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Associations of employment status with opioid misuse: Evidence from a nationally representative survey in the U.S.

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ABSTRACT

The opioid crisis in the United States (U.S.) is widespread and increasing in severity, and psychosocial exposures have been identified as potential risk factors. We examined associations of employment status with opioid misuse in a large, nationally representative, population-based sample in the U.S. Data were from the 2019 National Survey of Drug Use and Health (NSDUH), an annual cross-sectional survey. The association of employment status with opioid misuse in 40,143 participants was examined by multivariable logistic regression, adjusting for age, sex, race/ethnicity, marital status, household income, educational attainment, medical insurance status, physical health conditions and depression. Analyses were weighted to represent a nationally representative sample of adults in the U.S. In NSDUH 2019, 3.82% of American individuals reported past-year opioid misuse. After taking relevant variables into account, compared to workers who were employed with normal working hours (35–40 h/week), those who were currently unemployed had higher odds of opioid misuse (fully adjusted odds ratio and 95% confidence interval were 1.40 [1.09, 1.79]). Compared to workers employed with normal working hours, those who were in school/training or retired had lower odds of opioid misuse. Short or long working hours were not associated with opioid misuse. Government and employer policy interventions may benefit from emphasizing stable employment as a major social determinant of health in the context of the opioid crisis.

1. Introduction

The opioid crisis in the United States (U.S.) is widespread and rapidly increasing in severity, with a total of 17,087 drug overdose deaths attributed to prescription opioids in 2016 (McCormick et al., 2021). The Society of Actuaries' (SOA) estimates of the total economic impact of non-medical opioid use in the U.S. from 2015 to 2018 exceeded $631 billion (Davenport et al., 2019). The immense costs incurred by the opioid crisis impact multiple societal domains, encompassing the healthcare and criminal justice systems, government assistance and education programs, and workplaces, with 40% ($253 billion) of the economic impact driven by lost productivity and lifetime earnings due to opioid overdose deaths (Davenport et al., 2019; Florence et al., 2016).

Employment-related factors such as strenuous working conditions and unemployment have been reliably and robustly associated with both opioid prescription prevalence and opioid misuse, a behavior defined as the use of opioids outside of the directions of a prescribing physician (Asfaw et al., 2020; Han et al., 2017; Perlmutter et al., 2017). In addition, working hours, especially ≥ 55 h/week, have recently been identified as a prominent occupational exposure with significant health impacts (Li et al., 2020; Rugulies et al., 2021). To the best of our knowledge, only one recent study reported significant associations of working more than 40 h per week with the prevalence of outpatient opioid prescriptions, suggesting that long working hours may trigger stress pathways and resultant behavioral changes (Asfaw et al., 2020). Yet, there is no research evidence on long working hours and opioid misuse. Furthermore, previous studies also suggested that people who do not work full-time (i.e., short working hours) may be vulnerable to financial hardship and adverse health outcomes due to their impaired ability to work, leading to risky behaviors (Ropponen et al., 2014).

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Collectively, these issues present a research gap salient to the ongoing opioid epidemic.

The objective of this study was to assess associations of the whole spectrum of employment status including unemployment and working hours with opioid misuse, using data from the 2019 National Survey of Drug Use and Health (NSDUH). The NSDUH is a large cross-sectional survey with a population-based, nationally representative sample, offering a diverse sample of American adults spanning broad demographic and occupational characteristics, which is a major strength of this study. We hypothesized that unemployment and unregular working hours (i.e., long or short working hours) are associated with opioid misuse.

2. Methods

2.1. Study population

Data from the NSDUH 2019 survey was used for this current research study. The NSDUH study is an annual cross-sectional survey examining demographic, social, and behavioral factors in drug use and health among U.S. adults. The NSDUH study data are weighted to adjust the sample characteristics to better represent the general US population (Center for Behavioral Health Statistics and Quality, 2020). In total, there were 56,136 respondents in the NSDUH 2019 survey. Analyses were restricted to working-aged and old adults above the age of 18 at the time of the survey. In NSDUH 2019, there were 40,355 adults aged 18 or above. We excluded a further 212 participants who missed data on working hours. The final sample size for the current analysis consisted of 40,143 participants. All participants provided written informed consent. This study was reviewed and approved for exemption from ethical approval as a secondary data analysis project by the University of California, Los Angeles Institutional Review Board (IRB#21–007064).

2.2. Measures

Employment status was assessed with a self-administered questionnaire item asking about the participant's work situation in the past week. Employment categories included working at a full- or part-time job; having a job or volunteering but not working in the past week; keeping house full-time; in school/training; retired; not having a job for some other reason; disabled; unemployed or on layoff and looking for work. Working hours were measured with the question "How many hours did you work last week at all jobs or businesses?" among people who were working. Working hours were categorized according to methods used in the World Health Organization (WHO) and International Labor Organization (ILO) global assessments of long working hours: <35 h per week; 35–40 h per week (reference group); 41–48 h per week, and 55+ hours per week; with long working hours defined as working over 55 h per week (Li et al., 2020; Rugulies et al., 2021).

Opioid misuse was defined as the use of either heroin or prescription-strength pain relievers outside of the directions of a prescribing physician (Han et al., 2017; Perlmutter et al., 2017). Heroin use in the past year was assessed with the question "How long has it been since you last used heroin?". Pain reliever misuse in the past year was assessed with the question "Did you use any prescription pain reliever in any way a doctor did not direct you to use it?". Our outcome for opioid misuse included both prescription-strength pain reliever misuse and heroin use.

Data on sociodemographic factors were collected, including sex, age (18–29, 30–49, 50+), race (White; Black; Hispanic; Other), marital status (married; never married; divorced/widowed/separated), educational attainment (high school or less; some college; university or more), household income (<$30,000, $30,000–74,999, $75,000+), and medical insurance (private; public; and uninsured). Physical health conditions and depression were also assessed, with participants reporting if they had ever been diagnosed with a heart condition, diabetes, chronic bronchitis/chronic obstructive pulmonary disease, cirrhosis of the liver, hepatitis B, kidney disease, asthma, HIV/AIDS, cancer, high blood pressure, or had experienced a major depressive episode in the past year.

2.3. Statistical analysis

First, weighted descriptive statistics for the study sample were generated. Next, associations of employment status with opioid misuse were estimated using weighted multivariable logistic regression, and the results were expressed as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). Multivariable models were calculated in four steps: Model I adjusted for age, sex, and race; Model II included further adjustment for marital status, educational attainment, and household income; Model III additionally adjusted for medical insurance status, given that lack of insurance has been shown to be associated with opioid misuse (Becker et al., 2008); and Model IV added adjustment for physical health conditions and depression. All analyses were conducted using the SAS 9.4 software package, Survey Analysis Procedures.

3. Results

The characteristics of the sample population are shown in Table 1. The sample of 40,143 primarily consisted of middle-aged adults, with 33.75% of participants falling into the age category of 30–49. Males and females were approximately equally distributed, and most participants were married and had at least a high school education. Participants generally had an annual household income of $75,000 or higher (41.14%) and were insured (87.79%). The sample was predominantly White (63.61%) and included Black (11.81%), Hispanic (16.16%), and Other (8.42%) racial and ethnic groups. The prevalence of opioid misuse was 3.82%. Three percent of adults were unemployed, and 13.84% and 5.80% of people had short and long working hours, respectively.

Table 1
Characteristics of the sample population, weighted (N = 40,143).

Variables	N (%)
Sex	
Male	18,580 (48.12)
Female	21,563 (51.88)
Age	
<30	15,898 (19.10)
30-49	15,561 (33.75)
50+	8684 (47.15)
Race	
White	24,051 (63.61)
Black	5041 (11.81)
Hispanic	7027 (16.16)
Other	4024 (8.42)
Marital Status	
Married	16,756 (52.03)
Never married	17,631 (27.62)
Divorced/widowed/separated	5756 (20.35)
Education	
University or more	11,542 (33.86)
Some college	13,953 (31.06)
High school or less	14,648 (35.08)
Household income	
$75,000+	14,315 (41.14)
$30,000–74,999	14,664 (35.25)
<$30,000	11,164 (23.61)
Medical insurance	
Private insurance	21,993 (50.97)
Public insurance	12,026 (36.82)
No insurance	6124 (12.21)
Physical health conditions	
No	27,149 (58.23)
Yes	12,994 (41.77)
Depression	
No	35,969 (92.23)
Yes	4174 (7.77)
Opioid misuse	
No	38,306 (96.18)
Yes	1837 (3.82)

The results of associations are displayed in Table 2. The analyses show significant associations of unemployment with opioid misuse. Compared to workers who were employed with regular working hours (35–40 h per week), those who experienced disability or unemployment had higher odds of opioid misuse (adjusted ORs and 95% CIs were 1.49 [1.08, 2.06] and 1.60 [1.23, 2.07], respectively, in Model II). As shown by Models III and IV, the inclusion of additional adjustment for medical insurance, physical health conditions and depression somewhat attenuated the observed significant associations of disability and unemployment status with opioid misuse (fully adjusted ORs and 95% CIs were 1.09 [0.77, 1.56] and 1.40 [1.09, 1.79], respectively). Short or long working hours were not significantly associated with opioid misuse. In contrast, participants who were in school/training or retired exhibited significantly lower odds of opioid misuse (ORs and 95% CIs = 0.54 [0.30, 0.95] and 0.59 [0.43, 0.82], respectively).

4. Discussion

In this study, we examined the associations of employment status with opioid misuse in a large, nationally representative, population-based sample of U.S. adults. We observed significant associations of unemployment with opioid misuse. However, we did not find any significant associations of long or short working hours with opioid misuse. While working hours have significant effects on physical health, especially cardiovascular disease, the evidence to date suggests that working hours are not related to behavioral or psychiatric disorders, such as alcoholism, depression, or the use of psychotropic medicine (Hannerz and Albertsen, 2016; Pachito et al., 2021; Rugulies et al., 2021). Although one study found a significant association of long working hours with opioid prescriptions, the outcome for our study was opioid misuse – heroin or pain relievers outside of the directions of a prescribing physician (Asfaw et al., 2020). Hence, our findings regarding working hours are in line with previous evidence.

Table 2
Associations of employment status with opioid misuse (ORs and 95% CIs).

Employment status	Model I	Model II	Model III	Model IV
Working <35 h/week (N = 6,609, 13.84%)	1.03 (0.84, 1.53)	0.92 (0.79, 1.07)	0.92 (0.79, 1.08)	0.85 (0.72, 1.34)
Working 35–40 h/week (N = 10,793, 25.38%)	1.00	1.00	1.00	1.00
Working 41–48 h/week (N = 3,121, 7.11%)	0.83 (0.59, 1.15)	0.84 (0.60, 1.17)	0.84 (0.60, 1.17)	0.84 (0.60, 1.18)
Working 49–54 h/week (N = 2,216, 5.73%)	0.79 (0.58, 1.07)	0.85 (0.62, 1.16)	0.85 (0.62, 1.17)	0.87 (0.63, 1.18)
Working 55+ hours/week (N = 2,518, 5.80%)	0.81 (0.63, 1.05)	0.84 (0.65, 1.10)	0.85 (0.65, 1.10)	0.86 (0.66, 1.13)
Has job or volunteer worker, did not work past week (N = 2,250, 4.97%)	1.13 (0.84, 1.53)	1.04 (0.77, 1.41)	1.00 (0.73, 1.35)	0.99 (0.72, 1.34)
Keeping house full-time (N = 1,842, 3.68%)	0.99 (0.69, 1.41)	1.00 (0.70, 1.42)	0.93 (0.66, 1.31)	0.91 (0.64, 1.29)
In school/training (N = 1,168, 1.49%)	0.71 (0.40, 1.30)	0.54 (0.30, 0.98)	0.54 (0.30, 0.97)	0.54 (0.30, 0.95)
Retired (N = 3,112, 17.56%)	0.76 (0.55, 1.05)	0.68 (0.50, 0.92)	0.60 (0.44, 0.83)	0.59 (0.43, 0.82)
Does not have a job, some other reason (N = 3,238, 6.75%)	1.53 (1.15, 2.02)	1.26 (0.96, 1.65)	1.17 (0.89, 1.55)	1.18 (0.89, 1.57)
Disabled (N = 1,514, 4.81%)	2.09 (1.52, 2.88)	1.49 (1.08, 2.06)	1.37 (0.97, 1.93)	1.09 (0.77, 1.56)
Unemployed/on layoff, looking for work (N = 1,762, 2.88%)	1.96 (1.51, 2.54)	1.60 (1.23, 2.07)	1.46 (1.14, 1.88)	1.40 (1.09, 1.79)

CI, confidence interval; OR, odds ratio.
Logistic regression, weighted.
Model I: adjustment for age, sex, and race.
Model II: Model I + additional adjustment for marital status, educational attainment, and household income.
Model III: Model II + additional adjustment for medical insurance status.
Model IV: Model III + additional adjustment for physical health conditions and depression.

Our results regarding unemployment and opioid misuse also generally corroborate previous findings. Prior analyses of NSDUH data reported comparable results regarding associations of unemployment with opioid misuse, with similar risk estimates (Han et al., 2017; Perlmutter et al., 2017). These findings also support previous conclusions relating macroeconomic conditions with opioid misuse; for instance, one study reported that for every one percent increase in the county unemployment rate, the opioid death rate increased by 3.6%, while emergency department visits for opioid overdose increased by 7% (Hollingsworth et al., 2017). Overall, the preponderance of evidence demonstrates that as unemployment rates increase, even temporarily, the prevalence of opioid prescriptions, misuse, overdoses, and deaths rise accordingly (Hollingsworth et al., 2017; Venkataramani et al., 2020). Unemployment may be related to opioid misuse through multiple potential pathways, including increased risk of chronic pain and adverse impacts on mental health (Matthews et al., 2021; Price et al., 2002), including suicidal ideation, and completed suicide by opioid overdose, which are examples of crises that have been termed "deaths of despair" (Case and Deaton, 2015). As evidence indicates that medical insurance and physical and mental health conditions are related to opioid misuse (Becker et al., 2008; Friedman et al., 2020), we observed that adjustment for medical insurance, physical health conditions and depression attenuated the strength of associations (see Models III and IV). This holds particularly true that non-working people with disability had higher odds of opioid misuse, yet statistical significance was not reached after taking medical insurance, physical health conditions and depression into account.

Unlike previous NSDUH analyses with very broad categories of employment status, i.e., part-time work, full-time work, unemployment, and others (Han et al., 2017; Perlmutter et al., 2017), we examined every reason of non-working in association with opioid misuse. Interestingly, our findings showed lower odds of opioid misuse among adults who were in school/training or retired. Involvement in endeavors of post-secondary education and vocational training in adulthood may indicate higher socioeconomic status, and research has demonstrated compelling associations of socioeconomic disparities with opioid overdose deaths (Marshall et al., 2019). The reason why retired individuals had lower odds of opioid misuse was potentially due to selection of labor participation, in other words, they were healthy enough to work until retirement age without becoming disabled or unemployed. This constellation of factors common to the non-working population is also indicative of the healthy worker survivor effect, wherein individuals with health challenges are less able to work and hence have lower rates of participation in the labor force (Brown et al., 2017).

More limitations of this study need to be addressed. The cross-sectional nature of the data precludes assessments of causality, which is a major limitation of this study. Job characteristics such as physical demands may also modify the health effects of both unemployment and working hours. Additionally, survey data regarding sensitive information such as substance dependence may be impacted by factors such as social desirability bias. Participants may have underreported socially undesirable behaviors – especially in the case of heroin use (Reuter et al., 2021) – potentially leading to an overall downward bias in the results. However, these limitations were, to some extent, balanced by the major merit of this study, which is based on the large, nationally representative, population-based sample of U.S. adults, increasing the robustness of employment status assessment and the generalizability of

the findings.

In conclusion, our analyses suggested unemployment was significantly associated with opioid misuse in the U.S. The results of this study emphasize the importance of employment-related factors as social determinants of health in the context of the opioid crisis. The effects of the ongoing opioid epidemic are severe, and government and employer policy interventions may benefit from targeting stable employment as a key public health outcome.

Contributors

JL conceived the research question and study design. TAM prepared the data. TAM and JL conducted the statistical analyses and wrote the draft of the manuscript. GS and RVK contributed to the line of argumentation and revision of the manuscript. All authors approved the final manuscript.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2022.04.001.

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Appendix

We conducted a series of sensitivity analyses to examine the robust associations of employment status with opioid misuse, including separate adjustment for physical health conditions and depression, reference group as 30-40 hours/week, stratified analyses among working people and non-working people, restricted sample among people aged 18-64 (see Supplementary Tables 1-4). In general, the pattern of associations was unchanged.

Supplementary Table 1. Associations of Employment Status with Opioid Misuse (ORs and 95% CIs), Reviewing Physical Health Conditions and Depression in Separate Models

Employment status	Model I	Model II	Model III	Model IV	Model V
Working <35 hours/week (N=6,609, 13.84%)	1.03 (0.84, 1.53)	0.92 (0.79, 1.07)	0.92 (0.79, 1.08)	0.87 (0.74, 1.02)	0.85 (0.72, 1.34)
Working 35-40 hours/week (N=10,793, 25.38%)	1.00	1.00	1.00	1.00	1.00
Working 41-48 hours/week (N=3,121, 7.11%)	0.83 (0.59, 1.15)	0.84 (0.60, 1.17)	0.84 (0.60, 1.17)	0.84 (0.60, 1.17)	0.84 (0.60, 1.18)
Working 49-54 hours/week (N=2,216, 5.73%)	0.79 (0.58, 1.07)	0.85 (0.62, 1.16)	0.85 (0.62, 1.17)	0.85 (0.63, 1.16)	0.87 (0.63, 1.18)
Working 55+ hours/week (N=2,518, 5.80%)	0.81 (0.63, 1.05)	0.84 (0.65, 1.10)	0.85 (0.65, 1.10)	0.84 (0.65, 1.10)	0.86 (0.66, 1.13)
Has job or volunteer worker, did not work past week (N=2,250, 4.97%)	1.13 (0.84, 1.53)	1.04 (0.77, 1.41)	1.00 (0.73, 1.35)	0.99 (0.73, 1.34)	0.99 (0.72, 1.34)
Keeping house full-time (N=1,842, 3.68%)	0.99 (0.69, 1.41)	1.00 (0.70, 1.42)	0.93 (0.66, 1.31)	0.93 (0.66, 1.32)	0.91 (0.64, 1.29)
In school/training (N=1,168, 1.49%)	0.71 (0.40, 1.30)	0.54 (0.30, 0.98)	0.54 (0.30, 0.97)	0.54 (0.30, 0.98)	0.54 (0.30, 0.95)
Retired (N=3,112, 17.56%)	0.76 (0.55, 1.05)	0.68 (0.50, 0.92)	0.60 (0.44, 0.83)	0.57 (0.41, 0.80)	0.59 (0.43, 0.82)
Does not have a job, some other reason (N=3,238, 6.75%)	1.53 (1.15, 2.02)	1.26 (0.96, 1.65)	1.17 (0.89, 1.55)	1.18 (0.90, 1.56)	1.18 (0.89, 1.57)

Disabled (N=1,514, 4.81%)	2.09 (1.52, 2.88)	1.49 (1.08, 2.06)	1.37 (0.97, 1.93)	1.29 (0.91, 1.84)	1.09 (0.77, 1.56)
Unemployed/on layoff, looking for work (N=1,762, 2.88%)	1.96 (1.51, 2.54)	1.60 (1.23, 2.07)	1.46 (1.14, 1.88)	1.46 (1.14, 1.88)	1.40 (1.09, 1.79)

CI, confidence interval; OR, odds ratio.
Logistic regression, weighted.
Model I: adjustment for age, sex, and race;
Model II: Model I + additional adjustment for marital status, educational attainment, and household income;
Model III: Model II + additional adjustment for medical insurance status;
Model IV: Model III + additional adjustment for physical health conditions;
Model V: Model IV + additional adjustment for depression.

Supplementary Table 2. Associations of Employment Status with Opioid Misuse (ORs and 95% CIs), with Reference Group as 30-40 Hours/Week

Employment status	Model I	Model II	Model III	Model IV
Working <30 hours/week (N=4,713, 11.74%)	0.90 (0.73, 1.12)	0.82 (0.66, 1.01)	0.78 (0.63, 0.97)	0.76 (0.61, 0.93)
Working 30-40 hours/week (N=12,689, 31.61%)	1.00	1.00	1.00	1.00
Working 41-48 hours/week (N=3,121, 7.11%)	0.80 (0.58, 1.11)	0.83 (0.60, 1.14)	0.83 (0.60, 1.15)	0.84 (0.60, 1.17)
Working 49-54 hours/week (N=2,216, 5.73%)	0.76 (0.56, 1.04)	0.83 (0.61, 1.14)	0.84 (0.61, 1.16)	0.86 (0.63, 1.18)
Working 55+ hours/week (N=2,518, 5.80%)	0.79 (0.62, 1.00)	0.83 (0.64, 1.06)	0.84 (0.65, 1.08)	0.85 (0.66, 1.11)
Has job or volunteer worker, did not work past week (N=2,250, 4.97%)	1.09 (0.81, 1.48)	1.02 (0.75, 1.38)	0.98 (0.73, 1.33)	0.98 (0.72, 1.33)
Keeping house full-time (N=1,842, 3.68%)	0.95 (0.68, 1.34)	0.98 (0.70, 1.36)	0.92 (0.66, 1.27)	0.90 (0.65, 1.25)
In school/training (N=1,168, 1.49%)	0.69 (0.38, 1.25)	0.52 (0.29, 0.95)	0.53 (0.29, 0.95)	0.53 (0.30, 0.94)
Retired (N=3,112, 17.56%)	0.73 (0.53, 1.02)	0.66 (0.48, 0.91)	0.59 (0.43, 0.82)	0.59 (0.42, 0.81)
Does not have a job, some other reason (N=3,238, 6.75%)	1.48 (1.12, 1.95)	1.23 (0.95, 1.60)	1.16 (0.88, 1.52)	1.17 (0.89, 1.54)
Disabled (N=1,514, 4.81%)	2.02 (1.48, 2.77)	1.46 (1.07, 2.00)	1.34 (0.97, 1.87)	1.08 (0.77, 1.52)
Unemployed/on layoff, looking for work (N=1,762, 2.88%)	1.89 (1.45, 2.46)	1.56 (1.20, 2.03)	1.44 (1.11, 1.85)	1.38 (1.08, 1.77)

CI, confidence interval; OR, odds ratio.
Logistic regression, weighted.
Model I: adjustment for age, sex, and race;

Model II: Model I + additional adjustment for marital status, educational attainment, and household income;
Model III: Model II + additional adjustment for medical insurance status;
Model IV: Model III + additional adjustment for physical health conditions and depression.

Supplementary Table 3. Associations of Employment Status with Opioid Misuse (ORs and 95% CIs), with Stratified Analyses among Working People and Non-working People

		Model I	Model II	Model III	Model IV
Total sample (N=40,143)					
Employment status	Working people (N=25,257, 57.82%)	1.00	1.00	1.00	1.00
	Non-working people (14,886, 42.18%)	1.34 (1.14, 1.58)	1.14 (0.98, 1.32)	1.08 (0.93, 1.25)	1.06 (0.91, 1.23)
Working sample (N=25,257)					
Working hours/week	<35 (N=6,609 26.14%)	1.02 (0.88, 1.18)	0.93 (0.80, 1.08)	0.90 (0.65, 1.12)	0.87 (0.73, 1.03)
	35-40 (N=10,793 42.74%)	1.00	1.00	1.00	1.00
	41-48 (N=3,121 12.37%)	0.83 (0.60, 1.16)	0.85 (0.61, 1.18)	0.85 (0.61, 1.18)	0.85 (0.61, 1.18)
	49-54 (N=2,216 8.78%)	0.80 (0.59, 1.08)	0.86 (0.63, 1.17)	0.86 (0.63, 1.17)	0.87 (0.64, 1.18)
	55+ (N=2,518 9.98%)	0.82 (0.63, 1.07)	0.85 (0.65, 1.12)	0.85 (0.65, 1.12)	0.86 (0.73, 1.03)
Non-working sample (N=14,886)					
Reasons for non-working	Has job or volunteer worker, did not work past week (N=2,250, 11.79%)	1.00	1.00	1.00	1.00
	Keeping house full-time (N=1,842, 8.73%)	0.89 (0.55, 1.45)	0.98 (0.61, 1.57)	0.95 (0.59, 1.51)	0.94 (0.56, 1.52)
	In school/training (N=1,168, 3.55%)	0.68 (0.36, 1.29)	0.52 (0.27, 0.98)	0.54 (0.28, 1.04)	0.53 (0.28, 1.01)
	Retired (N=3,112, 41.67%)	0.61 (0.43, 0.86)	0.60 (0.42, 0.86)	0.55 (0.37, 0.81)	0.55 (0.36, 0.83)

	Does not have a job, some other reason (N=3,238, 16.01%)	1.37 (0.94, 1.99)	1.22 (0.84, 1.78)	1.18 (0.81, 1.72)	1.19 (0.82, 1.74)
	Disabled (N=1,514, 11.41%)	1.77 (1.20, 2.60)	1.36 (0.90, 2.05)	1.27 (0.83, 1.95)	1.01 (0.64, 1.59)
	Unemployed/on layoff, looking for work (N=1,762, 6.83 %)	1.81 (1.22, 2.69)	1.58 (1.05, 2.37)	1.49 (0.99, 2.25)	1.42 (0.94, 2.16)

CI, confidence interval; OR, odds ratio.
Logistic regression, weighted.
Model I: adjustment for age, sex, and race;
Model II: Model I + additional adjustment for marital status, educational attainment, and household income;
Model III: Model II + additional adjustment for medical insurance status;
Model IV: Model III + additional adjustment for physical health conditions and depression.

Supplementary Table 4. Associations of Employment Status with Opioid Misuse (ORs and 95% CIs), among People Aged 18-64

Employment status	Model I	Model II	Model III	Model IV
Working <35 hours/week (N=6,208, 17.11%)	1.08 (0.92, 1.26)	0.97 (0.83, 1.13)	0.91 (0.77, 1.07)	0.88 (0.74, 1.03)
Working 35-40 hours/week (N=10,555, 29.09%)	1.00	1.00	1.00	1.00
Working 41-48 hours/week (N=3,063, 8.44%)	0.82 (0.58, 1.14)	0.83 (0.59, 1.16)	0.83 (0.60, 1.16)	0.83 (0.60, 1.17)
Working 49-54 hours/week (N=2,169, 5.98%)	0.81 (0.59, 1.10)	0.87 (0.64, 1.19)	0.87 (0.64, 1.20)	0.89 (0.65, 1.21)
Working 55+ hours/week (N=2,478, 6.83%)	0.82 (0.63, 1.05)	0.85 (0.65, 1.11)	0.85 (0.65, 1.11)	0.86 (0.65, 1.13)
Has job or volunteer worker, did not work past week (N=2,114, 5.83%)	1.26 (0.93, 1.69)	1.16 (0.86, 1.56)	1.09 (0.81, 1.48)	1.09 (0.81, 1.48)
Keeping house full-time (N=1,819, 5.01%)	0.99 (0.69, 1.42)	1.01 (0.71, 1.44)	0.90 (0.64, 1.27)	0.89 (0.63, 1.26)
In school/training (N=1,166, 3.21%)	0.73 (0.40, 1.33)	0.56 (0.31, 1.02)	0.56 (0.31, 1.02)	0.56 (0.32, 1.00)
Retired (N=518, 1.43%)	1.13 (0.60, 2.14)	1.06 (0.56, 1.99)	0.98 (0.52, 1.82)	0.92 (0.48, 1.76)
Does not have a job, some other reason (N=3,077, 8.48%)	1.51 (1.12, 2.02)	1.24 (0.94, 1.64)	1.12 (0.95, 1.33)	1.13 (0.84, 1.51)
Disabled (N=1,368, 3.77%)	1.81 (1.34, 2.45)	1.27 (0.92, 1.75)	1.05 (0.74, 1.48)	0.84 (0.59, 1.19)
Unemployed/on layoff, looking for work (N=1,746, 4.81%)	2.01 (1.53, 2.62)	1.63 (1.25, 2.14)	1.44 (1.11, 1.86)	1.38 (1.07, 1.78)

CI, confidence interval; OR, odds ratio.
Logistic regression, weighted.
Model I: adjustment for age, sex, and race;
Model II: Model I + additional adjustment for marital status, educational attainment, and household income;

Model III: Model II + additional adjustment for medical insurance status;
Model IV: Model III + additional adjustment for physical health conditions and depression.