)
Other	0.031*	0.08	1.216	0.011	-0.031
	(0.002, 0.061)	(-0.048, 0.209)	(0.880, 1.679)	(-0.006, 0.028)	(-0.273, 0.211)
Year (2010 - REF)					
2011	0.023	0.014	1.014	0.001	0.284
	(-0.045, 0.091)	(-0.065, 0.093)	(0.894, 1.149)	(-0.007, 0.009)	(-0.371, 0.938)
2012	0.007	-0.039***	0.875***	-0.008***	0.476*
	(-0.011, 0.026)	(-0.040, -0.038)	(0.857, 0.893)	(-0.009, -0.007)	(0.169, 0.782)
2013	0.005	-0.033	0.902	-0.006	0.351
	(-0.074, 0.083)	(-0.109, 0.043)	(0.799, 1.017)	(-0.014, 0.001)	(-0.509, 1.210)
2014	0.008	-0.002	0.986	-0.001	0.136
	(-0.039, 0.056)	(-0.017, 0.013)	(0.909, 1.070)	(-0.006, 0.004)	(-0.758, 1.029)
2015	-0.009	-0.047*	0.885	-0.008	0.198
	(-0.055, 0.036)	(-0.090, -0.004)	(0.755, 1.036)	(-0.017, 0.002)	(-0.765, 1.160)
2016	0.003	-0.004	0.976	-0.002	0.159
	(-0.036, 0.043)	(-0.024, 0.015)	(0.880, 1.081)	(-0.008, 0.005)	(-0.671, 0.989)
2017	0.007	-0.031**	0.898**	-0.007***	0.380***
	(-0.004, 0.017)	(-0.049, -0.013)	(0.863, 0.935)	(-0.009, -0.004)	(0.294, 0.466)
2018	-0.018	-0.077**	0.812**	-0.012**	0.268
	(-0.064, 0.028)	(-0.122, -0.032)	(0.747, 0.884)	(-0.017, -0.008)	(-0.219, 0.756)
2019	0.026	0.065	1.138*	0.009	0.063
	(-0.028, 0.079)	(-0.004, 0.134)	(1.006, 1.286)	(-0.000, 0.018)	(-0.434, 0.559)
Region (Northeast - REF)					
North central, Midwest	0.053***	0.104***	1.251***	0.013***	0.230**
	(0.043, 0.062)	(0.077, 0.130)	(1.180, 1.326)	(0.010, 0.017)	(0.134, 0.325)
South	0.042***	0.078***	1.185***	0.010***	0.234
	(0.030, 0.054)	(0.057, 0.100)	(1.122, 1.252)	(0.007, 0.013)	(-0.004, 0.471)
West	0.026	0.064	1.164	0.009	0.057
	(-0.038, 0.091)	(-0.055, 0.183)	(0.909, 1.491)	(-0.006, 0.024)	(-0.304, 0.418)

Income (Poor to low income - REF)					
Middle to high income	-0.002	-0.002	0.998	0	-0.034
	(-0.017, 0.014)	(-0.064, 0.061)	(0.862, 1.156)	(-0.009, 0.009)	(-0.304, 0.235)
Receipt of food stamp (No - REF)					
YES	0.036	0.044	1.07	0.004	0.382**
	(-0.039, 0.112)	(-0.102, 0.189)	(0.760, 1.506)	(-0.018, 0.027)	(0.174, 0.590)
Health status (Excellent - REF)					
Good	0.066***	0.162***	1.466***	0.020***	0.223*
	(0.057, 0.076)	(0.142, 0.182)	(1.388, 1.548)	(0.018, 0.023)	(0.043, 0.403)
Fair	0.189***	0.321***	1.905***	0.039***	1.058**
	(0.160, 0.218)	(0.255, 0.386)	(1.602, 2.266)	(0.027, 0.051)	(0.673, 1.443)
Poor	0.290**	0.488***	2.589***	0.066**	1.183***
	(0.159, 0.421)	(0.307, 0.670)	(1.915, 3.500)	(0.034, 0.098)	(0.963, 1.402)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 9b. Regressions for the Use of Medications with Sedative Properties: ≥ 46 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 46 h/week	-0.005	0.002	1.009	0.002	-0.028
	(-0.117, 0.108)	(-0.060, 0.065)	(0.970, 1.049)	(-0.007, 0.011)	(-0.303, 0.247)
Age (18-26years - REF)					
27-64 years	0.260***	0.225***	1.289**	0.054**	0.381*
	(0.229, 0.291)	(0.179, 0.271)	(1.166, 1.424)	(0.034, 0.075)	(0.080, 0.683)
≥ 65 years	0.332*	0.317**	1.468***	0.084***	0.364
	(0.115, 0.550)	(0.173, 0.461)	(1.276, 1.689)	(0.054, 0.114)	(-0.054, 0.782)
Race (White - REF)					
Black	-0.262***	-0.117***	0.963**	-0.008**	-0.646***
	(-0.291, -0.233)	(-0.134, -0.100)	(0.945, 0.982)	(-0.013, -0.004)	(-0.699, -0.593)
Other	-0.289***	-0.188***	0.855***	-0.034***	-0.589***
	(-0.328, -0.251)	(-0.227, -0.150)	(0.825, 0.885)	(-0.042, -0.027)	(-0.667, -0.511)
Sex (Male - REF)					
Female	-0.003	-0.001	1.003	0.001	-0.022
	(-0.025, 0.018)	(-0.017, 0.016)	(0.964, 1.043)	(-0.008, 0.009)	(-0.132, 0.088)
Marital status (Married - REF)					
Divorced	0.175***	0.098***	1.069***	0.015***	0.328***
	(0.147, 0.204)	(0.081, 0.115)	(1.045, 1.093)	(0.010, 0.020)	(0.265, 0.391)
Unmarried	-0.059	-0.069	0.907*	-0.021*	-0.006
	(-0.197, 0.080)	(-0.160, 0.022)	(0.827, 0.994)	(-0.042, -0.001)	(-0.243, 0.230)
Family size (≤ 3 Members REF)					
4-6 Members	-0.218***	-0.178***	0.822***	-0.043***	-0.295***
	(-0.247, -0.188)	(-0.200, -0.155)	(0.813, 0.832)	(-0.045, -0.041)	(-0.349, -0.242)
> 6 Members	-0.457***	-0.367**	0.659**	-0.088**	-0.664***
	(-0.580, -0.335)	(-0.521, -0.213)	(0.537, 0.809)	(-0.128, -0.048)	(-0.874, -0.454)
Education (Less than college - REF)					

Some college or more	-0.022	-0.014	0.986	-0.003	-0.023
	(-0.057, 0.012)	(-0.035, 0.007)	(0.960, 1.012)	(-0.009, 0.003)	(-0.114, 0.067)
Occupation (Natural resources - REF)					
Hospitality services	0.012	0.047	1.106	0.022	-0.201
	(-0.355, 0.379)	(-0.199, 0.292)	(0.883, 1.384)	(-0.027, 0.071)	(-0.876, 0.475)
Trade	0.044	0.045	1.069	0.015	-0.022
	(-0.350, 0.438)	(-0.175, 0.266)	(0.933, 1.225)	(-0.015, 0.044)	(-0.966, 0.922)
Professional services	0.04	0.065	1.120*	0.025*	-0.134
	(-0.268, 0.348)	(-0.093, 0.223)	(1.020, 1.229)	(0.005, 0.045)	(-0.904, 0.637)
Manufacturing	-0.042	0.017	1.082	0.017	-0.303
	(-0.362, 0.277)	(-0.183, 0.217)	(0.914, 1.283)	(-0.020, 0.054)	(-0.911, 0.305)
Other	-0.024	0.036	1.115	0.024	-0.319
	(-0.297, 0.248)	(-0.125, 0.197)	(0.992, 1.253)	(-0.001, 0.049)	(-0.962, 0.324)
Year (2010 - REF)					
2011	0.027	-0.03	0.908*	-0.022*	0.281***
	(-0.034, 0.088)	(-0.081, 0.020)	(0.849, 0.971)	(-0.037, -0.007)	(0.248, 0.313)
2012	-0.079*	-0.115***	0.831***	-0.042***	0.130***
	(-0.137, -0.021)	(-0.155, -0.076)	(0.785, 0.879)	(-0.055, -0.029)	(0.086, 0.173)
2013	-0.003	-0.061*	0.877**	-0.030**	0.231*
	(-0.092, 0.085)	(-0.105, -0.016)	(0.825, 0.934)	(-0.043, -0.016)	(0.004, 0.458)
2014	0.022	-0.051	0.879***	-0.029***	0.289
	(-0.170, 0.215)	(-0.125, 0.024)	(0.869, 0.890)	(-0.032, -0.026)	(-0.240, 0.818)
2015	-0.02	-0.057	0.897*	-0.025*	0.149
	(-0.174, 0.133)	(-0.146, 0.032)	(0.824, 0.975)	(-0.044, -0.006)	(-0.171, 0.469)
2016	-0.036	-0.079*	0.868*	-0.032*	0.160**
	(-0.123, 0.051)	(-0.158, -0.000)	(0.779, 0.967)	(-0.056, -0.008)	(0.096, 0.224)
2017	-0.017	-0.095**	0.825**	-0.043**	0.303*
	(-0.049, 0.015)	(-0.133, -0.058)	(0.753, 0.904)	(-0.064, -0.023)	(0.084, 0.522)
2018	0.016	-0.085*	0.822**	-0.044**	0.403***
	(-0.068, 0.100)	(-0.156, -0.014)	(0.734, 0.919)	(-0.069, -0.019)	(0.342, 0.464)
2019	0.004	-0.015	0.956	-0.01	0.117
	(-0.131, 0.139)	(-0.111, 0.080)	(0.862, 1.061)	(-0.034, 0.014)	(-0.136, 0.371)
Region (Northeast - REF)					
North central, Midwest	0.133***	0.095***	1.090***	0.019***	0.241***
	(0.102, 0.164)	(0.072, 0.118)	(1.059, 1.122)	(0.013, 0.026)	(0.215, 0.267)

South	0.125***	0.092***	1.089***	0.019***	0.230***
	(0.089, 0.162)	(0.069, 0.115)	(1.071, 1.107)	(0.015, 0.023)	(0.145, 0.314)
West	0.009	0.023	1.036*	0.008*	-0.012
	(-0.055, 0.074)	(-0.010, 0.056)	(1.010, 1.063)	(0.002, 0.013)	(-0.165, 0.140)
Income (Poor to low income - REF)					
Middle to high income	-0.015	-0.016	0.978	-0.005	-0.005
	(-0.039, 0.008)	(-0.041, 0.008)	(0.939, 1.018)	(-0.014, 0.004)	(-0.062, 0.053)
Receipt of food stamp (No - REF)					
YES	0.309***	0.213***	1.204**	0.042**	0.488**
	(0.209, 0.409)	(0.169, 0.258)	(1.116, 1.299)	(0.025, 0.060)	(0.200, 0.776)
Health status (Excellent - REF)					
Good	0.359***	0.302***	1.411***	0.073***	0.582***
	(0.311, 0.407)	(0.251, 0.353)	(1.337, 1.490)	(0.062, 0.084)	(0.495, 0.669)
Fair	1.073***	0.782***	2.112***	0.168***	1.578***
	(1.008, 1.138)	(0.731, 0.833)	(2.033, 2.194)	(0.160, 0.176)	(1.382, 1.774)
Poor	1.855***	1.223***	2.637***	0.223***	2.691***
	(1.790, 1.920)	(1.181, 1.265)	(2.471, 2.814)	(0.206, 0.240)	(2.418, 2.964)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 10a. Regressions for the Use of Prescription Sleep Aid: ≥ 66 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Prescription Sleep Aid = YES)
Work hours/week					
≥ 66 h/week	0.091	0.143	1.28	0.017	0.566*
	(-0.085, 0.266)	(-0.119, 0.406)	(0.781, 2.098)	(-0.020, 0.054)	(0.104, 1.028)
Age (18-26years - REF)					
27-64 years	0.116***	0.335***	2.328***	0.039***	0.366*
	(0.084, 0.147)	(0.256, 0.414)	(1.853, 2.924)	(0.031, 0.047)	(0.006, 0.726)
≥ 65 years	0.069	0.256***	1.993***	0.030***	0.077
	(-0.006, 0.144)	(0.112, 0.400)	(1.401, 2.835)	(0.013, 0.047)	(-0.136, 0.291)
Race (White - REF)					
Black	-0.136***	-0.331***	0.442***	-0.039***	-0.377
	(-0.164, -0.108)	(-0.395, -0.266)	(0.370, 0.527)	(-0.046, -0.033)	(-0.758, 0.004)
Other	-0.107***	-0.219***	0.618***	-0.027***	-0.667***
	(-0.138, -0.077)	(-0.305, -0.133)	(0.493, 0.774)	(-0.037, -0.016)	(-0.845, -0.489)
Sex (Male - REF)					
Female	0.012	0.03	1.064	0.004	0.042
	(-0.015, 0.039)	(-0.025, 0.085)	(0.940, 1.205)	(-0.004, 0.012)	(-0.432, 0.515)
Marital status (Married - REF)					
Divorced	0.044*	0.084*	1.204*	0.012*	0.048
	(0.006, 0.083)	(0.016, 0.152)	(1.040, 1.395)	(0.002, 0.022)	(-0.196, 0.293)
Unmarried	0	0.022	1.072	0.004	-0.209
	(-0.031, 0.030)	(-0.042, 0.087)	(0.923, 1.246)	(-0.005, 0.014)	(-0.502, 0.083)
Family size (≤ 3 Members REF)					
4-6 Members	-0.067***	-0.157***	0.698***	-0.021***	-0.169
	(-0.095, -0.039)	(-0.215, -0.099)	(0.607, 0.801)	(-0.028, -0.013)	(-0.395, 0.058)
> 6 Members	-0.104**	-0.284**	0.485*	-0.036**	0.017
	(-0.166, -0.041)	(-0.499, -0.070)	(0.257, 0.917)	(-0.059, -0.013)	(-1.261, 1.296)
Education (Less than college - REF)					
Some college or more	0.014	0.056	1.141	0.008*	-0.068**
	(-0.017, 0.046)	(-0.003, 0.115)	(1.000, 1.302)	(0.000, 0.016)	(-0.094, -0.043)
Occupation (Natural resources - REF)					

Hospitality services	0.038	0.062	1.161	0.008	0.103
	(-0.032, 0.109)	(-0.087, 0.211)	(0.815, 1.654)	(-0.011, 0.027)	(-0.314, 0.521)
Trade	0.031	0.056	1.116	0.006	0.178
	(-0.042, 0.104)	(-0.095, 0.208)	(0.780, 1.599)	(-0.013, 0.025)	(-0.260, 0.615)
Professional services	0.072*	0.149*	1.399*	0.020*	0.161
	(0.013, 0.130)	(0.025, 0.273)	(1.043, 1.876)	(0.004, 0.035)	(-0.187, 0.508)
Manufacturing	0.04	0.084	1.21	0.011	0.129
	(-0.022, 0.103)	(-0.047, 0.216)	(0.888, 1.650)	(-0.006, 0.027)	(-0.044, 0.301)
Other	0.032	0.08	1.215	0.011	-0.045
	(-0.027, 0.091)	(-0.047, 0.207)	(0.898, 1.644)	(-0.005, 0.027)	(-0.326, 0.236)
Year (2010 - REF)					
2011	0.022	0.012	1.011	0.001	0.262
	(-0.022, 0.066)	(-0.067, 0.091)	(0.851, 1.202)	(-0.011, 0.012)	(-0.417, 0.941)
2012	0.007	-0.04	0.874	-0.008	0.460*
	(-0.042, 0.056)	(-0.136, 0.055)	(0.700, 1.090)	(-0.022, 0.005)	(0.115, 0.804)
2013	0.005	-0.033	0.903	-0.006	0.352
	(-0.037, 0.047)	(-0.118, 0.053)	(0.745, 1.094)	(-0.018, 0.006)	(-0.510, 1.215)
2014	0.008	-0.002	0.987	-0.001	0.126
	(-0.034, 0.051)	(-0.088, 0.084)	(0.812, 1.200)	(-0.013, 0.012)	(-0.775, 1.027)
2015	-0.009	-0.046	0.886	-0.007	0.192
	(-0.056, 0.038)	(-0.138, 0.045)	(0.721, 1.090)	(-0.020, 0.005)	(-0.749, 1.133)
2016	0.004	-0.004	0.978	-0.001	0.155
	(-0.037, 0.044)	(-0.091, 0.083)	(0.803, 1.190)	(-0.014, 0.011)	(-0.663, 0.973)
2017	0.007	-0.03	0.9	-0.007	0.382***
	(-0.034, 0.048)	(-0.114, 0.054)	(0.741, 1.094)	(-0.019, 0.006)	(0.300, 0.463)
2018	-0.018	-0.076	0.814*	-0.012*	0.267
	(-0.059, 0.024)	(-0.164, 0.011)	(0.665, 0.996)	(-0.024, -0.000)	(-0.246, 0.780)
2019	0.026	0.066	1.14	0.009	0.07
	(-0.023, 0.075)	(-0.034, 0.166)	(0.918, 1.416)	(-0.006, 0.024)	(-0.429, 0.570)
Region (Northeast - REF)					
North central, Midwest	0.052*	0.102*	1.250*	0.013*	0.214*
	(0.004, 0.101)	(0.007, 0.197)	(1.006, 1.552)	(0.001, 0.026)	(0.076, 0.352)
South	0.041	0.078	1.183	0.01	0.229
	(-0.003, 0.085)	(-0.011, 0.166)	(0.965, 1.451)	(-0.002, 0.021)	(-0.007, 0.464)
West	0.026	0.063	1.162	0.009	0.062
	(-0.017, 0.068)	(-0.027, 0.154)	(0.938, 1.438)	(-0.003, 0.021)	(-0.300, 0.425)
Income (Poor to low income - REF)					

Middle to high income	-0.002	-0.001	1	0	-0.034
	(-0.034, 0.030)	(-0.069, 0.067)	(0.856, 1.167)	(-0.010, 0.010)	(-0.295, 0.226)
Receipt of food stamp (No - REF)					
YES	0.036	0.042	1.068	0.004	0.361**
	(-0.016, 0.087)	(-0.057, 0.140)	(0.859, 1.327)	(-0.010, 0.018)	(0.150, 0.573)
Health status (Excellent - REF)					
Good	0.067***	0.163***	1.466***	0.021***	0.239*
	(0.036, 0.098)	(0.088, 0.238)	(1.209, 1.779)	(0.011, 0.030)	(0.069, 0.410)
Fair	0.188***	0.320***	1.900***	0.039***	1.074***
	(0.126, 0.250)	(0.219, 0.421)	(1.530, 2.361)	(0.026, 0.052)	(0.744, 1.404)
Poor	0.290***	0.489***	2.588***	0.066***	1.210***
	(0.137, 0.443)	(0.287, 0.692)	(1.781, 3.761)	(0.033, 0.099)	(0.982, 1.437)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

Appendix 10b. Regressions for the Use of Medications with Sedative Properties: ≥ 66 h/week

Variables	Linear Regression	Tobit Marginal Effect	Adjusted Logit Odds Ratio	Logit Marginal Effect	Linear Regression Among Users (Use of Sedative Properties Medications = YES)
Work hours/week					
≥ 66 h/week	0.093	0.063	1.056	0.012	0.162*
	(-0.156, 0.342)	(-0.108, 0.233)	(0.889, 1.255)	(-0.027, 0.051)	(0.012, 0.312)
Age (18-26years - REF)					
27-64 years	0.259***	0.225***	1.289***	0.054***	0.379*
	(0.108, 0.411)	(0.147, 0.303)	(1.194, 1.391)	(0.039, 0.070)	(0.059, 0.698)
≥ 65 years	0.331**	0.316***	1.468***	0.084***	0.358
	(0.123, 0.540)	(0.197, 0.435)	(1.302, 1.655)	(0.057, 0.111)	(-0.055, 0.772)
Race (White - REF)					
Black	-0.262***	-0.117***	0.963	-0.008	-0.646***
	(-0.330, -0.194)	(-0.164, -0.070)	(0.911, 1.018)	(-0.021, 0.004)	(-0.696, -0.597)
Other	-0.289***	-0.188***	0.854***	-0.034***	-0.589***
	(-0.368, -0.210)	(-0.253, -0.123)	(0.787, 0.927)	(-0.052, -0.017)	(-0.660, -0.517)
Sex (Male - REF)					
Female	0	0.001	1.003	0.001	-0.014
	(-0.058, 0.057)	(-0.039, 0.040)	(0.960, 1.049)	(-0.009, 0.011)	(-0.108, 0.080)
Marital status (Married - REF)					
Divorced	0.175***	0.097**	1.068*	0.015*	0.327***
	(0.080, 0.270)	(0.035, 0.159)	(1.005, 1.136)	(0.001, 0.029)	(0.262, 0.392)
Unmarried	-0.058	-0.069**	0.907***	-0.021***	-0.005
	(-0.137, 0.021)	(-0.119, -0.019)	(0.858, 0.958)	(-0.034, -0.009)	(-0.243, 0.234)
Family size (≤ 3 Members REF)					
4-6 Members	-0.217***	-0.177***	0.823***	-0.043***	-0.295***
	(-0.279, -0.156)	(-0.224, -0.130)	(0.779, 0.868)	(-0.055, -0.031)	(-0.350, -0.239)
> 6 Members	-0.458***	-0.367***	0.659***	-0.088***	-0.663***
	(-0.599, -0.316)	(-0.493, -0.241)	(0.552, 0.786)	(-0.123, -0.054)	(-0.876, -0.450)
Education (Less than college - REF)					
Some college or more	-0.022	-0.014	0.987	-0.003	-0.023
	(-0.105, 0.061)	(-0.065, 0.038)	(0.939, 1.036)	(-0.014, 0.008)	(-0.103, 0.057)
Occupation (Natural resources - REF)					
Hospitality services	0.013	0.047	1.106	0.022	-0.195
	(-0.212, 0.239)	(-0.079, 0.173)	(0.983, 1.244)	(-0.004, 0.048)	(-0.849, 0.458)
Trade	0.045	0.046	1.069	0.015	-0.019

	(-0.174, 0.264)	(-0.079, 0.171)	(0.955, 1.198)	(-0.010, 0.039)	(-0.945, 0.907)
Professional services	0.041	0.066	1.120*	0.025*	-0.13
	(-0.147, 0.229)	(-0.037, 0.169)	(1.020, 1.230)	(0.005, 0.045)	(-0.889, 0.630)
Manufacturing	-0.04	0.018	1.083	0.017	-0.297
	(-0.244, 0.164)	(-0.101, 0.137)	(0.967, 1.214)	(-0.007, 0.042)	(-0.899, 0.306)
Other	-0.023	0.036	1.115*	0.024*	-0.315
	(-0.201, 0.155)	(-0.064, 0.136)	(1.013, 1.226)	(0.003, 0.045)	(-0.943, 0.313)
Year (2010 - REF)					
2011	0.026	-0.031	0.907*	-0.022*	0.278***
	(-0.075, 0.127)	(-0.098, 0.036)	(0.838, 0.981)	(-0.040, -0.004)	(0.242, 0.315)
2012	-0.079	-0.115**	0.830***	-0.042***	0.129***
	(-0.201, 0.042)	(-0.198, -0.033)	(0.757, 0.911)	(-0.062, -0.021)	(0.086, 0.172)
2013	-0.003	-0.06	0.878**	-0.030**	0.232
	(-0.124, 0.118)	(-0.142, 0.021)	(0.804, 0.958)	(-0.049, -0.010)	(-0.004, 0.469)
2014	0.022	-0.051	0.880**	-0.029**	0.29
	(-0.131, 0.175)	(-0.142, 0.040)	(0.804, 0.962)	(-0.049, -0.009)	(-0.240, 0.819)
2015	-0.02	-0.057	0.897*	-0.025*	0.149
	(-0.143, 0.103)	(-0.140, 0.027)	(0.819, 0.982)	(-0.045, -0.004)	(-0.168, 0.467)
2016	-0.035	-0.079*	0.868**	-0.032***	0.161**
	(-0.145, 0.075)	(-0.156, -0.002)	(0.799, 0.944)	(-0.051, -0.013)	(0.096, 0.226)
2017	-0.016	-0.095*	0.826***	-0.043***	0.304*
	(-0.128, 0.096)	(-0.171, -0.018)	(0.756, 0.901)	(-0.062, -0.023)	(0.086, 0.522)
2018	0.017	-0.085*	0.822***	-0.044***	0.403***
	(-0.105, 0.138)	(-0.168, -0.002)	(0.752, 0.898)	(-0.064, -0.024)	(0.342, 0.465)
2019	0.005	-0.015	0.956	-0.01	0.119
	(-0.114, 0.124)	(-0.098, 0.068)	(0.871, 1.050)	(-0.032, 0.011)	(-0.137, 0.375)
Region (Northeast - REF)					
North central, Midwest	0.132*	0.095*	1.090*	0.019*	0.239***
	(0.022, 0.242)	(0.018, 0.172)	(1.002, 1.186)	(0.001, 0.038)	(0.207, 0.270)
South	0.125*	0.092*	1.089*	0.019*	0.229***
	(0.019, 0.230)	(0.017, 0.166)	(1.003, 1.182)	(0.001, 0.037)	(0.146, 0.312)
West	0.009	0.023	1.036	0.008	-0.012
	(-0.087, 0.105)	(-0.047, 0.092)	(0.957, 1.121)	(-0.010, 0.025)	(-0.160, 0.136)
Income (Poor to low income - REF)					
Middle to high income	-0.016	-0.017	0.978	-0.005	-0.008
	(-0.092, 0.059)	(-0.069, 0.036)	(0.922, 1.038)	(-0.018, 0.008)	(-0.040, 0.023)
Receipt of food stamp (No - REF)					
YES	0.309***	0.213***	1.204***	0.042***	0.486**
	(0.158, 0.460)	(0.123, 0.303)	(1.114, 1.301)	(0.024, 0.060)	(0.200, 0.772)
Health status (Excellent - REF)					
Good	0.359***	0.302***	1.411***	0.073***	0.585***

	(0.293, 0.426)	(0.246, 0.359)	(1.323, 1.505)	(0.060, 0.086)	(0.485, 0.685)
Fair	1.073***	0.781***	2.111***	0.168***	1.581***
	(0.937, 1.209)	(0.688, 0.875)	(1.946, 2.290)	(0.150, 0.186)	(1.367, 1.795)
Poor	1.855***	1.223***	2.637***	0.223***	2.694***
	(1.450, 2.261)	(0.962, 1.485)	(2.157, 3.223)	(0.174, 0.272)	(2.414, 2.975)

Note: Confidence Interval in parentheses; *** p<0.001, ** p<0.01, * p<0.05; REF = reference

APPENDIX CHAPTER 2:

Appendix 1: Medications with sedative properties (Comparisons eAnswers., 2021).

Drug Facts And Comparisons

Acetaminophen and Codeine Oral
Acetaminophen, Caffeine, and Dihydrocodeine Oral
Alfentanil Injection
Alosetron Oral
ALPRAZolam Oral
Amitriptyline Oral
Ampicillin and Sulbactam Injection
ARIPiprazole Injection
ARIPiprazole Oral
Azelastine and Fluticasone Intranasal
Benzonatate Oral
Brexpiprazole Oral
Brivaracetam Injection
Brivaracetam Oral
Brompheniramine, Pseudoephedrine, and Dextromethorphan Oral
Buprenorphine Implant
Buprenorphine Injection
Buprenorphine Oral
Buprenorphine Transdermal
Butalbital, Acetaminophen, and Caffeine Oral
Cannabidiol Oral
Capecitabine Oral
Carbinoxamine Oral
Cenobamate Oral
Cetirizine Injection
Cetirizine Oral
Chlorpheniramine and Phenylephrine Oral
Chlorpheniramine, Phenylephrine, and Dextromethorphan Oral
Chlorpheniramine, Pseudoephedrine, and Codeine Oral
Chlorpheniramine, Pseudoephedrine, and Dextromethorphan Oral
CloBAZam Oral
Clonidine and Chlorthalidone Oral
CloNIDine Injection
CloNIDine Oral
CloNIDine Transdermal
CloZAPine Oral
Codeine and Chlorpheniramine Oral
Codeine Oral
Cyproheptadine Oral
Deutetrabenazine Oral
Dexchlorpheniramine Oral
DiphenhydrAMINE Injection
DiphenhydrAMINE Oral
Diphenoxylate and Atropine Oral
Doxepin Oral
Eluxadoline Oral
Esketamine Intranasal
Fenfluramine Oral
FentaNYL Buccal
FentaNYL Injection
FentaNYL Intranasal

FentaNYL Sublingual
FentaNYL Transdermal
Flibanserin Oral
Flucytosine Oral
Flurazepam Oral
Gabapentin Enacarbil Oral
Guaifenesin and Codeine Oral
GuanFACINE Oral
Haloperidol Injection
Haloperidol Oral
Hydrocodone and Acetaminophen Oral
Hydrocodone and Chlorpheniramine Oral
Hydrocodone and Homatropine Oral
Hydrocodone and Pseudoephedrine Oral
HYDROcodone Oral
HYDROmorphone Injection
HYDROmorphone Oral
HYDROmorphone Rectal
Isocarboxazid Oral
LevETIRAcetam Injection
LevETIRAcetam Oral
Lithium Oral
Lofexidine Oral
Loratadine Oral
LORazepam Injection
LORazepam Oral
Loxapine Inhalation
Loxapine Oral
Lumateperone Oral
Mecamylamine Oral
Meperidine Injection
Meperidine Oral
Methadone Injection
Methadone Oral
Methocarbamol Injection
Methocarbamol Oral
Methyldopa and Hydrochlorothiazide Oral
Methyldopa Oral
Methyldopate Injection
Methylphenidate Oral
Methylphenidate Transdermal
MetyraPONE Oral
MetyroSINE Oral
Midazolam Injection
Midazolam Intranasal
Midazolam Oral
Mitotane Oral
Morphine and Naltrexone Oral
Morphine Injection
Morphine Oral
Morphine Rectal
Nabilone Oral
Nadolol and Bendroflumethiazide Oral
Nadolol Oral
Nalbuphine Injection
Naltrexone Injection
Naltrexone Oral
Olanzapine and Samidorphan Oral
OLANZapine Injection
OLANZapine Oral
Oliceridine Injection
Ondansetron Injection

Ondansetron Oral
Oxaprozin Oral
Oxycodone and Acetaminophen Oral
Oxycodone and Aspirin Oral
OxyMORphone Injection
OxyMORphone Oral
Paliperidone Injection
Paliperidone Oral
Papaverine Injection
Pentazocine and Naloxone Oral
Pentazocine Injection
Perphenazine Oral
PHENobarbital Oral
Pimozide Oral
Pregabalin Oral
Promethazine and Codeine Oral
Promethazine and Phenylephrine Oral
Promethazine Injection
Promethazine Oral
Promethazine Rectal
Promethazine, Phenylephrine, and Codeine Oral
RisperiDONE Injection
RisperiDONE Oral
SUFentanil Injection
SUFentanil Oral
SUMAtriptan Injection
SUMAtriptan Intranasal
SUMAtriptan Oral
Suvorexant Oral
Tapentadol Oral
Tetrabenazine Oral
TiZANidine Oral
TraMADol Oral
Triazolam Oral
Valbenazine Oral
Vigabatrin Oral
Vilazodone Oral
Viloxazine Oral

Appendix 2. Distribution of Psychological Distress in the Panel.

Psychological Distress	Year 1	Year 2	Total
No	27,562	25,110	52,672
Yes	0	2,452	2,452
Yes %	0	8.9	4
Total	27,562	27,562	55,124

Note: Balanced sample of the 27,562 individuals with the two years; No psychological distress at baseline (year 1).

Appendix 3. Transition frequencies in and out of work hour groups.

	Weekly Working Hours				
	30-35	36-40	41-50	51-60	≥ 61
Overall Sample					
Observations in year 1	2,903	16,695	5,221	1,990	753
Frequency in	172	495	274	126	46
Frequency out	237	399	281	141	55
Frequency in and out	409	894	555	267	101
Observations in year 2	2,838	16,791	5,214	1,975	744
Rate of movement as % year 1 observation	14.1%	5.4%	10.6%	13.4%	13.4%
All Men					
Observations in year 1	1,185	9,132	3,367	1,415	565
Frequency in	73	298	180	101	35
Frequency out	123	235	190	97	42
Frequency in and out	196	533	370	198	77
Observations in year 2	1,135	9,195	3,357	1,419	558
Rate of movement as % year 1 observation	16.5%	5.8%	11.0%	14.0%	13.6%
All Women					
Observations in year 1	1,718	7,563	1,854	575	188
Frequency in	99	197	94	25	11
Frequency out	114	164	91	44	13
Frequency in and out	213	361	185	69	24
Observations in year 2	1,703	7,596	1,857	556	186
Rate of movement as % year 1 observation	12.4%	4.8%	10.0%	12.0%	12.8%

Note: Frequency in: number of observations that entered a work hour subgroup after year 1; Frequency out: number of observations that exited the work hour subgroup after year 1.

Appendix 4. Transition frequencies out of each work hour group.

Weekly Working Hours	Overall		All Men		All Women	
30-35 h/week select	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
30-35 h/week	2,903	2,666	1,185	1,062	1,718	1,604
36-40 h/week	0	195	0	100	0	95
41-50 h/week	0	31	0	19	0	12
51-60 h/week	0	9	0	3	0	6
≥ 61 h/week	0	2	0	1	0	1
Total	2,903	2,903	1,185	1,185	1,718	1,718
36-40 h/week select						
30-35 h/week	0	138	0	55	0	83
36-40 h/week	16,695	16,296	9,132	8,897	7,563	7,399
41-50 h/week	0	186	0	119	0	67
51-60 h/week	0	62	0	53	0	9
≥ 61 h/week	0	13	0	8	0	5
Total	16,695	16,695	9,132	9,132	7,563	7,563
41-50 h/week select						
30-35 h/week	0	24	0	15	0	9
36-40 h/week	0	200	0	129	0	71
41-50 h/week	5,221	4,940	3,367	3,177	1,854	1,763
51-60 h/week	0	40	0	31	0	9
≥ 61 h/week	0	17	0	15	0	2
Total	5,221	5,221	3,367	3,367	1,854	1,854
51-60 h/week select						
30-35 h/week	0	6	0	3	0	3
36-40 h/week	0	79	0	51	0	28
41-50 h/week	0	42	0	32	0	10
51-60 h/week	1,990	1,849	1,415	1,318	575	531
≥ 61 h/week	0	14	0	11	0	3
Total	1,990	1,990	1,415	1,415	575	575
≥ 61 h/week select						
30-35 h/week	0	4	0	0	0	4
36-40 h/week	0	21	0	18	0	3
41-50 h/week	0	15	0	10	0	5
51-60 h/week	0	15	0	14	0	1
≥ 61 h/week	753	698	565	523	188	175
Total	753	753	565	565	188	188

Appendix 5. Covariate Transitions

Covariate Transitions						
	Observations in year 1	Frequency in	Frequency out	Frequency in and out	Observations in year 2	Rate of movement as % year 2 observation
Overall Sample - Age						
18-64yrs	26,556	0	228	228	26,328	0.9%
≥ 65yrs	1,006	228	0	228	1,234	18.5%
All Men Sample - Age						
18-64yrs	15,060	0	132	132	14,928	0.9%
≥ 65yrs	604	132	0	132	736	17.9%
All Women Sample - Age						
18-64yrs	11,496	0	96	96	11,400	0.8%
≥ 65yrs	402	96	0	96	498	19.3%
Overall Sample - Marital Status						
Married	16,221	443	186	629	16,478	3.9%
Not married	11,341	186	443	629	11,084	5.5%
All Men Sample - Marital Status						
Married	9,959	264	90	354	10,133	3.6%
Not married	5,705	90	264	354	5,531	6.2%
All Women Sample - Marital Status						
Married	6,262	179	96	275	6,345	4.4%
Not married	5,636	96	179	275	5,553	4.9%
Overall Sample - Family size						
≤ 2 Members	11,677	724	461	1,185	11,940	10.1%
> 2 Members	15,885	461	724	1,185	15,622	7.5%
All Men Sample - Family size						
≤ 2 Members	6,424	363	276	639	6,511	9.9%
> 2 Members	9,240	276	363	639	9,153	6.9%
All Women Sample - Family size						
≤ 2 Members	5,253	361	185	546	5,429	10.4%
> 2 Members	6,645	185	361	546	6,469	8.2%

Appendix 5. Covariate Transitions (Continued).

Covariate Transitions						
	Observations in year 1	Frequency in	Frequency out	Frequency in and out	Observations in year 2	Rate of movement as % year 2 observation
Overall Sample - Occupation						
Professional and management occupations	10,796	237	206	443	10,827	4.1%
Other	16,766	206	237	443	16,735	2.6%
All Men Sample - Occupation						
Professional and management occupations	5,454	132	113	245	5,473	4.5%
Other	10,210	113	132	245	10,191	2.4%
All Women Sample - Occupation						
Professional and management occupations	5,342	105	93	198	5,354	3.7%
Other	6,556	93	105	198	6,544	3.0%
Overall Sample - Income						
Poor to low income	5876	1425	1830	3255	5471	55.4%
Middle to high income	21686	1830	1425	3255	22091	15.0%
All Men Sample - Income						
Poor to low income	3,306	835	1,089	1,924	3,052	58.2%
Middle to high income	12,358	1,089	835	1,924	12,612	15.6%
All Women Sample - Income						
Poor to low income	2,570	590	741	1,331	2,419	51.8%
Middle to high income	9,328	741	590	1,331	9,479	14.3%
Overall Sample - Receipt of Food Stamps						
no	25,682	705	601	1,306	25,786	5.1%
yes	1,880	601	705	1,306	1,776	69.5%
All Men Sample - Receipt of Food Stamps						
no	14,667	378	332	710	14,713	4.8%
yes	997	332	378	710	951	71.2%
All Women Sample - Receipt of Food Stamps						
no	11,015	327	269	596	11,073	5.4%
yes	883	269	327	596	825	67.5%

Note: Frequency in: number of observations that entered a work hour subgroup after year 1; Frequency out: number of observations that exited the work hour subgroup after year 1.

Appendix 6: Association between long working hours and onset of psychological distress: fixed effects estimate without covariates.

Variable	Overall	All Men	All Women
Work hours/week (30-35hrs/week - REF)			
36-40 h/week	0.037**	0.050*	0.026
	(0.001, 0.073)	(-0.004, 0.105)	(-0.021, 0.073)
41-50 h/week	0.032	0.049	0.014
	(-0.011, 0.075)	(-0.012, 0.110)	(-0.052, 0.080)
51-60 h/week	0.037	0.073**	-0.035
	(-0.014, 0.088)	(0.003, 0.143)	(-0.120, 0.049)
≥ 61 h/week	0.073**	0.083**	0.090
	(0.011, 0.135)	(0.001, 0.164)	(-0.018, 0.198)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Results – Weighted

Appendix 7. Association Between long working Hours and the onset of psychological distress: Fixed effects regression analysis – Weighted.

Variables	Overall	All Men	All Women
Work hours/week (30-35hrs/week - REF)			
36-40 h/week	0.060**	0.077*	0.040
	(0.008, 0.111)	(-0.007, 0.161)	(-0.019, 0.100)
41-50 h/week	0.061**	0.071	0.059
	(0.001, 0.121)	(-0.017, 0.158)	(-0.034, 0.153)
51-60 h/week	0.047	0.088*	-0.054
	(-0.020, 0.113)	(-0.010, 0.187)	(-0.152, 0.043)
≥ 61 h/week	0.097**	0.098*	0.155*
	(0.016, 0.178)	(-0.007, 0.203)	(-0.018, 0.329)
Age (18-64years - REF)			
≥ 65 years	0.044***	0.046**	0.041**
	(0.017, 0.070)	(0.010, 0.081)	(0.003, 0.079)
Marital Status (Married - REF)			
Not married	-0.015	-0.025	-0.000
	(-0.042, 0.013)	(-0.061, 0.012)	(-0.041, 0.041)
Family Size (≤ 2 Members REF)			
> 2 Members	-0.013	0.013	-0.046***
	(-0.034, 0.009)	(-0.014, 0.040)	(-0.080, -0.011)
Occupation (Natural resources - REF)			
Professional services	-0.040**	-0.032	-0.062*
	(-0.075, -0.005)	(-0.072, 0.008)	(-0.124, 0.000)
Income (Poor to low income - REF)			
Middle to high income	0.016**	0.011	0.024**
	(0.003, 0.029)	(-0.005, 0.027)	(0.001, 0.048)
Receipt of food stamp (No - REF)			
Yes	0.024*	0.041**	0.001
	(-0.004, 0.052)	(0.009, 0.073)	(-0.047, 0.048)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 8. Association between long working hours and onset of psychological distress: fixed effects estimate without covariates- Weighted.

Variables	Overall	All Men	All Women
Work hours/week (30-35hrs/week - REF)			
36-40 h/week	0.062**	0.077*	0.049
	(0.011, 0.114)	(-0.008, 0.161)	(-0.012, 0.111)
41-50 h/week	0.065**	0.071	0.071
	(0.004, 0.126)	(-0.016, 0.159)	(-0.026, 0.167)
51-60 h/week	0.051	0.088*	-0.036
	(-0.016, 0.117)	(-0.011, 0.187)	(-0.134, 0.063)
≥ 61 h/week	0.101**	0.099*	0.156*
	(0.020, 0.183)	(-0.006, 0.204)	(-0.021, 0.333)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

APPENDIX CHAPTER 3:

Appendix 1: Medications with sedative properties (Comparisons eAnswers., 2021).

Drug Facts And Comparisons

Acetaminophen and Codeine Oral
Acetaminophen, Caffeine, and Dihydrocodeine Oral
Alfentanil Injection
Alosetron Oral
ALPRAZolam Oral
Amitriptyline Oral
Ampicillin and Sulbactam Injection
ARIPiprazole Injection
ARIPiprazole Oral
Azelastine and Fluticasone Intranasal
Benzonatate Oral
Brexpiprazole Oral
Brivaracetam Injection
Brivaracetam Oral
Brompheniramine, Pseudoephedrine, and Dextromethorphan Oral
Buprenorphine Implant
Buprenorphine Injection
Buprenorphine Oral
Buprenorphine Transdermal
Butalbital, Acetaminophen, and Caffeine Oral
Cannabidiol Oral
Capecitabine Oral
Carbinoxamine Oral
Cenobamate Oral
Cetirizine Injection
Cetirizine Oral
Chlorpheniramine and Phenylephrine Oral
Chlorpheniramine, Phenylephrine, and Dextromethorphan Oral
Chlorpheniramine, Pseudoephedrine, and Codeine Oral
Chlorpheniramine, Pseudoephedrine, and Dextromethorphan Oral
CloBAZam Oral
Clonidine and Chlorthalidone Oral
CloNIDine Injection
CloNIDine Oral
CloNIDine Transdermal
CloZAPine Oral
Codeine and Chlorpheniramine Oral
Codeine Oral
Cyproheptadine Oral
Deutetrabenazine Oral
Dexchlorpheniramine Oral
DiphenhydrAMINE Injection
DiphenhydrAMINE Oral
Diphenoxylate and Atropine Oral
Doxepin Oral
Eluxadoline Oral
Esketamine Intranasal
Fenfluramine Oral
FentaNYL Buccal
FentaNYL Injection
FentaNYL Intranasal

FentaNYL Sublingual
FentaNYL Transdermal
Flibanserin Oral
Flucytosine Oral
Flurazepam Oral
Gabapentin Enacarbil Oral
Guaifenesin and Codeine Oral
GuanFACINE Oral
Haloperidol Injection
Haloperidol Oral
Hydrocodone and Acetaminophen Oral
Hydrocodone and Chlorpheniramine Oral
Hydrocodone and Homatropine Oral
Hydrocodone and Pseudoephedrine Oral
HYDROcodone Oral
HYDROmorphone Injection
HYDROmorphone Oral
HYDROmorphone Rectal
Isocarboxazid Oral
LevETIRAcetam Injection
LevETIRAcetam Oral
Lithium Oral
Lofexidine Oral
Loratadine Oral
LORazepam Injection
LORazepam Oral
Loxapine Inhalation
Loxapine Oral
Lumateperone Oral
Mecamylamine Oral
Meperidine Injection
Meperidine Oral
Methadone Injection
Methadone Oral
Methocarbamol Injection
Methocarbamol Oral
Methyldopa and Hydrochlorothiazide Oral
Methyldopa Oral
Methyldopate Injection
Methylphenidate Oral
Methylphenidate Transdermal
MetyraPONE Oral
MetyroSINE Oral
Midazolam Injection
Midazolam Intranasal
Midazolam Oral
Mitotane Oral
Morphine and Naltrexone Oral
Morphine Injection
Morphine Oral
Morphine Rectal
Nabilone Oral
Nadolol and Bendroflumethiazide Oral
Nadolol Oral
Nalbuphine Injection
Naltrexone Injection
Naltrexone Oral
Olanzapine and Samidorphan Oral
OLANZapine Injection
OLANZapine Oral
Oliceridine Injection
Ondansetron Injection

Ondansetron Oral
Oxaprozin Oral
Oxycodone and Acetaminophen Oral
Oxycodone and Aspirin Oral
OxyMORphone Injection
OxyMORphone Oral
Paliperidone Injection
Paliperidone Oral
Papaverine Injection
Pentazocine and Naloxone Oral
Pentazocine Injection
Perphenazine Oral
PHENobarbital Oral
Pimozide Oral
Pregabalin Oral
Promethazine and Codeine Oral
Promethazine and Phenylephrine Oral
Promethazine Injection
Promethazine Oral
Promethazine Rectal
Promethazine, Phenylephrine, and Codeine Oral
RisperiDONE Injection
RisperiDONE Oral
SUFentanil Injection
SUFentanil Oral
SUMAtriptan Injection
SUMAtriptan Intranasal
SUMAtriptan Oral
Suvorexant Oral
Tapentadol Oral
Tetrabenazine Oral
TiZANidine Oral
TraMADol Oral
Triazolam Oral
Valbenazine Oral
Vigabatrin Oral
Vilazodone Oral
Viloxazine Oral

Appendix 2a. Fixed Effect Linear Model – Overall Sample.

	Fixed Effect Linear Model – Overall Sample			
Variables	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)				
36-40 h/week	0	-0.007	0.012	0.004
	(-0.029, 0.028)	(-0.031, 0.017)	(-0.003, 0.027)	(-0.022, 0.031)
41-50 h/week	0	-0.021	0.006	0.01
	(-0.036, 0.035)	(-0.050, 0.009)	(-0.014, 0.025)	(-0.024, 0.044)
51-55 h/week	-0.012	-0.013	0.009	-0.024
	(-0.061, 0.036)	(-0.051, 0.024)	(-0.014, 0.032)	(-0.069, 0.021)
≥ 61 h/week	-0.001	-0.014	0.003	0
	(-0.069, 0.068)	(-0.067, 0.038)	(-0.029, 0.034)	(-0.060, 0.061)
Age (18-26years - REF)				
27-64 years	-0.032*	-0.025*	0.01	-0.013
	(-0.067, 0.002)	(-0.050, 0.001)	(-0.007, 0.026)	(-0.046, 0.020)
≥ 65 years	-0.061**	-0.034	0.028*	-0.037
	(-0.116, -0.006)	(-0.079, 0.011)	(-0.003, 0.059)	(-0.096, 0.022)
Marital Status (Married - REF)				
Unmarried	0.022	-0.005	-0.014	-0.005
	(-0.010, 0.053)	(-0.031, 0.022)	(-0.031, 0.003)	(-0.036, 0.025)
Family Size (≤ 2 Members REF)				
> 2 Members	-0.037***	-0.020**	-0.009	-0.011
	(-0.055, -0.019)	(-0.035, -0.005)	(-0.022, 0.003)	(-0.030, 0.007)
Occupation (Non-professional - REF)				
Professional services	-0.016	0.000	-0.01	0.013
	(-0.045, 0.012)	(-0.023, 0.023)	(-0.024, 0.005)	(-0.015, 0.041)
Income (Poor to low income - REF)				
middle to high income	0.000	0.002	-0.015***	0.013**
	(-0.014, 0.014)	(-0.009, 0.013)	(-0.023, -0.008)	(0.000, 0.026)
Receipt of food stamp (No - REF)				
Yes	-0.011	0.001	0.013**	-0.006
	(-0.031, 0.010)	(-0.017, 0.019)	(0.000, 0.025)	(-0.024, 0.013)
Limitation (No - REF)				
Yes	0.043***	0.036***	0.034***	0.020**
	(0.029, 0.057)	(0.021, 0.052)	(0.023, 0.045)	(0.004, 0.036)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 2b. Fixed Logit Marginal Analysis – Overall sample.

	Fixed Logit Marginal Analysis – Overall sample			
Variables	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)				
36-40 h/week	0.000	-0.014	0.065	0.008
	(-0.046, 0.046)	(-0.068, 0.041)	(-0.025, 0.155)	(-0.044, 0.060)
41-50 h/week	0.005	-0.048	0.021	0.021
	(-0.056, 0.065)	(-0.118, 0.022)	(-0.092, 0.133)	(-0.045, 0.086)
51-55 h/week	-0.016	-0.032	0.049	-0.050
	(-0.094, 0.061)	(-0.132, 0.069)	(-0.124, 0.223)	(-0.137, 0.038)
≥ 61 h/week	-0.002	-0.029	0.002	0.003
	(-0.101, 0.098)	(-0.156, 0.099)	(-0.215, 0.218)	(-0.115, 0.120)
Age (18-26years - REF)				
27-64 years	-0.052*	-0.071*	0.068	-0.023
	(-0.105, 0.002)	(-0.144, 0.002)	(-0.048, 0.184)	(-0.081, 0.036)
≥ 65 years	-0.116**	-0.101	0.178*	-0.067
	(-0.226, -0.006)	(-0.235, 0.033)	(-0.027, 0.383)	(-0.178, 0.043)
Marital Status (Married - REF)				
Unmarried	0.041	-0.013	-0.093*	-0.009
	(-0.016, 0.097)	(-0.077, 0.051)	(-0.197, 0.010)	(-0.067, 0.049)
Family Size (≤ 2 Members REF)				
> 2 Members	-0.067***	-0.049**	-0.034	-0.021
	(-0.100, -0.034)	(-0.086, -0.011)	(-0.083, 0.015)	(-0.055, 0.012)
Occupation (Non-professional - REF)				
Professional services	-0.027	-0.005	-0.071	0.025
	(-0.076, 0.021)	(-0.065, 0.054)	(-0.168, 0.025)	(-0.026, 0.076)
Income (Poor to low income - REF)				
middle to high income	-0.000	0.004	-0.096***	0.027**
	(-0.024, 0.023)	(-0.025, 0.033)	(-0.142, -0.049)	(0.001, 0.054)
Receipt of food stamp (No - REF)				
Yes	-0.017	-0.000	0.053*	-0.012
	(-0.053, 0.018)	(-0.042, 0.041)	(-0.009, 0.114)	(-0.053, 0.030)
Limitation (No - REF)				
Yes	0.104***	0.074***	0.136***	0.037**
	(0.069, 0.140)	(0.042, 0.107)	(0.092, 0.181)	(0.007, 0.067)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 3. Fixed Effects Regressions for Outpatient Physicians.

	Fixed Effects Regressions for Outpatient Physicians		
Variables	**Logit Model**	**Marginal Effect**	**Linear Model**
Work hours/week (30-35 h/week - REF)			
36-40 h/week	1.173	0.037	0.004
	(0.673, 2.044)	(-0.092, 0.167)	(-0.006, 0.015)
41-50 h/week	0.864	-0.034	-0.002
	(0.393, 1.900)	(-0.214, 0.146)	(-0.014, 0.010)
51-55 h/week	0.893	-0.026	-0.001
	(0.304, 2.618)	(-0.273, 0.221)	(-0.017, 0.015)
≥ 61 h/week	5.038*	0.333**	0.023**
	(0.954, 26.595)	(0.046, 0.621)	(0.001, 0.044)
Age (18-26years - REF)			
27-64 years	1.486	0.091	0.002
	(0.432, 5.115)	(-0.195, 0.378)	(-0.005, 0.009)
≥ 65 years	0.897	-0.024	-0.003
	(0.165, 4.883)	(-0.402, 0.353)	(-0.020, 0.015)
Marital Status (Married - REF)			
Unmarried	0.703	-0.081	-0.001
	(0.256, 1.930)	(-0.310, 0.148)	(-0.009, 0.006)
Family Size (≤ 2 Members REF)			
> 2 Members	0.947	-0.013	0.000
	(0.482, 1.858)	(-0.168, 0.142)	(-0.004, 0.004)
Occupation (Non-professional - REF)			
Professional services	0.696	-0.083	-0.005
	(0.352, 1.379)	(-0.240, 0.074)	(-0.014, 0.005)
Income (Poor to low income - REF)			
middle to high income	0.643*	-0.102*	-0.003*
	(0.393, 1.051)	(-0.215, 0.011)	(-0.006, 0.000)
Receipt of food stamp (No - REF)			
Yes	1.353	0.070	0.004
	(0.814, 2.249)	(-0.047, 0.187)	(-0.003, 0.010)
Limitation (No - REF)			
Yes	2.534***	0.217***	0.009***
	(1.564, 4.106)	(0.111, 0.324)	(0.004, 0.014)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 4a. Fixed Effect Logit Model – Among Medication Users.

	Fixed Effect Logit Model – Among Medication Users			
Variables	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)				
36-40 h/week	1.012	0.875	1.288	1.134
	(0.681, 1.504)	(0.636, 1.206)	(0.820, 2.023)	(0.814, 1.579)
41-50 h/week	0.892	0.814	1.157	1.255
	(0.524, 1.517)	(0.538, 1.234)	(0.654, 2.046)	(0.827, 1.903)
51-55 h/week	1.001	0.925	0.954	1.703
	(0.465, 2.152)	(0.495, 1.728)	(0.365, 2.491)	(0.854, 3.399)
≥ 61 h/week	1.173	0.755	0.595	1.393
	(0.465, 2.958)	(0.346, 1.647)	(0.169, 2.095)	(0.596, 3.254)
Age (18-26years - REF)				
27-64 years	0.734	0.540**	1.186	0.768
	(0.449, 1.197)	(0.337, 0.864)	(0.626, 2.248)	(0.497, 1.187)
≥ 65 years	0.444	0.613	2.616	0.877
	(0.118, 1.674)	(0.271, 1.386)	(0.759, 9.011)	(0.393, 1.959)
Marital Status (Married - REF)				
Unmarried	1.355	1.147	0.819	1.007
	(0.842, 2.178)	(0.785, 1.677)	(0.465, 1.442)	(0.681, 1.487)
Family Size (≤ 2 Members REF)				
> 2 Members	0.937	0.894	0.907	1.044
	(0.695, 1.263)	(0.717, 1.115)	(0.696, 1.181)	(0.830, 1.314)
Occupation (Non-professional - REF)				
Professional services	0.996	0.989	1.030	0.870
	(0.630, 1.574)	(0.698, 1.402)	(0.616, 1.723)	(0.613, 1.236)
Income (Poor to low income - REF)				
middle to high income	1.002	0.898	0.716***	1.220**
	(0.809, 1.240)	(0.753, 1.071)	(0.558, 0.920)	(1.009, 1.476)
Receipt of food stamp (No - REF)				
Yes	0.941	1.028	1.451**	0.984
	(0.701, 1.263)	(0.808, 1.309)	(1.038, 2.029)	(0.750, 1.290)
Limitation (No - REF)				
Yes	2.057***	1.477***	1.819***	1.133
	(1.589, 2.665)	(1.248, 1.749)	(1.453, 2.277)	(0.951, 1.349)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 4b: Fixed Effect Linear Model – Among Medication Users

	Fixed Effect Linear Model – Among Medication Users			
Variables	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)				
36-40 h/week	0.007	-0.027	0.021	0.026
	(-0.041, 0.055)	(-0.086, 0.032)	(-0.022, 0.064)	(-0.032, 0.083)
41-50 h/week	-0.005	-0.038	0.014	0.044
	(-0.061, 0.051)	(-0.109, 0.033)	(-0.039, 0.067)	(-0.027, 0.116)
51-55 h/week	0.005	-0.018	-0.001	0.077
	(-0.083, 0.092)	(-0.124, 0.088)	(-0.072, 0.070)	(-0.021, 0.176)
≥ 61 h/week	0.028	-0.060	-0.037	0.046
	(-0.095, 0.150)	(-0.204, 0.083)	(-0.131, 0.057)	(-0.086, 0.179)
Age (18-26years - REF)				
27-64 years	-0.038	-0.098***	0.015	-0.048
	(-0.107, 0.032)	(-0.171, -0.024)	(-0.039, 0.068)	(-0.125, 0.030)
≥ 65 years	-0.059	-0.081	0.063	-0.031
	(-0.145, 0.026)	(-0.196, 0.035)	(-0.017, 0.143)	(-0.149, 0.086)
Marital Status (Married - REF)				
Unmarried	0.031	0.022	-0.018	0.002
	(-0.017, 0.079)	(-0.038, 0.082)	(-0.059, 0.024)	(-0.056, 0.060)
Family Size (≤ 2 Members REF)				
> 2 Members	-0.006	-0.018	-0.015	0.006
	(-0.032, 0.021)	(-0.055, 0.018)	(-0.045, 0.015)	(-0.029, 0.040)
Occupation (Non-professional - REF)				
Professional services	-0.003	0.000	0.005	-0.025
	(-0.047, 0.041)	(-0.058, 0.058)	(-0.034, 0.045)	(-0.083, 0.032)
Income (Poor to low income - REF)				
middle to high income	0.001	-0.017	-0.031***	0.030**
	(-0.025, 0.026)	(-0.047, 0.014)	(-0.053, -0.009)	(0.001, 0.058)
Receipt of food stamp (No - REF)				
Yes	-0.008	0.012	0.040**	-0.004
	(-0.045, 0.030)	(-0.033, 0.058)	(0.006, 0.073)	(-0.045, 0.036)
Limitation (No - REF)				
Yes	0.052***	0.062***	0.057***	0.019
	(0.034, 0.070)	(0.036, 0.089)	(0.037, 0.078)	(-0.007, 0.045)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 4c. Fixed Marginal Analysis – Among Medication Users.

	Fixed Marginal Analysis – Among Medication Users			
Variables	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)				
36-40 h/week	0.003	-0.030	0.060	0.031
	(-0.094, 0.099)	(-0.101, 0.041)	(-0.046, 0.167)	(-0.051, 0.114)
41-50 h/week	-0.028	-0.046	0.035	0.056
	(-0.156, 0.100)	(-0.135, 0.044)	(-0.101, 0.171)	(-0.047, 0.160)
51-55 h/week	0.000	-0.018	-0.011	0.131
	(-0.186, 0.186)	(-0.158, 0.123)	(-0.242, 0.219)	(-0.034, 0.296)
≥ 61 h/week	0.039	-0.062	-0.123	0.082
	(-0.187, 0.265)	(-0.226, 0.103)	(-0.409, 0.164)	(-0.126, 0.291)
Age (18-26years - REF)				
27-64 years	-0.076	-0.145***	0.041	-0.065
	(-0.195, 0.044)	(-0.248, -0.042)	(-0.113, 0.195)	(-0.173, 0.043)
≥ 65 years	-0.194	-0.117	0.219*	-0.032
	(-0.489, 0.101)	(-0.302, 0.068)	(-0.029, 0.466)	(-0.230, 0.166)
Marital Status (Married - REF)				
Unmarried	0.074	0.030	-0.048	0.002
	(-0.043, 0.191)	(-0.056, 0.116)	(-0.183, 0.088)	(-0.095, 0.098)
Family Size (≤ 2 Members REF)				
> 2 Members	-0.016	-0.025	-0.023	0.011
	(-0.088, 0.057)	(-0.073, 0.023)	(-0.087, 0.040)	(-0.046, 0.068)
Occupation (Non-professional - REF)				
Professional services	-0.001	-0.002	0.007	-0.034
	(-0.112, 0.110)	(-0.079, 0.074)	(-0.115, 0.129)	(-0.122, 0.053)
Income (Poor to low income - REF)				
middle to high income	0.000	-0.024	-0.079**	0.049**
	(-0.052, 0.052)	(-0.063, 0.015)	(-0.139, -0.018)	(0.002, 0.097)
Receipt of food stamp (No - REF)				
Yes	-0.015	0.006	0.087**	-0.004
	(-0.086, 0.056)	(-0.048, 0.060)	(0.011, 0.164)	(-0.071, 0.063)
Limitation (No - REF)				
Yes	0.175***	0.089***	0.142***	0.031
	(0.114, 0.236)	(0.046, 0.132)	(0.088, 0.195)	(-0.012, 0.074)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 5. Fixed Effect Logit Model for Outpatient Physicians – Among Medication Users.

	Fixed Effect Logit Model for Outpatient Physicians – Among Medication Users		
Variables	**Logit Model**	**Marginal Effect**	**Linear Model**
Work hours/week (30-35 h/week - REF)			
36-40 h/week	1.284	0.051	0.012
	(0.604, 2.727)	(-0.107, 0.209)	(-0.016, 0.040)
41-50 h/week	0.784	-0.048	-0.008
	(0.269, 2.280)	(-0.257, 0.160)	(-0.039, 0.022)
51-55 h/week	0.769	-0.052	-0.012
	(0.153, 3.876)	(-0.363, 0.260)	(-0.057, 0.033)
≥ 61 h/week	6.411	0.366*	0.065*
	(0.651, 63.149)	(-0.019, 0.751)	(-0.002, 0.132)
Age (18-26years - REF)			
27-64 years	1.592	0.093	0.003
	(0.292, 8.699)	(-0.260, 0.446)	(-0.019, 0.026)
≥ 65 years	3.185	0.239	0.012
	(0.168, 60.260)	(-0.376, 0.854)	(-0.022, 0.047)
Marital Status (Married - REF)			
Unmarried	0.227*	-0.308*	-0.013
	(0.040, 1.273)	(-0.622, 0.006)	(-0.029, 0.004)
Family Size (≤ 2 Members REF)			
> 2 Members	0.963	-0.008	-0.002
	(0.389, 2.382)	(-0.191, 0.176)	(-0.011, 0.008)
Occupation (Non-professional - REF)			
Professional services	0.738	-0.062	-0.012
	(0.293, 1.859)	(-0.250, 0.125)	(-0.037, 0.012)
Income (Poor to low income - REF)			
middle to high income	0.522**	-0.132**	-0.010**
	(0.272, 1.000)	(-0.262, -0.003)	(-0.019, -0.001)
Receipt of food stamp (No - REF)			
Yes	1.718	0.111	0.015*
	(0.886, 3.330)	(-0.027, 0.250)	(-0.003, 0.034)
Limitation (No - REF)			
Yes	2.607***	0.199***	0.013***
	(1.358, 5.007)	(0.051, 0.348)	(0.005, 0.021)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Weighted Results

Appendix 6a. Fixed Effect Logit Model – Overall Sample (Weighted)

	Fixed Effect Logit Model – Overall Sample				
Variables	**Outpatient**	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)					
36-40 h/week	1.379*	1.095	0.941	1.369	1.006
	(0.971, 1.958)	(0.852, 1.407)	(0.706, 1.253)	(0.872, 2.150)	(0.777, 1.303)
41-45 h/week	1.709**	0.912	0.808	1.465	1.029
	(1.022, 2.857)	(0.623, 1.336)	(0.512, 1.275)	(0.730, 2.939)	(0.711, 1.488)
46-50 h/week	1.342	1.290	0.748	1.538	0.989
	(0.821, 2.195)	(0.883, 1.886)	(0.484, 1.158)	(0.767, 3.086)	(0.677, 1.444)
51-55 h/week	2.062*	0.796	0.963	2.304	0.656
	(0.945, 4.499)	(0.458, 1.385)	(0.474, 1.955)	(0.605, 8.770)	(0.366, 1.177)
56-60 h/week	1.247	1.132	0.750	1.296	0.786
	(0.625, 2.488)	(0.692, 1.853)	(0.412, 1.363)	(0.379, 4.431)	(0.478, 1.293)
≥ 61 h/week	1.632	0.868	1.039	1.140	0.917
	(0.734, 3.628)	(0.521, 1.443)	(0.536, 2.014)	(0.431, 3.013)	(0.523, 1.607)
Age (18-26years - REF)					
27-64 years	1.389	0.786*	0.736	1.161	0.860
	(0.896, 2.154)	(0.592, 1.044)	(0.504, 1.075)	(0.619, 2.177)	(0.640, 1.156)
≥ 65 years	1.900*	0.716	0.573	1.164	0.962
	(0.966, 3.737)	(0.377, 1.361)	(0.273, 1.202)	(0.420, 3.227)	(0.539, 1.717)
Marital Status (Married - REF)					
Unmarried	0.878	1.372**	1.008	0.727	0.888
	(0.581, 1.326)	(1.021, 1.843)	(0.715, 1.422)	(0.425, 1.242)	(0.664, 1.187)
Family Size (≤ 2 Members REF)					
> 2 Members	0.750***	0.759***	0.878	0.909	0.919
	(0.603, 0.931)	(0.636, 0.906)	(0.718, 1.074)	(0.699, 1.182)	(0.775, 1.091)
Occupation (Non-professional - REF)					
Professional services	0.798	0.881	0.968	0.935	1.310**
	(0.558, 1.142)	(0.685, 1.133)	(0.710, 1.320)	(0.559, 1.565)	(1.021, 1.679)
Income (Poor to low income - REF)					
middle to high income	0.846*	1.074	1.077	0.728**	1.101
	(0.704, 1.017)	(0.946, 1.219)	(0.925, 1.255)	(0.566, 0.937)	(0.961, 1.261)
Receipt of food stamp (No - REF)					
Yes	1.259	1.040	0.986	1.428*	0.882
	(0.956, 1.659)	(0.856, 1.265)	(0.787, 1.235)	(0.981, 2.078)	(0.708, 1.099)
Limitation (No - REF)					
Yes	1.426***	1.482***	1.454***	1.898***	1.149*
	(1.220, 1.668)	(1.236, 1.777)	(1.234, 1.714)	(1.509, 2.387)	(0.988, 1.336)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 6b. Fixed Marginal Analysis – Overall Sample (Weighted).

	Fixed Marginal Analysis – Overall Sample				
Variables	**Outpatient**	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)					
36-40 h/week	0.078*	0.022	-0.015	0.076	0.002
	(-0.006, 0.163)	(-0.039, 0.083)	(-0.084, 0.055)	(-0.033, 0.186)	(-0.063, 0.066)
41-45 h/week	0.129**	-0.022	-0.051	0.093	0.007
	(0.010, 0.249)	(-0.113, 0.069)	(-0.159, 0.056)	(-0.075, 0.260)	(-0.085, 0.099)
46-50 h/week	0.072	0.062	-0.069	0.104	-0.003
	(-0.047, 0.191)	(-0.031, 0.155)	(-0.171, 0.032)	(-0.062, 0.271)	(-0.097, 0.091)
51-55 h/week	0.172*	-0.054	-0.009	0.198	-0.103
	(-0.001, 0.344)	(-0.184, 0.075)	(-0.182, 0.163)	(-0.096, 0.491)	(-0.243, 0.036)
56-60 h/week	0.054	0.030	-0.069	0.063	-0.060
	(-0.114, 0.222)	(-0.090, 0.151)	(-0.208, 0.070)	(-0.236, 0.362)	(-0.182, 0.063)
≥ 61 h/week	0.119	-0.034	0.009	0.032	-0.022
	(-0.069, 0.306)	(-0.155, 0.087)	(-0.153, 0.172)	(-0.205, 0.268)	(-0.161, 0.118)
Age (18-26years - REF)					
27-64 years	0.080	-0.059*	-0.075	0.036	-0.037
	(-0.025, 0.186)	(-0.128, 0.010)	(-0.166, 0.016)	(-0.116, 0.188)	(-0.111, 0.036)
≥ 65 years	0.154**	-0.081	-0.134	0.037	-0.010
	(0.001, 0.307)	(-0.236, 0.073)	(-0.302, 0.035)	(-0.209, 0.283)	(-0.153, 0.134)
Marital Status (Married - REF)					
Unmarried	-0.031	0.078**	0.002	-0.077	-0.029
	(-0.131, 0.069)	(0.005, 0.151)	(-0.081, 0.085)	(-0.207, 0.053)	(-0.101, 0.042)
Family Size (≤ 2 Members REF)					
> 2 Members	-0.069**	-0.068***	-0.031	-0.023	-0.021
	(-0.123, -0.016)	(-0.110, -0.025)	(-0.079, 0.017)	(-0.086, 0.041)	(-0.063, 0.022)
Occupation (Non-professional - REF)					
Professional services	-0.054	-0.031	-0.008	-0.016	0.067**
	(-0.141, 0.033)	(-0.092, 0.030)	(-0.082, 0.067)	(-0.141, 0.108)	(0.005, 0.129)
Income (Poor to low income - REF)					
middle to high income	-0.040*	0.017	0.018	-0.076**	0.024
	(-0.084, 0.005)	(-0.014, 0.048)	(-0.019, 0.055)	(-0.137, -0.014)	(-0.010, 0.057)
Receipt of food stamp (No - REF)					
Yes	0.054*	0.010	-0.003	0.085*	-0.031
	(-0.010, 0.118)	(-0.038, 0.057)	(-0.057, 0.051)	(-0.003, 0.172)	(-0.086, 0.023)
Limitation (No - REF)					
Yes	0.084***	0.096***	0.092***	0.153***	0.034*

	(0.047, 0.121)	(0.052, 0.140)	(0.050, 0.133)	(0.098, 0.208)	(-0.003, 0.072)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 7a. Fixed Effect Logit Model – Among Medication Users (Weighted)

	Fixed Effect Logit Model – Among Medication Users				
Variables	**Outpatient**	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)					
36-40 h/week	2.547*	1.088	0.902	1.308	1.113
	(0.837, 7.749)	(0.669, 1.768)	(0.604, 1.348)	(0.752, 2.275)	(0.742, 1.669)
41-45 h/week	2.847	1.046	0.703	1.568	1.543
	(0.410, 19.777)	(0.462, 2.365)	(0.390, 1.268)	(0.677, 3.634)	(0.854, 2.785)
46-50 h/week	1.709	1.221	0.622	1.141	1.170
	(0.209, 13.995)	(0.549, 2.716)	(0.336, 1.154)	(0.509, 2.562)	(0.630, 2.170)
51-55 h/week	28.917***	0.782	0.855	0.519	0.842
	(3.851, 217.141)	(0.220, 2.778)	(0.302, 2.420)	(0.097, 2.789)	(0.288, 2.456)
56-60 h/week	20.830**	1.499	0.876	0.950	2.294
	(1.139, 381.100)	(0.482, 4.667)	(0.381, 2.011)	(0.283, 3.191)	(0.815, 6.457)
≥ 61 h/week	49.085***	0.800	1.030	0.677	1.340
	(3.623, 664.958)	(0.273, 2.344)	(0.398, 2.663)	(0.185, 2.472)	(0.458, 3.923)
Age (18-26years - REF)					
27-64 years	0.219	0.750	0.606*	1.392	0.707
	(0.004, 10.771)	(0.425, 1.323)	(0.346, 1.061)	(0.623, 3.110)	(0.405, 1.235)
≥ 65 years	0.534	0.630	0.547	2.446	1.032
	(0.007, 38.470)	(0.132, 3.003)	(0.210, 1.428)	(0.605, 9.886)	(0.379, 2.812)
Marital Status (Married - REF)					
Unmarried	0.866	1.453	1.356	0.905	0.833
	(0.206, 3.640)	(0.842, 2.508)	(0.843, 2.184)	(0.453, 1.811)	(0.519, 1.334)
Family Size (≤ 2 Members - REF)					
> 2 Members	1.018	0.947	1.053	1.051	0.983
	(0.434, 2.389)	(0.641, 1.400)	(0.799, 1.387)	(0.742, 1.488)	(0.736, 1.312)
Occupation (Non-professional - REF)					
Professional services	13.119***	0.882	0.917	1.190	0.926
	(1.888, 91.140)	(0.516, 1.507)	(0.603, 1.396)	(0.614, 2.306)	(0.610, 1.404)
Income (Poor to low income - REF)					
middle to high income	0.608	0.967	0.958	0.789	1.136
	(0.260, 1.423)	(0.737, 1.267)	(0.769, 1.194)	(0.568, 1.096)	(0.897, 1.439)
Receipt of food stamp (No - REF)					
Yes	0.347**	1.025	1.105	1.471	0.943
	(0.129, 0.936)	(0.701, 1.499)	(0.814, 1.499)	(0.918, 2.357)	(0.675, 1.319)
Limitation (No - REF)					
Yes	1.486	2.117***	1.580***	2.103***	1.096
	(0.893, 2.472)	(1.517, 2.953)	(1.278, 1.953)	(1.599, 2.766)	(0.883, 1.361)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 7b. Fixed Marginal Analysis – Among Medication Users (Weighted)

	Fixed Marginal Analysis – Among Medication Users				
Variables	**Outpatient**	**Office Based**	**Emergency Room**	**Hospital Discharges**	**Dental**
Work hours/week (30-35 h/week - REF)					
36-40 h/week	0.154*	0.020	-0.025	0.060	0.026
	(-0.027, 0.335)	(-0.098, 0.138)	(-0.119, 0.070)	(-0.059, 0.178)	(-0.074, 0.126)
41-45 h/week	0.171	0.011	-0.082	0.098	0.107
	(-0.133, 0.476)	(-0.187, 0.209)	(-0.213, 0.049)	(-0.073, 0.268)	(-0.039, 0.254)
46-50 h/week	0.089	0.048	-0.109	0.030	0.038
	(-0.262, 0.441)	(-0.146, 0.243)	(-0.242, 0.025)	(-0.150, 0.210)	(-0.114, 0.191)
51-55 h/week	0.457***	-0.059	-0.037	-0.155	-0.041
	(0.124, 0.790)	(-0.356, 0.238)	(-0.281, 0.206)	(-0.553, 0.243)	(-0.293, 0.210)
56-60 h/week	0.430**	0.098	-0.032	-0.012	0.203*
	(0.082, 0.778)	(-0.174, 0.370)	(-0.227, 0.164)	(-0.292, 0.269)	(-0.038, 0.443)
≥ 61 h/week	0.489**	-0.053	0.007	-0.092	0.072
	(0.091, 0.887)	(-0.306, 0.200)	(-0.222, 0.236)	(-0.402, 0.218)	(-0.195, 0.339)
Age (18-26years - REF)					
27-64 years	-0.209	-0.070	-0.121*	0.075	-0.085
	(-0.770, 0.352)	(-0.207, 0.068)	(-0.251, 0.010)	(-0.102, 0.253)	(-0.222, 0.051)
≥ 65 years	-0.078	-0.112	-0.144	0.189	0.008
	(-0.641, 0.485)	(-0.485, 0.261)	(-0.362, 0.074)	(-0.064, 0.441)	(-0.238, 0.253)
Marital Status (Married - REF)					
Unmarried	-0.022	0.091	0.072	-0.022	-0.045
	(-0.245, 0.200)	(-0.042, 0.224)	(-0.044, 0.187)	(-0.176, 0.132)	(-0.159, 0.070)
Family Size (≤ 2 Members - REF)					
> 2 Members	0.003	-0.013	0.012	0.011	-0.004
	(-0.128, 0.133)	(-0.108, 0.081)	(-0.052, 0.077)	(-0.065, 0.086)	(-0.075, 0.067)
Occupation (Non-professional - REF)					
Professional services	0.491**	-0.030	-0.020	0.038	-0.019
	(0.090, 0.893)	(-0.160, 0.099)	(-0.117, 0.077)	(-0.103, 0.179)	(-0.121, 0.083)
Income (Poor to low income - REF)					
middle to high income	-0.075	-0.008	-0.010	-0.051	0.031
	(-0.205, 0.055)	(-0.074, 0.057)	(-0.061, 0.041)	(-0.124, 0.023)	(-0.027, 0.089)
Receipt of food stamp (No - REF)					
Yes	-0.171*	0.006	0.023	0.080	-0.014
	(-0.345, 0.004)	(-0.086, 0.098)	(-0.049, 0.096)	(-0.016, 0.176)	(-0.096, 0.068)
Limitation (No - REF)					
Yes	0.060	0.180***	0.109***	0.156***	0.022
	(-0.021, 0.142)	(0.103, 0.258)	(0.055, 0.163)	(0.080, 0.231)	(-0.031, 0.076)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

Appendix 8. Fixed Effect Logit Model for Outpatient Physicians (Weighted)

	Fixed Effect Logit Model for Outpatient Physicians			
	Overall Sample		Among Medication Users	
Variables	**Logit Model**	**Marginal Effect**	**Logit Model**	**Marginal Effect**
Work hours/week (30-35 h/week - REF)				
36-40 h/week	1.047	0.009	1.169	0.030
	(0.521, 2.102)	(-0.133, 0.151)	(0.511, 2.672)	(-0.129, 0.188)
41-45 h/week	0.859	-0.030	0.520	-0.124
	(0.268, 2.759)	(-0.256, 0.196)	(0.108, 2.502)	(-0.413, 0.166)
46-50 h/week	0.789	-0.046	0.378	-0.180
	(0.276, 2.254)	(-0.242, 0.150)	(0.063, 2.265)	(-0.501, 0.141)
51-55 h/week	1.571	0.096	1.959	0.126
	(0.288, 8.577)	(-0.275, 0.467)	(0.216, 17.779)	(-0.273, 0.524)
56-60 h/week	0.521	-0.118	0.290	-0.224
	(0.143, 1.895)	(-0.335, 0.099)	(0.049, 1.697)	(-0.513, 0.065)
≥ 61 h/week	16.048***	0.525***	13.705*	0.390**
	(2.490, 103.423)	(0.254, 0.796)	(0.956, 196.438)	(0.011, 0.770)
Age (18-26years - REF)				
27-64 years	1.344	0.058	4.352	0.267
	(0.237, 7.637)	(-0.291, 0.406)	(0.553, 34.233)	(-0.141, 0.675)
≥ 65 years	1.039	0.007	6.007	0.329
	(0.111, 9.753)	(-0.415, 0.430)	(0.220, 164.409)	(-0.301, 0.959)
Marital Status (Married - REF)				
Unmarried	0.426	-0.168	0.182**	-0.330**
	(0.136, 1.332)	(-0.375, 0.039)	(0.038, 0.865)	(-0.614, -0.047)
Family Size (≤ 2 Members - REF)				
> 2 Members	1.390	0.066	1.296	0.048
	(0.585, 3.299)	(-0.116, 0.249)	(0.396, 4.240)	(-0.170, 0.265)
Occupation (Non-professional - REF)				
Professional services	0.471*	-0.155	0.536	-0.115
	(0.194, 1.145)	(-0.342, 0.032)	(0.135, 2.128)	(-0.377, 0.147)
Income (Poor to low income - REF)				
middle to high income	0.527**	-0.130**	0.406**	-0.161**
	(0.295, 0.940)	(-0.250, -0.010)	(0.188, 0.876)	(-0.297, -0.025)
Receipt of food stamp (No - REF)				
Yes	1.353	0.062	1.662	0.093
	(0.679, 2.697)	(-0.081, 0.205)	(0.635, 4.347)	(-0.080, 0.266)
Limitation (No - REF)				
Yes	2.252***	0.168**	2.707**	0.184**
	(1.260, 4.023)	(0.028, 0.309)	(1.235, 5.930)	(0.039, 0.330)

Note: Robust confidence interval in parentheses; *** p<0.01, ** p<0.05, * p<0.1; REF=reference

CURRICULUM VITAE

Emmanuel Ezekekwu, BPharm, MHA, PhD(c)

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EDUCATION

2023 (May)	Ph.D., Public Health Sciences, Health Management & Systems Sciences. Dissertation: "The Association of Long Working Hours and the Use of Prescription Sedatives among U.S. Workers"
2017	Master of Health Administration **Western Kentucky University**
2010	Bachelor of Pharmacy (Hons) **University of Nigeria**

RESEARCH AND TEACHING EXPERIENCE

2018 – 2022	Graduate Research Assistant **Center for Health Organization Transformation (CHOT), School of Public Health & Information Sciences, University of Louisville**, Louisville, KY
2016 – 2017	Graduate Research Assistant **Department of Public Health, Western Kentucky University,** Bowling Green Kentucky
Summer, 2017	Administrative Intern **Commonwealth Regional Specialty Hospital,** Bowling Green Kentucky

SELECTED PUBLICATIONS

Ezekekwu, E., Salunkhe, S. S., Jennings, J. A. C., & Kelly Pryor, B. N. (2022). Community-Based and System-Level Interventions for Improving Food Security and Nutritious Food Consumption: A Systematic Review. *Journal of Hunger & Environmental Nutrition*, *17*(2), 149-169.

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Karimi, S. M., Salunkhe, S. S., White, K. B., Alzahrani, S. A., Little, B., McKinney, W. P., ... **Ezekekwu,** E. & Moyer, S. (2021). Facial Mask Use and COVID-19 Protection Measures in Jefferson County, Kentucky: Results from an Observational Survey, November 5− 11, 2020. *The University of Louisville Journal of Respiratory Infections*, *5*(1), 7.

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WORKING PAPERS

Ezekekwu, E., Kabir, U., & Thornewill, J. Hospital ownership and responses to readmissions: A resource dependence theory framework.

William N. Mkanta, **Ezekekwu**, Emmanuel, Michelle C. Reece, Neale R. Chumbler. Cross Sectional Analysis of The Risk Factor for Repeated Hospitalizations Among Female Medicaid Beneficiaries.

Kabir, U., **Ezekekwu**, E., Meredith R., Dobalian, A. Adherence Level of Recommended Preventative Services for Individuals with Psychological Distress. Preventing Chronic Diseases.

Mkanta, W., Reece M., Alamri A., Pope D., **Ezekekwu E**. Cross-Sectional Analysis of the Risk Factors for Multiple Hospitalizations among Female Medicaid Beneficiaries. Journal of Healthcare Management.

SELECTED PRESENTATIONS

Ezekekwu, E., Thornewill, J., Antimisiaris, D., & Esterhay, R. (2022). Transformational strategies for optimizing use of medications and related therapies through us pharmacists and pharmacies: Findings from a national study.

Ezekekwu, E., Brandon Mitchell and Judah Thornewill**.** Robust Public Health Preparedness for Preventing the Next Pandemic. Presentation at RSPP Workshop on Pandemics, Location and Mobility. Ponta Delgada, Azores, Portugal (November 1 – 2, 2021).

Ezekekwu, E., Seyed, K and Johnson, C. Evaluating the Use of Sedatives in the US. Working Population. Poster presentation at AcademyHealth Annual Research Meeting, June 14-17, 2021.

Ezekekwu, E., Seyed, K and Johnson, C. Examining the Use of Sedative Drugs in the US. Working Population. Poster presentation at Virtual ISPOR 2021(May 17-20, 2021). International Society for Pharmacoeconomics and Outcomes.

Ezekekwu, E., Salunkhe, S., and Jennings, J.C. "Systematic Review of Effective Community-Based and System Level Interventions for Improving Food Security." Poster presentation accepted at AcademyHealth Annual Research Meeting, Boston, MA, June 2020. (Conference held virtually in response to COVID-19).

Ezekekwu, E., Salunkhe, S., and Jennings, J.C. "Systematic Review of Effective Community-Based and System Level Interventions for Improving Food Security." Poster presentation at Kentucky Public Health Association Annual Conference, April 2020. (Conference held virtually in response to COVID-19).

Ezekekwu, E. (2020, October). Hospital ownership and responses to readmissions: A resource dependence theory framework. Oral presentation at *APHA's 2020 VIRTUAL Annual Meeting and Expo (Oct. 24-28)*. American Public Health Association.

Jennings, J.C **Ezekekwu, E.U**, and Ali, M. Advancements in Social Determinants of Health CHOT IAB Meeting. Malvern, PA. April 2019

William N. Mkanta, Michelle C. Reece, **Ezekekwu Emmanuel** U., Niyati thaku, Abdulgafir Ibrahim, Darnez Pope, Rukhaiya khatoon, Abeer Alamri. Mental Health and Healthcare Access among Refugees. Oral and Poster Presentation at Refugees Health Summit, April 18th, 2019 Bowling Green, KY, USA.

Ali, M. & **Ezekekwu, E.U**. (October 2018) - Interventions to Reduce 30-Day Hospital Readmission Rates for Adults with Heart Failure: A Systematic Literature Review. Poster presentation at NSF Center for Health Organization's 2019 Spring Industry Advisory Board meeting on October and 11th and 12th, Mclean, Virginia, USA.

Ezekekwu, E. U. (March 26, 2017) - An Examination of the likelihood of Home Discharge after General Hospitalizations among Medicaid Recipients. Oral presentation at the 47th WKU Student Research Conference, Bowling Green, KY, USA.

Ezekekwu, E.U (November 2016) - Evaluation of Long-term care in Kentucky: Oral presentation at: Department of Public Health; Bowling Green, KY, USA.

Ezekekwu, E.U (March 2016). Pattern of Marijuana and Illicit Drug consumption. Poster presentation at 46th WKU Student Research Conference, Bowling Green, KY, USA.

ACADEMIC SERVICE

2019 – 2022 **University of Louisville School of Public Health and Information Sciences Department of Health Management and Systems Sciences**

- MSHA and EMSHA Survey development and
-

2021 (Spring) Advisor (Christopher E Johnson, PhD)

- PHMS 383 Healthcare Quality Management, PHMS 282 Healthcare Information & Technology Management, PHMS 305 Healthcare Organizational Leadership & Governance.

2016 – 2017 **Western Kentucky University**

Advisor (William Mkanta, PhD)
Course: International Comparisons of Health Care Systems (Spring and Fall, 2017)

HCA 347 Course: Health Care Quality and Accountability (Spring and Fall, 2016)

ACADEMIC SERVICE

2020 – Present Reviewer, Academy of Management Annual Conference

2020 – Present Reviewer, APHA 2020 Annual Meeting and Expo

2020 – Present Reviewer, Journal of Primary Care & Community Health

2020 – Present Reviewer, CDC Chronic Diseases

2020 – Present Reviewer, Journal of Healthcare Management

2019 – Present Reviewer, The Journal of Health Care Organization, Provision, and Financing

2019 – Present Reviewer, AcademyHealth Annual Conference

SKILLS

- Microsoft office including Excel, PowerPoint and Forms
- Project management
- Statistical Software: STATA, SPSS, and R
- SQL
- Qualtrics
- Endnote
- Review Manager
- Quality Improvement
- Data analytics and informatics
- Risk Management
- Time-efficient, systematic working methodology.

CERTIFICATIONS

2018 – Present	CITI Programs: Responsible Conduct of Research and Basic/Refresher Course - Human Subjects Research
2013	Certificate in Key accounts management
2013	Certificate in customer centric interactions

SCHOLARSHIPS AND AWARDS

2023	Dean's Award, Graduation, University of Louisville
2023	Winner of the 2022 Integrated Public Use Microdata Series (IPUMS) Research Award competition.
2021	First Place Recipient, 2020 Jules Delambre Student Paper Contest by the Anthropologists and Sociologists of Kentucky
2020	Recipient, School of Public Health and Information Sciences Scholarship for attendance at the APHA 2020 Annual Meeting and Expo
2018 – 2021	Recipient, Presidential Diversity Fellow, University of Louisville,

2018-2021	Recipient, University of Louisville School of Public Health and Information Sciences Full Tuition Scholarship
2017	Dean's Award, Graduation, WKU
2017	Recipient, American College of Healthcare Executives (ACHE) student scholarship
2016-2017	Recipient, College of Health and Human Services (CHHS) Scholarship, WKU

PROFESSIONAL MEMBERSHIPS AND ACTIVITIES

- Member, AcademyHealth
- Member, Academy of Management
- Member, International Society for Pharmacoeconomics and Outcomes
- Member, American Public Health Association.
- Member, National Association of Health Services Executives
- Member, American College of Healthcare Executives
- Past Senate President (2016-2017), African Student Union, WKU Chapter
- Past Deputy secretary General (2007-2008), Pharmaceutical Association of Nigerian Students

INDUSTRY EXPERIENCE

2022 – Present	Director of Research **Intrinsica Global, Inc.,** Louisville, KY
2021 – 2022	Data Analyst and Co-Investigator **Intrinsica Global, Inc. (formerly Rapid Alliance),** Louisville, KY
Spring, 2017	Job Shadowing **Wayne County Hospital**, Monticello Kentucky
2014 -2015	National Sales Manager **Tricare Pharmaceutical Ltd,** Lagos.
2013 -2014	Specialist Medical Representative (Territory Coordinator) **MERCK & CO**, Nigeria.
2012 – 2013	Medical Representative **Sanofi**

2011-2012	Pharmacy Manager **Jurdynal Health Pharmacy,** Lagos.

VOLUNTEER SERVICE

2021	LouVax (Louisville metropolis vaccination)
2020 - 2021	Louisville Metro Mask Survey Observation Project
2016	Salvation Army, Bowling Green, Kentucky, USA
2016	International Refugee Center, Bowling Green, Kentucky, USA
2010	Red Cross, Nigeria.

References Available Upon Request