

Examining the Relationship Among Opioid Misuse, Disability, and Employment

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Abstract

Background: Epidemiological data indicates that the rise of the opioid epidemic coincided with the aging of the United States population and changes in labor force participation, especially among older adults. Past research has found that around 40% of all disabled Medicare beneficiaries under the age of 65 are prescribed opioids by a doctor, and that it is estimated that up to one in five may engage in daily use. Persons with disabilities face barriers for returning to work, which are compounded by risk factors from their opioid use. **Methods:** Using a population health sample of U.S. adults (n=38,282) from the National Survey on Drug Use and Health, this study investigated the associations of non-medical prescription opioid use, psychological distress, mental health functional impairment, activities of daily living limitations, and self-rated health with unemployment due to disability. Subgroup analyses were conducted to examine similarities and differences for persons at high risk for disability compared to those not at high risk. Generalized structural equation modeling (GSEM) was conducted to examine the direct and indirect effects of opioid misuse on unemployment due to disability, with 1) psychological distress, 2) mental health functional impairment, 3) poor self-rated health, and 4) activities of daily living (ADL) limitations as mediating variables. **Results:** Four point six percent of the study sample reported non-medical prescription opioid use (NMPOU) within the past year, and more NMPOU users were unemployed due to disability than non-users (Users: 7%, Non-users, 5%, $p < .05$). Findings revealed that there was no direct effect from NMPOU to unemployment due to disability, when controlling for all other variables (OR=1.09, $p=0.66$, 95% CI: 0.74, 1.61). Although NMPOU was more prevalent for those at high risk for disability, no subgroup differences in the relationship of NMPOU to unemployment due to disability was observed for those at high risk and those not at risk for disability. Indirect effects of NMPOU to unemployment due to disability were observed through 1) Poor Health, 2) ADL limitations, 3) World Health Organization Disability Assessment Schedule (WHODAS), and 4) Kessler Psychological Distress Scale (K6) as mediating variables. **Discussion and Implications:** As the opioid epidemic continues, it is crucial that systems of care identify opportunities for collaboration and innovation to help persons who are at risk for problems related to opioid use. Understanding these pathways are vital for developing prevention and intervention programs aimed at decreasing the burden of new disabled beneficiaries, and assisting current disabled beneficiaries to successfully transition back into the workforce.

Background

In 2017, the U.S. Department of Health and Human Services declared the opioid crisis a public health emergency (U.S. Department of Health and Human Services [HHS], Office of the Secretary, 2017). Sales of prescription opioids increased 400 percent from 1999 to 2014 (Centers for Disease Control and Prevention [CDC], 2017) and, although the amount of opioid pain relievers prescribed peaked in 2010 (Guy et al., 2017), the prevalence of opioid use disorders, frequency of use, and related mortalities have continued to rise (Han, Compton, Jones, & Cai, 2015). In 2015, 91.8 million U.S. adults were prescribed an opioid pain reliever, and 11.5 million misused them and 1.9 million had an opioid-use disorder (Han et al., 2017). Findings from epidemiological data (CDC, 2016, 2017) indicate that the rise of the opioid epidemic coincided with the aging of the “baby boom” generation who were amidst their most disability-prone years from 1990 and 2011 (Purcell, 2016; U.S. Social Security Administration [SSA], 2018). As the population ages, the proportion of persons with disabilities increases (Kraus, 2017) resulting in more people applying for and receiving Social Security disability benefits (SSA, 2017a). Persons 35 to 49 years old represent an important segment of the labor market, and they are the most likely age cohort to be prescribed opioids (Rasu & Knell, 2017). Those with disabilities face barriers in the process of returning to work, which are compounded by risk factors from their opioid use (Wyman, 2017).

Although the opioid epidemic has been recognized as a public health emergency, there continues to be a dearth of knowledge on the impact of prescription opioid use on disability, rehabilitation, and work for Social Security disability beneficiaries. Past research has found that around 40% of all disabled Medicare beneficiaries under the age of 65 are prescribed opioids by a doctor, and that it is estimated that up to one in five may engage in daily use (Morden et al., 2014). Although additional state-controlled substance laws have been enacted since 2006, overall, they have been ineffective in reducing prevalence of chronic use in this population (Meara et al., 2016).

Previous research has found that substance use is common, and that chronic use or dependence is associated with lower rates of labor force participation (Bush & Lipari, 2015; French, Roebuck, & Alexander, 2001). Krueger (2017) investigated the influence of the opioid epidemic and found that among 25 to 54 year old men who are not in the labor force, approximately half have a serious health condition, half take pain medication on a daily basis, and the majority take prescription opioids. Pain-related issues have been identified as a barrier for returning to work among disabled beneficiaries (Patel, Greasley, & Watson, 2007). A systematic literature review found workers with musculoskeletal disorders who were prescribed opioids within 12 weeks of onset are associated with prolonged work disability (Carnide et al., 2017). While prescription opioids continue to be commonly used to treat many types of pain, particularly among persons with disabilities (Volkow & McLellan, 2016), the effectiveness of long-term opioid therapy has mixed results (Ballantyne et al., 2016; Reinecke et al., 2014). Psychosocial supports and services are also needed for this population to successfully achieve recovery (Dugosh et al., 2016).

Previous research has found that persons with disabilities experience higher rates of serious psychological distress (SPD) than those without disabilities (Okoro & Dhingra, 2014). Adults with disabilities are many times more likely to experience SPD compared to persons without disabilities (Okoro et al., 2009). Subsequent studies supported these findings; for example, adult cardiovascular disease survivors with SPD had worse disability status than those

without SPD (Fan, Strine, Jiles, Berry, & Mokdad, 2009). Adults with disabilities were also found to have a higher prevalence of mild to moderate and severe psychological distress than those without disabilities (Okoro & Dhingra, 2014). Severe psychological distress, serious mental illness, and the co-morbidity of chronic medical conditions were found to be related, although no clear causal pathway was identified (Swartz & Jantz, 2014). Taken together, the existing research provides strong evidence that SPD is associated with disability.

It is well known that persons with disabilities have lower rates of employment and greater workforce nonparticipation than persons without disabilities. Research has found that higher psychological distress is associated with an increased use of disability benefits for somatic or psychiatric conditions (Rai et al., 2014). Additionally, unemployed status was associated with frequent mental distress among persons with disabilities (Okoro, Strine, McGuire, Balluz, & Mokdad, 2007). Consequently, persons with serious mental disorders (e.g. serious and persistent mental illness) experience significantly less earnings than their non-disabled peers (Kessler et al., 2008), which creates increased reliance on benefit and entitlement programs (i.e. SSI/SSDI). Substance misuse and addiction has been found to be associated with increased psychological distress in nationally representative samples (Clements-Nolle, Larson, Buttar, & Dermid-Gray, 2017; Lund et al., 2013; Moller, Tait, & Byrne, 2012; Tenorio & Lo, 2011).

Statement of Research Problem and Purpose

There is a critical need to understand how the opioid epidemic impacts disability, mental health, and outcomes related to chronic medical conditions that influence workforce participation. Past research has suggested that opioid use is associated with poorer physical functioning (Rogers, Kemp, McLachlan, & Blyth, 2013), difficulty performing tasks of daily living (Joseph et al., 2016), higher rates of depression (Goesling et al., 2015; Smith et al., 2015), and higher psychological distress (Rogers, Kemp, McLachlan, & Blyth, 2013; Smith et al., 2015). These factors can lead to chronic medical conditions, and can have serious implications on long-term employment outcomes and dependence on Social Security Disability Insurance (SSDI) or Supplemental Security Income (SSI) disability benefits (Brede, Mayer, & Gatchel, 2012; Kidner, Mayer, Gatchel, 2009).

To explicate the causal linkages from opioid misuse to disability, mental health, and outcomes related to chronic medical conditions that influence workforce participation, this project will address the following research question: What is the relationship among opioid misuse, disability status, and employment? My study aims and hypotheses are:

- Aim 1:** Analyze the relationship of opioid misuse with disability status and employment.
- a. Test the association of opioid misuse with unemployment due to disability
 - H1a. Opioid misuse will be associated with increased odds for unemployment due to disability
 - b. Test the association of opioid misuse with poor overall health
 - H1b. Opioid misuse will be associated with increased odds for poor self-rated health
 - c. Test the association of opioid misuse with mental health symptoms
 - H1c. Opioid misuse will be associated with increased mental health symptoms
 - d. Test the association of opioid misuse with activities of daily living limitations

H1d. Opioid misuse will be associated with increased odds for activities of daily living limitations

Aim 2: Examine the similarities and differences in the relationship of opioid misuse to employment for disabled and non-disabled persons.

a. Examine subgroup differences in the association of opioid misuse with unemployment due to disability for those in poor health versus not in poor health

H2a. For persons in poor health, the associated odds of opioid misuse with unemployment due to disability will be greater than those not in poor health

b. Examine subgroup differences in the association of opioid misuse with unemployment due to disability for those with serious mental health symptoms versus those without

H2b. For persons with serious mental health symptoms, the associated odds of opioid misuse with unemployment due to disability will be greater than those without serious mental health symptoms

c. Examine subgroup differences in the association of opioid misuse with unemployment due to disability for those with activities of daily living limitations versus those without

H2c. For persons with activities of daily living limitations, the associated odds of opioid misuse with unemployment due to disability will be greater than those without activities of daily living limitations

Aim 3: Investigate the mediating relationship of psychological distress with opioid misuse and employment.

a. Examine the role of psychological distress as a mediator in the relationship of opioid misuse to unemployment due to disability

H3a. Opioid misuse will have an indirect effect on unemployment due to disability through psychological distress as a significant mediator

b. Examine the role of poor overall health as a mediator in the relationship of opioid misuse to unemployment due to disability

H3b. Opioid misuse will have an indirect effect on unemployment due to disability through poor health as a significant mediator

c. Examine the role of mental health impairment as a mediator in the relationship of opioid misuse to unemployment due to disability

H3c. Opioid misuse will have an indirect effect on unemployment due to disability through mental health impairment as a significant mediator

d. Examine the role of activities of daily living limitations as a mediator in the relationship of opioid misuse to unemployment due to disability

H3c. Opioid misuse will have an indirect effect on unemployment due to disability through activities of daily living limitations as a significant mediator

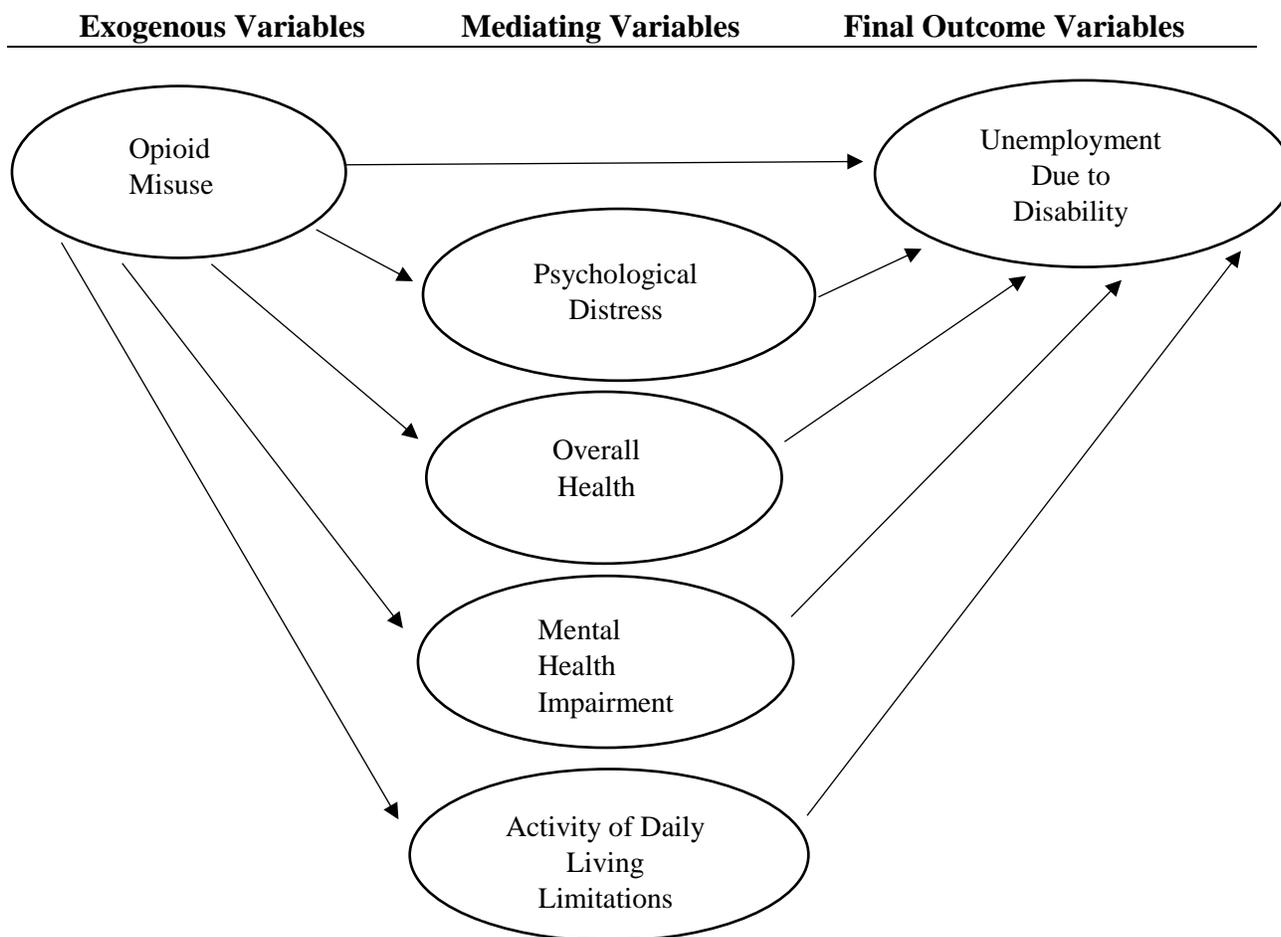


Figure 1. Conceptual Model of Mediating Variables in the Relationship of Opioid Misuse and Unemployment Due to Disability

Methods

Sample

Analysis was conducted on the 2015 National Survey of Drug Use and Health (NSDUH) Public-Use File (Center for Behavioral Health Statistics and Quality, 2016), which is comprised of a non-institutionalized, community-based population aged 12 years and older in the United States. The NSDUH survey was collected by the Substance Abuse and Mental Health Services Administration (SAMHSA) using an independent, multi-stage area probability sampling within each state and the District of Columbia using a coordinated design. States were used as a first level of stratification, and was further stratified into state sampling regions (SSRs), where area segments were selected based on census tracts and census block groups. Dwelling units (DU) were randomly selected within area segments, where up to two residents 12 years and older were selected in order to provide the necessary sample sizes for population age groupings (25% for 12 to 17, 25% for 18 to 25, 15% for 26 to 34, 20% for 35 to 49, 15% for 50 and older).

The NSDUH captured the use of tobacco products, alcohol, illicit drugs (including non-medical use of prescription drugs) and mental health. Analysis from this data is used by federal, state, and local government agencies to study substance use problems and trends, assess the need

for treatment services, and develop funding strategies and prevention measures. Data were collected using computer assisted personal interviewing (CAPI) and audio computer-assisted self-interviewing (ACASI). CAPI was used by the field interviewer for screening and to collect and record demographic data. The ACASI portion of the interview was used for more sensitive questions regarding substance use and mental health, where respondents read questions on a computer screen or listen to questions on headphones, and record their answers without the interviewer knowing their responses. Missing values were imputed in the dataset using predictive mean neighborhoods (PMN), a combination of model-assisted imputation methodology and a random nearest neighbor hot-deck procedure. Sampling design weights were created to account for non-response, demographics of the state of residence, poststratification steps, and calibrated based on the 2010 decennial census. Data editing, statistical adjustments for nonresponse, close monitoring and periodic retraining of interviewers, and improvements in various quality control procedures were employed to increase the accuracy of survey estimates. The full sample in the Public-Use File included 68,073 persons 12 years and older. For the purposes of this analysis, the final sample included only participants who were adults 18 years and older, with 38,282 respondents.

Independent Variable of Interest

Non-medical prescription opioid use (NMPOU) captured ‘opioid misuse’ and was defined as any self-reported use of prescription pain relievers in the past year which was not directed by a doctor. Respondents were first given the instruction, “When you answer these questions, please think only about your drug use in any way a doctor did not direct you to use it, including: (1) using it without a prescription of your own, (2) using it in greater amounts, more often, or longer than you were told to take it, and (3) using it in any other way a doctor did not direct you to use it.” They were then asked the question, “Have you ever, even once, used prescription pain relievers in any way a doctor did not direct you to use it?” Of those who answered yes, a follow-up question was asked, “How long has it been since you last used prescription pain relievers?” A value of ‘1’ was coded for persons who used prescription pain relievers at least once within the past 12 months, and ‘0’ for use more than 12 months ago or never used.

Final Outcome Variable

Unemployed due to disability was defined as not working at a job within the past week due to being disabled for work. Respondents were asked the question “Did you work at a job or business at any time last week? By last week, I mean the week beginning on Sunday, [from date of interview] and ending on Saturday, [from date of interview].” Of those who answered no, they were then asked the question “Even though you did not work at any time last week, did you have a job or business?” Of those who answered no, a follow-up question was asked, “Which one of these reasons best describes why you did not have a job or business last week? 1) Looking for work, 2) On layoff and not looking for work, 3) Keeping house or caring for children full time, 4) Going to school/training, 5) Retired, 6) Disabled for work, 7) Didn’t want a job, or 8) Some other reason.” A value of ‘1’ was coded for persons who did not work at a job within the past week due to being disabled for work, and ‘0’ for all other responses.

Mediating Variables

Psychological distress. Psychological distress was measured using the Kessler Psychological Distress Scale (K6) (Kessler et al., 2002), which was developed to measure the prevalence of mental disorder symptoms in population health and epidemiological surveys. This scale has been found to have high discriminant validity in distinguishing between persons who are likely to meet the criteria for mental illness, versus those who do not meet the clinical threshold for receiving a diagnosis (Croft, Mokdad, Power, Greenlund, & Giles, 2009; Kessler et al., 2002). In this study, the six items of the scale were summed and had a range of 0-24, with higher scores reflecting higher psychological distress. Reliability analysis revealed that the scale had good internal consistency in this analysis (Cronbach's $\alpha = 0.89$). Exploratory factor analysis using principal axis factoring revealed good validity in the K6 in capturing psychological distress as a single-factor latent construct, with strong factor loadings ranging from 0.65 to 0.82 for all six items.

Mental health functional impairment. Mental health functional impairment was constructed from a modified and reduced version of the World Health Organization Disability Assessment Schedule (WHODAS), which is a scale used to measure functional impairment that consists of a series of items that are used assessing disturbances in social adjustment and behavior (Center for Behavioral Health Statistics and Quality, 2016; Novak, Colpe, Barker, & Gfoerer, 2010; Rehm et al., 1999). Respondents answered questions about their functional impairments (remembering, concentrating, going out of the house on your own, dealing with people you don't know well, participating in social activities, taking care of household responsibilities, taking care of daily work/school responsibilities, and getting your daily work done as quickly as needed) due to emotions, nerves, or mental health problems. A value of '3' was assigned for each of the daily activities that a respondent indicated having "severe" difficulty performing, or if the respondent indicated not performing the activity due to problems with emotions, nerves, or mental health. A value of '2' was assigned for each of the daily activities that a respondent indicated having "moderate" difficulty performing, and a value of 1 was assigned for "mild" difficulty. A value of '0' was assigned for all other responses and nonresponses for each activity. These assigned values were summed to calculate a total score for WHODAS which ranged from 0 to 24 (Center for Behavioral Health Statistics and Quality, 2016). Reliability analysis revealed that the scale had good internal consistency in this analysis (Cronbach's $\alpha = 0.93$). Exploratory factor analysis using principal axis factoring revealed good validity in the WHODAS in capturing mental health functional impairment as a single-factor latent construct, with strong factor loadings ranging from 0.72 to 0.83 for all eight items.

Poor self-rated health. Poor self-rated health was constructed from a single item question, where respondents were asked, "This question is about your overall health. Will you say your health is generally excellent, very good, good, fair, or poor?" A value of '1' was coded for those who responded "fair" or "poor," and a value of '0' was coded for those who responded "excellent," "very good," or "good." Although this question has limitations, it is widely used in population health studies, and has shown good concurrent validity with its associations to other measures of morbidity, disability, and utilization of services (Idler & Benyamini, 1999; Idler, Russell, & Davis, 2000; Mossey & Shapiro, 1982).

Activity of daily living limitations. Activity of daily living limitations was constructed from 6 items based on the Washington Group general measure of disability, designed to be used in population health surveys to identify persons with a disability in a culturally neutral and standardized way (Madans et al., 2004; Washington Group on Disability Statistics, 2018).

Respondents were asked the following questions 1) Are you deaf or do you have serious difficulty hearing, 2) Are you blind or do you have serious difficulty seeing, even when wearing glasses, 3) Because of a physical, mental or emotional condition, do you have serious difficulty concentrating, remembering, or making decision, 4) Do you have serious difficulty walking or climbing stairs, 5) Do you have difficulty dressing or bathing, and 6) Because of a physical, mental or emotional condition, do you have difficulty doing errands alone such as visiting a doctor's office or shopping. For all questions, a value of '1' was coded for those who responded yes, and a value of '0' was coded for those who answered no. The six items were summed and had a range of 0 to 6, and dichotomized to identify persons with none versus those with 1 or more activity limitations.

Socio-demographics Variables

Race Categories. Categorical variables for race were created for each major race group, in order to capture racial differences. Non-Hispanic White was used as the reference group and code '0' for each race group variable. Separate categorical variables for race was created, for Non-Hispanic Black/African Americans, Non-Hispanic Asians, and Hispanic, where each group was coded as '1.'

Age. The age variable was coded to reflect stages in the life course, using the following ranges: 18 – 25 years old was coded '1', 26-34 years old was coded '2', 35-49 years old was coded '3', 50-64 years old was coded '4', and 65 or older was coded '5.'

Gender. A categorical variable was created for gender. Male gender was set as the reference group. Male gender was coded '0' and female gender was coded '1.'

Marital status. Marital status is defined as being currently married versus not married. A categorical variable was created for marital status, where married was coded '1' and widowed, divorced/separated, or never married was coded '0.'

Poverty status. Poverty status is defined as persons living up to two times the federal poverty threshold. Being in poverty was coded as '1,' and not in poverty was coded as '0.'

Education. Educational status was defined as having a college degree or higher. Respondents who were college graduates or above were coded as '1,' and those without a college degree were coded '0.'

Regionality. Regionality was defined as residence in large metro, small metro, or non-metro areas. Metro status was determined for counties using Core Based Statistical Area (CBSA) classification from the Office of Management and Budget (OMB) (Center for Behavioral Health Statistics and Quality, 2016). Categorical variables were created for small metro and non-metro areas, both coded as '1,' and residence in a large metro area was coded as '0' for the reference group.

Health insurance. Categorical variables for Medicaid, Medicare and private insurance were created to capture differences in health insurance coverage. Each variable was coded '1,' for persons with this type of coverage, and '0' for those not enrolled in the plan.

Other Substance Use

Binge drinking. Binge drinking alcohol is a known risk factor for mental health problems (Bellos et al., 2013; Powers, Duffy, Loxton, & Burns, 2016), and is different from light to moderate drinking, which may be protective (Alati et al., 2007; Power, Rodgers, & Hope, 1998; Skogen Harvey, Henderson, Stordakm & Myklettun, 2009). Binge drinking is defined as having four or more alcoholic drinks on the same occasion at least once in the last 30 days.

Respondents were asked, “During the past 30 days, that is [since date of interview], on how many days did you have [4 or more for women]/[5 or more for men] drinks in the same occasion? By ‘occasion,’ we mean at the same time or within a couple of hours of each other.” Affirmative responses of 1-30 were recoded as ‘1’ to capture recent binge drinking in the past month, and a value of ‘0’ was coded for no binge drinking in the past month.

Marijuana and hashish use. Marijuana and hashish use was defined as use at least once within the past 12 months. Findings on the short- and long-term harms and benefits on use of marijuana and its derivatives are debated, and its current legal status is inconsistent among states, often conflicting with federal laws (National Academies of Sciences, Engineering, and Medicine, 2017). In this study, respondents were asked the question, “How long has it been since you last used marijuana or hashish?” A value of ‘1’ was coded to capture use of marijuana or hashish within the past 12 months, and ‘0’ for use more than 12 months ago or never used.

Heroin, cocaine, crack cocaine, methamphetamine, inhalant and hallucinogen use. The use of heroin, cocaine, crack cocaine, methamphetamines, inhalants, and hallucinogens were captured separately, and defined as the use of substance within the past 12 months. The short- and long-term harmful effects in the use of heroin (Bewley, Ben-Arie, James, & Marks, 1968; Centers for Disease Control and Prevention, 2016; Grella & Lovinger, 2012), cocaine (Goldstein, DesLauriers, Burda, & Johnson-Arbor, 2009; Levesque et al., 2016; Minnes et al., 2012), crack cocaine (Hoff et al., 1996; Smart, 1991), methamphetamines (Scott et al., 2007; Sommers, Baskin, & Baskin-Sommers, 2006) and inhalants (Cairney et al., 2013; Crossin, Cairney, Lawrence, & Duncan, 2017) are well documented. The long-term health effects for the use of hallucinogens are not well-understood (National Institute on Drug Abuse, 2015). With the exception of inhalants, which are commonly available (i.e. household products such as gasoline, aerosol sprays, paint/solvents, cleaners, etc.), all other substances included in the analysis are illegal under federal and state laws. Respondents were prompted for each substance with the instruction, “The next questions are about [heroin, cocaine, crack cocaine, methamphetamine, inhalants, or hallucinogens].” Of those who responded that they have used the substance at least once in their lifetime, they were asked, “How long has it been since you last used [heroin, cocaine, crack cocaine, methamphetamines, inhalants, or hallucinogens]?” Use of heroin, cocaine, crack cocaine, methamphetamines, inhalants, or hallucinogens were coded as separate variables for this analysis, with a value of ‘1’ for use within the past 12 months, and ‘0’ for use more than 12 months ago or never used.

Non-medical prescription stimulant, tranquilizer and sedative use. The use of prescription stimulants, tranquilizers, and sedatives were captured separately. These substances can be prescribed for medical purposes, or misused without a prescription, used excessively, or not as directed by a doctor. Misuse of these substances can lead to addiction, dependence, and deleterious long-term effects (Becker, Fiellin, & Desai, 2007; Coben et al., 2010; Weyandt et al., 2009). Respondents were first prompted with the instruction, “The next question asks about using prescription [stimulants, tranquilizers, or sedatives] in any way a doctor did not direct you to use them.” Respondents were asked to consider use of the substance without a prescription, using it in greater amounts, more often, or longer than instructed, and using it in any other way not directed by a doctor. They were then asked the question, “Have you ever, even once, used any prescription [stimulants, tranquilizers, or sedatives] in any way a doctor did not direct you to use it?” Of respondents who answered yes, a follow-up question asked, “How long has it been since you last used prescription [stimulants, tranquilizers, sedatives]?” Use of stimulants, tranquilizers, and sedatives were coded as separate variables for this analysis, with a value of ‘1’

coded for use within the past 12 months, and ‘0’ for used more than 12 months ago or never used.

Other Mental Health Variables

Depressive episodes. Two variables were included in the analysis for depressive episodes. The first variable captured having a depressive episode in one’s lifetime; the second variable captured having a depressive episode in the past year. A depressive episode was defined as meeting five of the nine criteria from the *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition (DSM-IV)*, which include depressed mood, diminished interest or pleasure in everyday activities, significant weight loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive or inappropriate guilt, diminished ability to think or concentrate, and recurrent thoughts of death (American Psychiatric Association, 2000; Center for Behavioral Health Statistics and Quality, 2016). Both variables were coded as ‘1’ for presence of an episode, and ‘0’ for none.

Suicidality. Two variables were included in the analysis to measure suicidality. The first variable, suicidal thoughts, was defined as having serious thoughts of killing oneself in the past 12 months. Respondents were asked, “The next few questions are about thoughts of suicide. At any time in the past 12 months, that is from [date of interview] up to and including today, did you seriously think about trying to kill yourself?” Past-year suicide attempt was defined as having made an attempt to take one’s own life in the past 12 months. Respondents were asked, “During the past 12 months, did you try to kill yourself?” Both variables were coded as ‘1’ for yes, and ‘0’ for no. Past research has found that suicidal thoughts and suicidal attempts are highly correlated with mental health problems (Han, Gfroerer, McKeon, & Compton, 2015).

Data Analysis Plan

Descriptive analysis was conducted to examine the characteristics of non-medical prescription opioid users and non-users. Stata 15.0 was used for all analyses in this study (StataCorp, 2017).

For Aim 1a, logistic regression analysis was conducted to examine the associations of non-medical prescription opioid use (NMPOU) and unemployment due to disability. For Aim1b, logistic regression analysis was conducted to examine the associations of NMPOU and overall health, measured by poor self-rated health. For Aim1c, OLS regression was conducted to examine the associations of NMPOU with mental health symptoms. Two separate analyses were conducted for Aim 1c., for mental health functional impairment (WHODAS) and psychological distress (K6) as dependent variables. For Aim 1d., logistic regression analysis was conducted to examine the associations of NMPOU and activities of daily living limitations, measured by the Washington Group disability measure. Analysis weights were used for all analyses, and were used to compute unbiased, design-based estimates, to account for non-responders (Center for Behavioral Health Statistics and Quality, 2016).

For Aim 2a, logistic regression analysis was conducted to examine the associations of NMPOU and unemployment due to disability, for those in poor health versus those not in poor health. For Aim 2b, logistic regression analysis was conducted to examine the associations of NMPOU and unemployment due to disability, for those with serious mental health symptoms versus those without. Two separate analyses were conducted for Aim 2b., where subgroups were created to identify those with serious mental health symptoms versus those without, using cut

points from two scales (WHODAS & K6). For Aim 2c., logistic regression analysis was conducted to examine the associations of NMPO and unemployment due to disability, for those with at least 1 ADL limitation versus those with none.

For Aim 3, a weighted generalized structural equation model (GSEM) was conducted to examine the direct and indirect effects of NMPOU on unemployment due to disability, with 1) psychological distress, 2) mental health functional impairment, 3) poor self-rated health, and 4) activities of daily living limitation as mediating variables. A generalized model was used for estimation to allow for categorical and continuous variables in the analysis.

Results

The independent variable of interest in this analysis was non-medical prescription opioid use (NMPOU). The analysis included 2,271 non-medical prescription opioid users and 36,011 non-users. Once survey weights were applied, 4.6% of the study sample reported non-medical prescription opioid use in the past year. From descriptive statistics in Table 1, more non-medical prescription opioid users were unemployed due to disability compared to non-users (Users: 7%; Non-users: 5%, $p < .05$). Average scores for psychological distress as measured by the K6 were statistically higher for users compared to non-users (Users: 6.77; Non-users: 3.52, $p < .001$). Average scores for mental health functional impairment as measured by the WHODAS were also statistically higher for users compared to non-users (Users: 6.67; Non-users: 3.22, $p < .001$). More users had activity limitation than non-users (Users: 27%; Non-users: 19%, $p < .001$), and users also had a higher percentage of poor self-rated health than non-users (Users: 18%; Non-users: 13%, $p < .01$). Socio-demographically, users were fairly similar in race characteristics compared to non-users, although there were 4% more Whites in the non-medical prescription opioid user group (71%), compared to the non-user group (67%). There were statistically similar percentages of Blacks and Hispanics in both subgroups, and smaller percentages of Asians in the non-medical prescription opioid use group. Non-medical prescription opioid users were skewed towards younger age groups, where 50% of users were between the age of 18-34. More men were found in the non-medical prescription opioid user group (56%), compared to non-users (48%). Fewer users were married (Users: 34%; Non-users: 55%, $p < .001$), college graduates (Users: 21%; Non-users: 32%, $p < .001$), and more lived in poverty (43%), compared to non-users (34%). Statistically similar percentages of users and non-users resided in large metro (55%), small metro (30-31%) and non-metro (14-15%) areas. Overall, non-medical prescription opioid users also engaged in greater use of other substances (see Table 1), had higher rates of past year (Users: 17%; Non-users: 12%, $p < .001$) and lifetime (Users: 28%; Non-users: 12%, $p < .001$) depressive episodes and suicidal thoughts (Users: 13%; Non-users: 3%, $p < .001$) and attempts (Users: 2%; Non-users: $< 1\%$, $p < .001$).

Results for Aim 1

Findings indicate the relationship between non-medical prescription opioid use (NMPOU) and unemployment due to disability was not statistically observed (OR=1.09, $p=0.66$, 95% CI: 0.74, 1.61) (see Table 2). The hypothesis that opioid misuse was associated with increased odds for unemployment due to disability was not supported (H1a). In terms of overall health, those who engage in NMPOU were 28% more likely to report poor self-rated health (OR=1.28, $p < .05$, 95% CI: 1.02, 1.62) (see Table 5). The hypothesis that opioid misuse was associated with increased odds for overall health was supported (H1b). NMPOU was associated

with an increase in mental health symptoms, measured by K6 and WHODAS. NMPOU was statistically significantly associated with higher psychological distress ($b=0.50$, 95% CI: 0.25, 0.75, $\beta=0.02$, $p<0.001$) (see Table 3) and mental health functional impairment ($b=0.52$, 95% CI: 0.21, 0.83, $\beta=0.02$, $p<0.01$) (see Table 4). The hypothesis that opioid misuse was associated with mental health symptoms was supported (H1c). The associated odds of NMPOU with activities of daily living limitations were not statistically observed (OR=1.03, $p=0.82$, 95% CI: 0.83, 1.27) (see Table 6). The hypothesis that opioid misuse was associated with activities of daily living limitations was not supported (H1d).

Results for Aim 2

Findings indicate that NMPOU was not statistically significantly associated with unemployment due to disability (see H1a). Subgroup analyses revealed no differences in the relationship of NMPOU to unemployment due to disability, for those in poor health versus those who are not (H2a), for those with serious mental health symptoms versus those without (H2b), and for those with at least 1 limitation in activities of daily living versus those with none (H2c) (see Table 7). Prevalence of NMPOU was higher for those in poor health compared to those not in poor health (Poor health: 6%; Not in poor health: 4%, $p<.001$), for those with serious mental health symptoms (K6) compared to those without (With serious symptoms: 14%; Without serious symptoms: 4%, $p<.001$), for those with serious mental health impairment (WHODAS) compared to those without (With impairment: 12%; Without impairment: 4%, $p<.001$), and those with 1 or more activities of daily living limitations compared to those with none (With limitations: 6%; Without limitation: 4%, $p<.001$).

Results for Aim 3

Direct effects of opioid misuse. Findings indicate that direct effects were observed in the relationship of NMPOU with higher psychological distress ($b=0.89$, 95% CI: 0.56, 1.21, $\beta=0.03$, $p<.001$), increased mental health functional impairment ($b=0.59$, 95% CI: 0.29, 0.90, $\beta=0.02$, $p<.001$), and higher associated odds with poor self-rated health (OR=1.60, $p<0.001$, 95% CI: 1.30, 1.97) (see Figure 2 & Table 7).

Indirect effects of opioid misuse and unemployment due to disability. Findings indicate that indirect effects were observed for NMPOU with unemployment due to disability, through the following mediators: 1) Poor Health, 2) ADL limitations, 3) WHODAS, and 4) K6. Analyses conducted using generalized structural equation modeling revealed the following paths:

Indirect Effects through Poor Health

1. NMPOU → Poor Health → Unemployment Due to Disability
2. NMPOU → Poor Health → ADL → Unemployment Due to Disability
3. NMPOU → Poor Health → ADL → WHODAS → Unemployment Due to Disability
4. NMPOU → Poor Health → ADL → K6 → WHODAS → Unemployment Due to Disability
5. NMPOU → Poor Health → WHODAS → Unemployment Due to Disability
6. NMPOU → Poor Health → K6 → WHODAS → Unemployment Due to Disability

Indirect Effects through Mental Health

1. NMPOU → WHODAS to Unemployment Due to Disability
2. NMPOU → K6 → WHODAS → Unemployment Due to Disability

Discussion

The purpose of the present study was to 1) analyze the relationship of opioid misuse with disability status and employment, 2) examine the similarities and differences in the relationship of opioid misuse to employment for disabled and non-disabled persons, and 3) investigate the mediating relationship of psychological distress with opioid misuse and employment. Findings revealed significant relationships between opioid misuse (NMPOU) with psychological distress, mental health functional impairment and poor self-rated health. These are measures commonly-used in population health research to identify persons with chronic health and mental health conditions (Bessaha, 2015; Center for Behavioral Health Statistics and Quality, 2017). There was no statistically significant direct effect from NMPOU to unemployment due to disability, when controlling for all other variables (H1a). However, indirect effects were observed in the relationship of NMPOU with unemployment due to disability through 1) Poor Health, 2) ADL limitations, 3) WHODAS, and 4) K6 as mediating variables. Analyses conducted separately for disabled and non-disabled persons as subgroups (H2a, H2b, H2c) found no differences in the relationship of NMPOU with unemployment due to disability. Taken together, these findings indicate that there does not appear to be a direct relationship with opioid misuse to unemployment due to disability; however, there is an indirect relationship that is mediated through poor health, psychological distress and mental health functional impairment.

Poor Health as Mediator

Poor self-rated health emerged as the most important mediator in the relationship of NMPOU with unemployment due to disability in this analysis. This finding is expected, as prescription opioids are commonly used as a frontline treatment for patients with pain symptoms, and severe chronic pain at the highest levels are associated with poor health (Institute of Medicine, 2011). Although the prescribing of opioids is primarily for acute and chronic pain management (Kyriacou, 2017; Witkin et al., 2017), previous research has found that persons who are initially prescribed opioid pain relievers for therapeutic purposes are at high risk for non-medical use, developing into abuse and addiction (Martell et al., 2007; McCabe et al., 2017). Consistent with past research indicating that opioid misuse is associated poor overall health outcomes (Becker, Sullivan, Tetrault, Desai, & Fiellin, 2008), this finding suggests the opioid misuse may then lead to further disablement and the potential to permanently exiting from the labor force (Reeuwijk, van Klaveren, van Rijn, Burdorf, & Robroek, 2017).

Mental Health as Mediator

Findings suggest that poor overall health is an important mediator from opioid misuse to unemployment due to disability in this analysis. Mental health variables in the form of psychological distress and mental health functional impairment emerged as mediating variables in six of the eight pathways. Past research has found that the risk of a mental health diagnosis increases the longer opioids are prescribed (Scherrer et al., 2013), and that a longer duration of prescription opioid use is linked to newly diagnosed serious mental health disorders (Salas et al., 2017; Scherrer et al., 2016). Research with community-based samples identified that persons who engaged in symptomatic use of opioids (i.e. taking an opioid in response to increased pain compared to taking an opioid at a regularly scheduled time or to engage in a specific activity) experienced increased pain-related mental health symptomology (Skinner, Lewis, & Trafton, 2012). This is consistent with past research that found prescription opioids may become less

effective in treating chronic pain over time (Ballantyne & LaForge, 2007; Ballantyne & Mao, 2003; Martell et al., 2007; Von Korff & Deyo, 2004), and that unsuccessfully managed physical pain can contribute to more non-medical prescription opioid use (Dahlman, Kral, Wenger, Hakansson, & Novak, 2017; Evans et al., 2017).

Implications

The demographic characteristics of non-medical prescription opioid users (NMPOU) has future implications for Social Security. Opioid users in this study were skewed towards younger age groups (18-25: 25%, 26-34: 25%, 35-49: 26%, 50-64: 19%, and 65+: 5%), and more than three quarters of opioid users are between 18 and 49 years old (see Table 1). As the U.S. population continues to age, greater proportions of persons who have misused opioids will reach their most disability-prone years (Kraus, 2017). Findings from this analysis indicate that there appears to be an indirect relationship between opioid misuse and unemployment due to disability that is mediated through poor health, psychological distress and mental health functional impairment.

Mental health is an important part of the equation in addressing the opioid epidemic. As the federal government and state governments mobilize resources to address this public health emergency, it is recommended that their responses include secondary prevention strategies to address the long-term impact of the opioid epidemic. Public policy and intervention programs are needed that systematically address mental health to mitigate the potential impact of opioid use, poor health and mental health problems. Addressing the mental health needs of persons impacted by the opioid epidemic may help mitigate against greater numbers of persons applying and qualifying for Social Security disability benefits in the future and permanently exiting from the workforce as opioid users age.

Limitations and Strengths

There are limitations to this study. Because the analyses conducted in the study used single year, cross-sectional data, the causality in the effect of non-medical prescription opioid use, psychological distress, mental health functional impairment, activities of daily living limitations, self-rated health, and unemployment due to disability cannot be fully established. The final outcome variable, unemployment due to disability, was defined as any respondent who self-reported that they did not work at a job or business any time last week because they were ‘disabled for work.’ The study’s operationalization of unemployed due to disability differs from the Social Security Administration which defines disability as, “the inability to engage in any substantial gainful activity (SGA) by reason of any medically determinable physical or mental impairment(s) which can be expected to result in death or which has lasted or can be expected to last for a continuous period of not less than 12 months” (Social Security Administration, 2017b). Therefore, persons identified in this study as unemployed due to disability may not in all cases fit the SSA criteria. Non-medical prescription opioid use was defined as any self-reported use of prescription pain relievers in the past year which was not directed by a doctor. The study’s operationalization of opioid misuse did not capture respondents’ motivation for non-medical use (i.e. pain management versus recreational use), onset and frequency of use, or capture all diagnostic criteria for Opioid Use Disorder defined by the *Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition (DSM 5)* (APA, 2013).

The initial study proposal (Aim 1) planned to measure overall health using the World Health Disability Assessment Schedule (WHODAS 2.0) and mental health disability using the Sheehan Disability Scale. NSDUH uses a reduced and modified version of the WHODAS to assess mental health functional impairment which does not include physical health. Therefore, self-rated health was included in the analyses to capture respondent's overall physical health status. NSDUH's variables for the Sheehan Disability Scale (SDS) were only administered to respondents who met the criteria for a past year Major Depressive Episode (n=3,571 or 7% once survey weights were applied). Therefore, the SDS was not used in this study. For Aim 3, path analysis using structural equation modeling (SEM) was conducted using a generalized model (GSEM). Due to violations in assumptions of parametric tendencies, almost all goodness-of-fit statistics commonly reported in SEM cannot be accurately estimated in a weighted, generalized model (χ^2 test of model fit, the Root Mean Squared Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI)). However, results from each portion of the path model (F-statistic, R^2 , pseudo- R^2 , Log Likelihood Ratio) provided empirical support for the feasibility of the overall path model (See Tables 2 – 6).

This study does have many strengths. It is one of the first of its kind to examine the pathways in which opioid epidemic impacts workforce participation using large-scale, population health data. Additionally, a notable strength of this study comes from its generalizability, due to the nationally representative design of NSDUH, and the use of four commonly used measures of health and mental health (K6, WHODAS, ADLs, and self-rated health) in population health and clinical research. Findings from the analyses conducted in this study can inform practice, policy and future research on the opioid crisis and its impact on Social Security disability beneficiaries and the U.S. workforce at-large.

References

- Alati, R., Dunn, N., Purdie, D. M., Roche, A. M., Dennerstein, L., Darlington, S. J.,... Green, A. C. (2007). Moderate alcohol consumption contributes to women's well-being through the menopausal transition. *Climacteric*, *10*, 491-499. <https://doi.org/10.1080/13697130701739118>
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Ballantyne, J.C., Abdel Shaheed, C., Maher, C.G., Williams, K.A., Day, R., & McLachlan, A.J. (2016). Efficacy, tolerability, and dose-dependent effects of opioid analgesics for low back pain: A systematic review and meta-analysis. *Journal of the American Medical Association*, *176*, 958-968. <https://doi.org/10.1001/jamainternmed.2016.1251>
- Ballantyne, J.C., & LaForge, S.L. (2007). Opioid dependence and addiction in opioid treated pain patients. *Pain*, *129*, 235–55. <https://doi.org/10.1016/j.pain.2007.03.028>
- Ballantyne, J.C., & Mao, J. (2003). Opioid therapy for chronic pain. *New England Journal of Medicine*, *349*, 1943–1953. <https://doi.org/10.1056/NEJMra025411>
- Becker, W. C., Fiellin, D. A., & Desai, R. A. (2007). Non-medical use, abuse and dependence on sedatives and tranquilizers among U.S. adults: Psychiatric and socio-demographic correlates. *Drug and Alcohol Dependence*, *90*, 280-287. <https://doi.org/10.1016/j.drugalcdep.2007.04.009>
- Becker, W.C., Sullivan, L.E., Tetrault, J.M., Desai, R.A., & Fiellin, D.A. (2008). Non-medical use, abuse and dependence on prescription opioids among U.S. adults: Psychiatric, medical and substance use correlates. *Drug and Alcohol Dependence*, *94*, 38-47. <https://doi.org/10.1016/j.drugalcdep.2007.09.018>
- Bellos, S., Skapinakis, P., Rai, D., Zitko, P., Araya, R., Lewis, G.,... Mavreas, V. (2013). Cross-cultural patterns of the association between varying levels of alcohol consumption and the common mental disorders of depression and anxiety: Secondary analysis of the WHO collaborative study on psychological problems in general health care. *Drug and Alcohol Dependence*, *133*, 825-831. <https://doi.org/10.1016/j.drugalcdep.2013.08.030>
- Bessaha, M.L. (2015). Factor structure of the Kessler Psychological Distress Scale (K6) among emerging adults. *Research o Social Work Practice*, *27*, 616-624. <https://doi.org/10.1177/1049731515594425>.

- Bewley, T. H., Ben-Arie, O., & James, I. P. (1968). Morbidity and mortality from heroin dependence: Survey of heroin addicts known to home office. *British Medical Journal*, *1*, 725-726. <https://doi.org/10.1136/bmj.1.5594.725>
- Brede, E., Mayer, T. G., & Gatchel, R. J. (2012). Prediction of Failure to Retain Work 1 Year After Interdisciplinary Functional Restoration in Occupational Injuries. *Archives of Physical Medicine and Rehabilitation*, *93*, 268-274. <http://dx.doi.org/10.1016/j.apmr.2011.08.029>
- Bush, D.M., & Lipari, R.N. (2015, April). *The CBHSQ Report: Substance use and substance use disorder, by industry*. Retrieved from https://www.samhsa.gov/data/sites/default/files/report_1959/ShortReport-1959.pdf.
- Cairney, S., O'Connor, N., Dingwall, K. M., Maruff, P., Shafiq-Antonacci, R., Currie, J., & Currie, B. J. (2013). A prospective study of neurocognitive changes 15 years after chronic inhalant abuse. *Addiction*, *108*, 1107-1114. <https://doi.org/10.1111/add.12124>
- Carnide, N., Hogg-Johnson, S., Cote, P., Irvin, E., Van Eerd, D., Koehoorn, M., & Furlan, A.D. (2017). Early prescription opioid use for musculoskeletal disorders and work outcomes: A systematic review of the literature. *Clinical Journal of Pain*, *33*, 647-658. <https://doi.org/10.1097/AJP.0000000000000452>.
- Center for Behavioral Health Statistics and Quality. (2017). *2016 National Survey on Drug Use and Health: Methodological summary and definitions*. Rockville, MD: Substance Abuse and Mental Health Services Administration. Retrieved from <https://www.samhsa.gov/data/sites/default/files/NSDUH-MethodSummDefs-2016/NSDUH-MethodSummDefs-2016.htm>
- Centers for Disease Control and Prevention. (2016). *Wide-ranging online data for epidemiologic research (WONDER)*. Retrieved from <http://wonder.cdc.gov>.
- Centers for Disease Control and Prevention. (2017). *Annual Surveillance Report of Drug-Related Risks and Outcomes — United States* (Surveillance Special Report 1). Retrieved from <https://www.cdc.gov/drugoverdose/pdf/pubs/2017cdc-drug-surveillance-report.pdf>.
- Clements-Nolle, K., Larson, S., Buttar, A., & Dermid-Gray, L. (2017). Childhood maltreatment and unprotected sex among female juvenile offenders: Evidence of mediation by substance abuse and psychological distress. *Women's Health Issues*, *27*, 188-195. <http://dx.doi.org/10.1016/j.whi.2016.12.004>
- Coben, J. H., Davis, S. M., Furbee, P. M., Sikora, R. D., Tillotson, R. D., & Bossarte, R. M. (2010). Hospitalizations for poisoning by prescription opioids, sedatives, and tranquilizers. *American Journal of Preventive Medicine*, *38*, 517-524. <https://doi.org/10.1016/j.amepre.2010.01.022>

- Croft, J. B., Mokdad, A. H., Power, A. K., Greenlund, K. J., & Giles, W. H. (2009). Public health surveillance of serious psychological distress in the United States. *International Journal of Public Health, 54*, 4-6. <https://doi.org/10.1007/s00038-009-0017-y>
- Crossin, R., Cairney, S., Lawrence, A. J., & Duncan, J. R. (2017). Adolescent inhalant abuse leads to other drug use and impaired growth; implications for diagnosis. *Australian and New Zealand Journal of Public Health, 41*, 99-104. <https://doi.org/10.1111/1753-6405.12595>
- Dahlman, D., Kral, A. H., Wenger, L., Hakansson, A., & Novak, S. P. (2017). Physical pain is common and associated with nonmedical prescription opioid use among people who inject drugs. *Substance Abuse Treatment, Prevention & Policy, 12*, 1-11. <https://doi.org/10.1186/s13011-017-0112-7>
- Dugosh, K., Abraham, A., Seymour, B., McLoyd, K., Chalk, M., & Festinger, D. (2016). A systematic review on the use of psychosocial interventions in conjunction with medications for the treatment of opioid addiction. *Journal of Addiction Medicine, 10*, 91-101. <https://doi.org/10.1097/ADM.0000000000000193>.
- Evans, T.I., Liebling, E.J., Green, T.C., Hadland, S.E., Clark, M.A., & Marshall, B.D. (2017). Associations between physical pain, pain management, and frequency of nonmedical prescription opioid use among young adults: A sex-specific analysis. *Journal of Addiction Medicine, 11*, 266-272. <https://doi.org/10.1097/ADM.0000000000000318>
- Fan, A. Z., Strine, T. W., Jiles, R., Berry, J. T., & Mokdad, A. H. (2009). Psychological distress, use of rehabilitation services, and disability status among noninstitutionalized US adults aged 35 years and older, who have cardiovascular conditions, 2007. *International Journal of Public Health, 54*, 100-105. <https://doi.org/10.1007/s00038-009-1313-2>
- French, M. T., Roebuck, M. C., & Alexandre, P. K. (2001). Illicit drug use, employment, and labor force participation. *Southern Economic Journal, 68*, 349-368. <http://www.jstor.org/stable/1061598>.
- Goesling, J., Henry, M. J., Moser, S. E., Rastogi, M., Hassett, A. L., Clauw, D. L., & Brummett, C. M. (2015). Symptoms of depression are associated with opioid use regardless of pain severity and physical functioning among treatment-seeking patients with chronic pain. *The Journal of Pain, 16*(9), 844-851. <http://dx.doi.org/http://dx.doi.org/10.1016/j.jpain.2015.05.010>
- Goldstein, R. A., DesLauriers, C., Burda, A., & Johnson-Arbor, K. (2009). Cocaine: History, social implications, and toxicity: A review. *Seminars in Diagnostic Pathology, 26*, 10-17. <https://doi.org/10.1053/j.semmp.2008.12.001>

- Grella, C. E., & Lovinger, K. (2012). Gender differences in physical and mental health outcomes among an aging cohort of individuals with a history of heroin dependence. *Addictive Behaviors*, *37*, 306-312. <https://doi.org/10.1016/j.addbeh.2011.11.028>
- Guy, G.P., Zhang K., Bohm, M.K., Losby, J., Lewis, B., Young, R., ...Dowell, D. (2017). Changes in opioid prescribing in the United States, 2006–2015. *Morbidity and Mortality Weekly Report*, *66*, 697–704. <http://dx.doi.org/10.15585/mmwr.mm6626a4>.
- Han, B., Compton, W. M., Blanco, C., Crane, E., Lee, J., & Jones, C. M. (2017). Prescription opioid use, misuse, and use disorders in U.S. adults: 2015 National Survey on Drug Use and Health. *Annals of Internal Medicine*, *167*, 293-301. <https://doi.org/10.7326/M17-0865>.
- Han, B., Compton, W. M., Jones, C. M., & Cai, R. (2015). Nonmedical prescription opioid use and use disorders among adults aged 18 through 64 years in the United States, 2003-2013. *Journal of the American Medical Association*, *314*, 1468-1478. <https://doi.org/10.1001/jama.2015.11859>.
- Han, B., Gfroerer, J., McKeon, R., & Compton, W. M. (2015). Prevalence and correlates of past 12-month suicide attempt among adults with past-year suicidal ideation in the United States. *Journal of Clinical Psychiatry*, *76*, 295-302. <https://doi.org/10.4088/JCP.14m09287>
- Hoff, A. L., Riordan, H., Morris, L., Cestaro, V., Wieneke, M., Alpert, R., ... Volkow, N. (1996). Effects of crack cocaine on neurocognitive function. *Psychiatry Research*, *60*, 167-176. [https://doi.org/10.1016/0165-1781\(96\)02758-8](https://doi.org/10.1016/0165-1781(96)02758-8)
- Idler, E., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health and Social Behavior*, *38*, 21-37. Retrieved from <http://www.jstor.org/stable/2955359>
- Idler, E., Russell, L. B., & Davis, D. (2000). Survival, functional limitations, and self-rated health in the NHANES I Epidemiologic Follow-up Study, 1992. *American Journal of Epidemiology*, *152*, 874-883. <https://doi.org/10.1093/aje/152.9.874>
- Institute of Medicine. (2011) *Relieving pain in America: A blueprint for transforming prevention, care, education, and research*. Washington, DC: The National Academies Press.
- Joseph, N., Pace, A., Skojec, A., Gordin, V., Xu, C., Chinchilli, V..., & Caldwell, J. (2016). Adverse effects associated with higher opioid use. *Journal of Pain*, *17*, S7. <http://dx.doi.org/10.1016/j.jpain.2016.01.027>
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L., ... Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, *32*, 959-976.

<https://doi.org/10.1017/S0033291702006074>

- Kessler, R. C., Heeringa, S., Lakoma, M. D., Petukhova, M., Rupp, A. E., Schoenbaum, M., ... Zaslavsky, A. M. (2008). Individual and societal effects of mental disorders on earnings in the United States: results from the national comorbidity survey replication. *American Journal of Psychiatry*, *165*, 703-711. Retrieved from <http://ajp.psychiatryonline.org/doi/abs/10.1176/appi.ajp.2008.08010126>
- Kidner, C. L., Mayer, T. G., & Gatchel, R. J. (2009). Higher opioid doses predict poorer functional outcome in patients with chronic disabling occupational musculoskeletal disorders. *Journal of Bone and Joint Surgery - Series A*, *91*, 919-927. <http://dx.doi.org/10.2106/JBJS.H.00286>
- Kraus, L. (2017). *2016 Disability Statistics Annual Report*. Durham, NH: University of New Hampshire. Retrieved from https://disabilitycompendium.org/sites/default/files/user-uploads/2016_AnnualReport.pdf
- Kruger, A. B. (2016, October). *Where have all the workers gone?* Paper presented at the Federal Reserve Bank of Boston. Retrieved from <https://www.bostonfed.org/-/media/Documents/economic/...2016/Alan-B-Krueger.pdf>
- Kruger, A. B. (2017, September). *Where have all the workers gone? An inquiry into the decline of the U.S. labor force participation rate*. Paper presented at the Brookings Papers on Economic Activity. Retrieved from https://www.brookings.edu/wpcontent/uploads/2017/09/1_krueger.pdf.
- Kyriacou, D. N. (2017). Opioid vs nonopioid acute pain management in the emergency department. *Journal of the American Medical Association*, *318*, 1655-1656. <https://doi.org/10.1001/jama.2017.16725>.
- Lévesque, A., Roy, E., Jutras-Aswad, D., Zang, G., Artenie, A. A., & Bruneau, J. (2016). Examining the link between psychological distress, mental health disorders and sharing behaviors among cocaine users. *Addictive Behaviors*, *62*, 54-59. <https://doi.org/10.1016/j.addbeh.2016.06.004>
- Lund, I.O., Skurtveit, S., Sarfri, M., Bakstad, B., Welle-Strand, G., & Ravndal, E. (2013). A 2-year prospective study of psychological distress among a national cohort of pregnant women in opioid maintenance treatment and their partners. *Journal of Substance Use*, *18*, 148-160. <https://doi.org/10.3109/14659891.2011.642928>
- Madans, J.H., Altman, B.M., Rasch, E.K., Mbogoni, M., Synneborn, M., Banda, J.,... DePalma, E. (2004). Washington Group position paper: Proposed purpose of an internationally comparable general disability measure. Available online at: http://www.cdc.gov/nchs/data/washington_group/WG_purpose_paper.pdf

- Martell, B. A., O'Connor, P. G., Kerns, R. D., Becker, W. C., Morales, K. H., Kosten, T. R., & Fiellin, D. A. (2007). Systematic review: Opioid treatment for chronic back pain: Prevalence, efficacy, and association with addiction. *Annals of Internal Medicine*, *146*, 116-127. <https://doi.org/10.7326/0003-4819-146-2-200701160-00006>
- McCabe, S. E., West, B. T., Veliz, P., McCabe, V. V., Stoddard, S. A., & Boyd, C. J. (2017). Trends in medical and nonmedical use of prescription opioids among US adolescents: 1976–2015. *Pediatrics*, *139*, 1-9. <https://doi.org/10.1542/peds.2016-2387>
- Meara, E., Horwitz, J.R., Powell, W., McClelland, L., Zhou, W., O'Malley, J., & Morden, N.E. (2016). State legal restrictions and prescription opioid use among disabled adults. *New England Journal of Medicine*, *375*, 44-53. <https://doi.org/10.1056/NEJMsa1514387>
- Minnes, S., Min, M. O., Singer, L. T., Edguer, M., Wu, M., & Thi, P. (2012). Cocaine use during pregnancy and health outcome after 10 years. *Drug and Alcohol Dependence*, *126*, 71-79. <https://doi.org/10.1016/j.drugalcdep.2012.04.015>
- Moller, C.I., Tait, R.J., & Byrne, D.G. (2012). Self-harm, substance use and psychological distress in the Australian general population. *Addiction*, *108*, 211-220. <https://doi.org/10.1111/j.1360-0443.2012.04021.x>
- Morden, N.E., Munson, J.C., Colla, C.H., Skinner, J.S., Bynum, J.P., Zhou, W., & Meara, E. (2014). Prescription opioid use among disabled Medicare beneficiaries: intensity, trends, and regional variation. *Medical Care*, *52*, 852-859. <https://doi.org/10.1097/MLR.0000000000000183>
- Mossey, J. M., & Shapiro, E. (1982). Self-rated health: A predictor of mortality among the elderly. *American Journal of Public Health*, *72*, 800-808. <https://doi.org/10.2105/AJPH.72.8.800>
- National Academies of Sciences, Engineering, and Medicine. (2017). *The health effects of cannabis and cannabinoids: The current state of evidence and recommendations for research*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/24625>
- National Institute on Drug Abuse. (2015). Hallucinogens and dissociative drugs. Retrieved from <https://www.drugabuse.gov/publications/hallucinogens-dissociative-drugs/how-do-hallucinogens-ld-psilocybin-peyote-dmt-ayahuasca-affect-brain-body>
- Novak, S. P., Colpe, L. J., Barker, P. R., & Gfroerer, J. C. (2010). Development of a brief mental health impairment scale using a nationally representative sample in the USA. *International Journal of Methods in Psychiatric Research*, *19*, 49-60. <https://doi.org/10.1002/mpr.313>

- Okoro, C.A. & Dhingra, S.S. (2014). Severity of psychological distress among adults with and without disabilities. *Social Work in Public Health, 29*, 671-685. <https://doi.org/10.1080/19371918.2014.938386>
- Okoro, C.A., Strine, T.W., McGuire, L., Balluz, L., & Mokdad, A. (2007). Employment status and frequent mental distress among adults with disabilities. *Occupational Medicine, 57*, 217-220. <https://doi.org/10.1093/occmed/kql177>
- Okoro, C. A., Strine, T. W., Balluz, L. S., Crews, J. E., Dhingra, S., Berry, J. T., & Mokdad, A. H. (2009). Serious psychological distress among adults with and without disabilities. *International Journal Public Health, 54*, 52–60. <https://doi.org/10.1007/s00038009-0077-z>
- Okoro, C.A., Stoodt, G., Rohrer, J.E., Strine, T.W., Li, C., & Balluz, L.S. (2014). Serious psychological distress and physical activity. *Public Health Reports, 129*, 30-38. <https://doi.org/10.1177/003335491412900106>
- Patel, S., Greasley, & Watson, P.J. (2007). Barriers to rehabilitation and return to work for unemployed chronic pain patients: A qualitative study. *European Journal of Pain, 11*, 831-840. <https://doi.org/10.1016/j.ejpain.2006.12.011>.
- Power, C., Rodgers, B., & Hope, S. (1998). U-shaped relation for alcohol consumption and health in early adulthood and implications for mortality. *The Lancet, 352*, 877. [https://doi.org/10.1016/S0140-6736\(98\)23937-7](https://doi.org/10.1016/S0140-6736(98)23937-7)
- Powers, J., Duffy, L., Burns, L., & Loxton, D. (2016). Binge drinking and subsequent depressive symptoms in young women in Australia. *Drug and Alcohol Dependence, 161*, 86-94. <https://doi.org/10.1016/j.drugalcdep.2016.01.019>
- Purcell, P.J. (2016). Employment at older ages and Social Security benefit claiming. *Social Security Bulletin, 76*, 1-17. <https://www.ssa.gov/policy/docs/ssb/v76n4/v76n4p1.pdf>
- Rai, D., Kosidou, K., Lundberg, M., Araya, R., Lewis, G., & Magnusson, C. (2012). Psychological distress and risk of long-term disability: Population-based longitudinal study. *Journal of Epidemiology and Community Health, 66*, 586–592. <https://doi.org/10.1136/jech.2010>
- Rasu, R.S., & Knell, M.E. (2017). Determinants of opioid prescribing for nonmalignant chronic pain in US outpatient settings. *Pain Medicine, 18*, 1000-1008. <https://doi.org/10.1093/prn/prn025>.
- Reeuwijk, K. G., van Klaveren, D., van Rijn, R. M., Burdorf, A., & Robroek, S. W. (2017). The influence of poor health on competing exit routes from paid employment among older workers in 11 European countries. *Scandinavian Journal of Work, Environment & Health, 43*, 24. <https://doi.org/10.5271/sjweh.3601>
- Rehm, J., Üstün, T. B., Saxena, S., Nelson, C. B., Chatterji, S., Ivis, F., & Adlaf, E. (1999). On the development and psychometric testing of the WHO screening instrument to assess

- disablement in the general population. *International Journal of Methods in Psychiatric Research*, 8, 110-122. <https://doi.org/10.1002/mpr.61>
- Reinecke, H., Weber, C., Lange, K., Simon, M., Sorgatz, H., & Stein, C. (2015). Analgesic efficacy of opioids in chronic pain: Recent meta-analyses. *British Journal of Pharmacology*, 172, 324-333. <https://doi.org/10.1111/bph.12634>.
- Rogers, K. D., Kemp, A., McLachlan, A. J., & Blyth, F. (2013). Adverse selection? A multi-dimensional profile of people dispensed opioid analgesics for persistent non-cancer pain. *PLoS ONE*, 8, e80095. <http://dx.doi.org/10.1371/journal.pone.0080095>
- Salas, J., Scherrer, J. F., Schneider, F. D., Burroughs, T., Sullivan, M. D., Bucholz, K. K., ... Ahmedani, B. K. (2017). New-onset depression following stable, slow, and rapid rate of prescription opioid dose escalation. *Pain*, 158, 306-312. <https://doi.org/10.1097/j.pain.0000000000000763>
- Scherrer, J. F., Salas, J., Copeland, L. A., Stock, E. M., Ahmedani, B. K., Sullivan, M. D., ... Lustman, P. J. (2016). Prescription opioid duration, dose, and increased risk of depression in 3 large patient populations. *Annals of Family Medicine*, 14, 54-62. <https://doi.org/10.1370/afm.1885>
- Scott, J. C., Woods, S. P., Matt, G. E., Meyer, R. A., Heaton, R. K., Atkinson, J. H., & Grant, I. (2007). Neurocognitive effects of methamphetamine: A critical review and meta-analysis. *Neuropsychology Review*, 17, 275-297. <https://doi.org/10.1007/s11065-007-9031-0>
- Skinner, M.A., Lewis, E.T., & Trafton, J.A. (2012). Opioid use patterns and association with pain severity and mental health functioning in chronic pain. *Pain Medicine*, 13, 507-519. <https://doi.org/10.1111/j.1526-4637.2012.01352.x>
- Skogen, J. C., Harvey, S. B., Henderson, M., Stordal, E., & Mykletun, A. (2009). Anxiety and depression among abstainers and low-level alcohol consumers. The Nord-Trondelag Health Study. *Addiction*, 104, 1519-1530. <https://doi.org/10.1111/j.1360-0443.2009.02659.x>
- Smart, R. G. (1991). Crack cocaine use: A review of prevalence and adverse effects. *The American Journal of Drug and Alcohol Abuse*, 17, 13-26. <https://doi.org/10.3109/00952999108992806>
- Smith, K., Mattick, R. P., Bruno, R., Nielsen, S., Cohen, M., Campbell, G., ... & Degenhardt, L. (2015). Factors associated with the development of depression in chronic non-cancer pain patients following the onset of opioid treatment for pain. *Journal of Affective Disorders*, 184, 72-80. <http://dx.doi.org/http://dx.doi.org/10.1016/j.jad.2015.05.049>
- Sommers, I., Baskin, D., & Baskin-Sommers, A. (2006). Methamphetamine use among young adults: Health and social consequences. *Addictive Behaviors*, 31, 1469-1476. <https://doi.org/10.1016/j.addbeh.2005.10.004>

- Swartz, J.A. & Jantz, I. (2014). Association between nonspecific severe psychological distress as an indicator of serious mental illness and increasing levels of medical multimorbidity. *American Journal of Public Health*, 104, 2350-2358. <http://dx.doi.org/10.2105/AJPH.2014.302165>
- StataCorp. (2017). *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LLC.
- Tenorio, K.A. & Lo, C.C. (2011). Social location, social integration, and the co-occurrence of substance abuse and psychological distress. *American Journal of Drug and Alcohol Abuse*, 37(4), 218-223. <https://doi.org/10.3109/00952990.2011.568079>
- U.S. Department of Health and Human Services, Office of the Secretary. (2017). *Determination that a public health emergency exists*. Retrieved from <https://www.hhs.gov/sites/default/files/opioid%20PHE%20Declaration-no-sig.pdf>.
- Social Security Administration. (2016). *Annual Statistical Report on the Social Security Administration Disability Insurance Program, 2015* (13-11826). Retrieved from https://www.ssa.gov/policy/docs/statcomps/di_asr/2015/di_asr15.pdf
- U.S. Social Security Administration. (2017a). *Annual statistical report on the Social Security Disability Insurance Program, 2016*. Retrieved from https://www.ssa.gov/policy/docs/statcomps/di_asr/2016/di_asr16.pdf.
- U.S. Social Security Administration. (2017b). *Disability evaluation under Social Security*. Retrieved from <https://www.ssa.gov/disability/professionals/bluebook/general-info.htm>
- U.S. Social Security Administration. (2018). The facts about Social Security's disability program [Fact Sheet]. Retrieved from <https://www.ssa.gov/pubs/EN-05-10570.pdf>
- Volkow, N.D., & Thomas, A.T. (2016). Opioid abuse in chronic pain – misconceptions and mitigation strategies. *New England Journal of Medicine*, 374, 1253-1263. <https://doi.org/10.1056/NEJMra1507771>.
- Von Korff M., & Deyo, R.A. (2004). Potent opioids for chronic musculoskeletal pain: Flying blind? *Pain*, 109, 207–209. <https://doi.org/10.1016/j.pain.2004.02.019>
- Washington Group on Disability Statistics. (2018). The Washington Group on Disability Statistics (WG). Retrieved from: <http://www.washingtongroup-disability.com/>
- Weyandt, L., Janusis, G., Wilson, K., Verdi, G., Paquin, G., Lopes, J., ... Dussault, C. (2009). Nonmedical prescription stimulant use among a sample of college students: Relationship with psychological variables. *Journal of Attention Disorders*, 13, 284-296. <https://doi.org/10.1177/1087054709342212>

Witkin, L. R., Zylberger, D., Mehta, N., Hindenlang, M., Johnson, C., Kean, J., & ... Inturrisi, C. E. (2017). Patient-reported outcomes and opioid use in outpatients with chronic pain. *Journal of Pain, 18*, 583-596. <https://doi.org/10.1016/j.jpain.2016.12.018>

Table 1. Descriptive Variables Characteristic of Prescription Opioid Users and Non-Users (N=38,282)

Variables	Non-Medical Prescription Opioid Users (n=2,271)	Non-Users (n=36,011)	p-value ^a
Unemployed Due to Disability	7%	5%	p<.05
Disability Measures			
Psychological Distress (K6)			
Mean (SE)	6.77 (0.12)	3.52 (0.02)	p<.001
Mental Health Functional Impairment (WHODAS)			
Mean (SE)	6.67 (0.14)	3.22 (0.03)	p<.001
Activity of Daily Living Limitations (ADL)	27%	19%	p<.001
Poor Self-Rated Health	18%	13%	p<.01
Socio-demographics			
White	71%	67%	p<.05
Black	10%	12%	p=.18
Asian	2%	6%	p<.001
Hispanic	17%	16%	p=.39
Age			
18-25	25%	13%	p<.001
26-34	25%	15%	
35-49	26%	25%	
50-64	19%	27%	
65+	5%	20%	
Gender			
Male	56%	48%	p<.001
Female	44%	52%	
Married	34%	55%	p<.001
2x poverty	43%	34%	p<.001
College graduate	21%	32%	p<.001
Large metro	55%	55%	p=.51
Small metro	31%	30%	
Non-metro	14%	15%	
Medicaid	10%	22%	p<.001
Medicare	18%	13%	p<.001
Private Health Insurance	56%	68%	p<.001
Other Substance Use			
Binge drinking			
Alcohol	52%	26%	p<.001
Marijuana & hashish	47%	12%	p<.001
Heroin	5%	<1%	p<.001
Cocaine	13%	1%	p<.001
Crack cocaine	3%	<1%	p<.001

Methamphetamine	5%	<1%	p<.001
Inhalants	2%	<1%	p<.001
Hallucinogens	11%	1%	p<.001
Stimulants	15%	1%	p<.001
Tranquilizers	24%	1%	p<.001
Sedatives	6%	<1%	p<.001
Other Mental Health Variables			
Lifetime depressive episode	28%	12%	p<.001
Past-year depressive episode	17%	7%	p<.001
Past-year suicidal thoughts	13%	3%	p<.001
Past-year suicide attempt	2%	<1%	p<.001

a. Wald tests were conducted to test for statistical differences in means using survey weights.

Table 2. Weighted Logistic Regression of Non-Medical Prescription Opioid Use on Unemployment Due to Disability (N=38,282)

Variables	OR	SE	95% CI
Non-Medical Prescription Opioid Use	1.09	0.20	0.74; 1.61
Disability Measures			
Psychological Distress (K6)	0.98	0.01	0.95; 1.002
Mental Health Functional Impairment (WHODAS) Activity of Daily Living Limitations (ADL)	1.09***	0.01	1.06; 1.11
Poor Self-Rated Health	3.47***	0.39	2.78; 4.34
	3.58***	0.35	2.94; 4.34
Socio-demographics			
White (Ref)	--	--	--
Black	1.30	0.18	0.98; 1.73
Asian	0.57	0.31	0.19; 1.67
Hispanic	0.49***	0.08	0.34; 0.69
Age	1.15*	0.06	1.03; 1.28
Gender (Ref: Male)	--	--	--
Female	0.62***	0.06	0.51; 0.76
Married	1.13	0.11	0.92; 1.39
2x poverty	1.82***	0.24	1.39; 2.37
College graduate	0.46***	0.07	0.34; 0.61
Large metro (Ref)	--	--	--
Small metro	1.15	0.12	0.92; 1.42
Non-metro	1.16	0.16	0.89; 1.52
Medicaid	1.97***	0.22	1.57; 2.46
Medicare	1.90***	0.31	1.37; 2.63
Private Health Insurance	0.39***	0.05	0.30; 0.51

F (38, 13) = 60.98, p<0.001

Pseudo R-Squared (unweighted) 0.43

*p-value<0.05, **p-value<0.01, ***p-value<0.001

Table 3. Weighted Regression of Non-Medical Prescription Opioid Use on Psychological Distress (K6) (N=38,282)

Variables	b (SE)	95% CI	β
Non-Medical Prescription			
Opioid Use	0.50 (0.12)	0.25; 0.75	0.02***
Unemployed Due to Disability	-0.19 (0.15)	-0.48; 0.11	-0.01
Disability Measures			
Mental Health Functional Impairment (WHODAS) Activity of Daily Living Limitations (ADL)	0.39 (0.01)	0.38; 0.41	0.46***
Poor Self-Rated Health	0.97 (0.07)	0.83; 1.11	0.09***
	0.74 (0.12)	0.51; 0.97	0.06***
Socio-demographics			
White (Ref)	--	--	--
Black	0.11 (0.07)	-0.03; 0.25	0.01
Asian	0.43 (0.12)	0.20; 0.67	0.02**
Hispanic	-0.31 (0.07)	-0.45; -0.17	-0.03***
Age	-0.41 (0.02)	-0.46; -0.37	-0.12***
Gender (Ref: Male)	--	--	--
Female	0.01 (0.05)	-0.10; 0.12	0.001
Married	-0.33 (0.05)	-0.44; -0.22	-0.04***
2x poverty	0.27 (0.06)	0.16; 0.38	0.03***
College graduate	-0.09 (0.05)	-0.19; 0.004	-0.01
Large metro (Ref)	--	--	--
Small metro	-0.08 (0.05)	-0.18; 0.02	-0.01
Non-metro	0.07 (0.06)	-0.05; 0.19	0.01
Medicaid	0.07 (0.09)	-0.11; 0.25	0.01
Medicare	0.13 (0.09)	-0.06; 0.32	0.01
Private Health Insurance	-0.14 (0.06)	-0.27; -0.01	-0.02
Adjusted R-Squared	0.49		

*p-value <0.05, **p-value <0.01, ***p-value <0.001

Table 4. Weighted Regression of Non-Medical Prescription Opioid Use on Mental Health Functional Impairment (WHODAS) (N=38,282)

Variables	b (SE)	95% CI	β
Non-Medical Prescription			
Opioid Use	0.52 (0.16)	0.21; 0.83	0.02**
Unemployed Due to Disability	1.53 (0.20)	1.13; 1.94	0.07***
Disability Measures			
Psychological Distress (K6)	0.51 (0.01)	0.49; 0.53	0.43***
Activity of Daily Living Limitations (ADL)	1.17 (0.10)	0.97; 1.37	0.09***
Poor Self-Rated Health	0.12 (0.10)	-0.09; 0.33	0.01
Socio-demographics			
White (Ref)	--	--	--
Black	-0.64 (0.08)	-0.80; -0.48	-0.04***
Asian	-0.50 (0.10)	-0.69; -0.30	-0.02***
Hispanic	-0.32 (0.07)	-0.46; -0.18	-0.02***
Age	-0.21 (0.03)	-0.26; -0.16	-0.05***
Gender (Ref: Male)	--	--	--
Female	0.67 (0.05)	0.57; 0.76	0.07***
Married	-0.06 (0.06)	-0.17; 0.05	-0.01
2x poverty	-0.21 (0.06)	-0.33; -0.08	-0.02**
College graduate	0.42 (0.06)	0.30; 0.54	0.04***
Large metro (Ref)	--	--	--
Small metro	0.21 (0.05)	0.12; 0.30	0.02***
Non-metro	-0.03 (0.07)	-0.17; 0.11	-0.002
Medicaid	0.09 (0.09)	-0.09; 0.27	0.01
Medicare	-0.34 (0.12)	-0.57; -0.10	-0.03*
Private Health Insurance	0.23 (0.07)	0.09; 0.36	0.02*
Adjusted R-Squared	0.53		

*p-value <0.05, **p-value <0.01, ***p-value <0.001

Table 5. Weighted Logistic Regression of Non-Medical Prescription Opioid Use on Poor Self-Rated Health (N=38,282)

Variables	OR	SE	95% CI
Non-Medical Prescription			
Opioid Use	1.28*	0.15	1.02; 1.62
Unemployed Due to Disability	3.36***	0.31	2.79; 4.05
Disability Measures			
Psychological Distress (K6)	1.06***	0.01	1.04; 1.08
Mental Health Functional Impairment (WHODAS)	1.01	0.01	1.00; 1.02
Activity of Daily Living Limitations (ADL)	2.84***	0.17	2.51; 3.21
Socio-demographics			
White (Ref)	--	--	--
Black	1.17*	0.09	1.00; 1.37
Asian	1.27	0.23	0.88; 1.84
Hispanic	2.04***	0.17	1.72; 2.42
Age	1.49***	0.05	1.39; 1.58
Gender (Ref: Male)	--	--	--
Female	0.90	0.05	0.80; 1.02
Married	0.86*	0.05	0.76; 0.98
2x poverty	1.65***	0.09	1.48; 1.83
College graduate	0.52***	0.04	0.45; 0.61
Large metro (Ref)	--	--	--
Small metro	0.96	0.06	0.85; 1.09
Non-metro	1.03	0.08	0.88; 1.20
Medicaid	1.15	0.10	0.97; 1.38
Medicare	1.26*	0.12	1.03; 1.53
Private Health Insurance	0.70***	0.06	0.59; 0.83

F (37, 14) = 92.21, p<0.001

Pseudo R-Squared (unweighted) 0.20

*p-value<0.05, **p-value<0.01, p-value<0.001

Table 6. Weighted Logistic Regression of Non-Medical Prescription Opioid Use on Activity of Daily Living Limitations (ADL) (N=38,282)

Variables	OR	SE	95% CI
Non-Medical Prescription			
Opioid Use	1.03	0.11	0.83; 1.27
Unemployed Due to Disability	3.23***	0.35	2.59; 4.03
Disability Measures			
Psychological Distress (K6)	1.09***	0.01	1.08; 1.10
Mental Health Functional Impairment (WHODAS)	1.08***	0.01	1.07; 1.09
Poor Self-Rated Health	2.78***	0.17	2.46; 3.15
Socio-demographics			
White (Ref)	--	--	--
Black	0.84**	0.05	0.74; 0.96
Asian	0.69 *	0.12	0.49; 0.98
Hispanic	0.94	0.08	0.79; 1.11
Age	1.35***	0.04	1.27; 1.42
Gender (Ref: Male)	--	--	--
Female	0.96	0.05	0.87; 1.06
Married	0.87*	0.06	0.77; 1.00
2x poverty	1.17**	0.06	1.06; 1.30
College graduate	0.60***	0.04	0.53; 0.68
Large metro (Ref)	--	--	--
Small metro	1.09	0.06	0.97; 1.22
Non-metro	1.14	0.08	0.98; 1.32
Medicaid	1.33**	0.11	1.13; 1.56
Medicare	2.48***	0.20	2.12; 2.92
Private Health Insurance	0.87*	0.06	0.76; 0.99

F (37, 14) = 58.88, p<0.001

Pseudo R-Squared (unweighted) 0.25

*p-value<0.05, **p-value<0.01, ***p-value<0.001

Table 7. Association of Non-Medical Prescription Opioid Use with Unemployment Due to Disability for Subgroups (a. Poor Health, b. Serious Mental Health Symptoms, c. Serious Mental Health Impairment, d. Activities of Daily Living Limitations) (N=38,282)

	Poor Health (n=4,189)					Not in Poor Health (n=34,093)				
Model A	%	OR	SE	p-value	95% CI	%	OR	SE	95% CI	p-value
Non-Medical Prescription Opioid Use	6%	1.02	0.29	0.95	0.57, 1.81	4%	1.15	0.35	0.63, 2.11	0.65
	Serious Mental Health Symptoms (K6) (n=2,540)					Without Serious Mental Health Symptoms (K6) (n=35,742)				
Model B	%	OR	SE	p-value	95% CI	%	OR	SE	95% CI	p-value
Non-Medical Prescription Opioid Use	14%	1.21	0.39	0.55	0.64, 2.30	4%	1.12	0.24	0.73, 1.71	0.60
	Serious Mental Health Impairment (WHODAS) (n=3,706)					Without Serious Mental Health Impairment (WHODAS) (n=34,576)				
Model C	%	OR	SE	p-value	95% CI	%	OR	SE	95% CI	p-value
Non-Medical Prescription Opioid Use	12%	1.03	0.36	0.93	0.51, 2.07	4%	1.22	0.28	0.76, 1.94	0.40
	Activities of Daily Living Limitations (ADL) (n=6,305)					Activities of Daily Living Limitations (ADL) (n=31,977)				
Model D	%	OR	SE	p-value	95% CI	%	OR	SE	95% CI	p-value
Non-Medical Prescription Opioid Use	6%	1.22	0.31	0.44	0.74, 2.01	4%	0.91	0.38	0.39, 2.12	0.83

*p<.05, **p<.01, ***p<.001

Table 8. Weighted Generalized Structural Equation Model: Path Analysis of Non-Medical Prescription Opioid Use and Disability (N = 38,282)

Unemployment due to Disability ^a	b(SE)	OR	95% CI
Mental Health Functional Impairment	0.08(0.01)	1.08***	1.06; 1.10
Activity Limitations	1.20(0.11)	3.34***	2.68; 4.15
Poor Self-Rated Health	1.25(0.10)	3.49***	2.86; 4.25
Psychological Distress ^b	b(SE)	β	95% CI
Non-Medical Prescription Opioid Use	0.89(0.16)	0.03***	0.56; 1.21
Activity Limitations	1.88(0.09)	0.19***	1.70; 2.07
Poor Self-Rated Health	1.08(0.12)	0.11***	0.85; 1.32
Mental Health Functional Impairment ^c	b(SE)	β	95% CI
Non-Medical Prescription Opioid Use	0.59(0.15)	0.02***	0.29; 0.90
Psychological distress	0.52 (0.01)	0.01***	0.50; 0.54
Activity Limitations	1.34(0.09)	0.10***	1.15; 1.53
Poor Self-Rated Health	0.29(0.11)	0.02*	0.07; 0.52
Poor Self-Rated Health ^d	b(SE)	OR	95% CI
Non-Medical Prescription Opioid Use	0.47(0.10)	1.60***	1.30; 1.97
Activity of Daily Living Limitations ^e	b(SE)	OR	95% CI
Poor Self-Rated Health	1.37(0.06)	3.94***	3.50; 4.42

*p-value <0.05, **p-value <0.01, ***p-value <0.001

a. Model included age, gender, race, poverty, education, stimulant use, and health insurance (see Table 2).

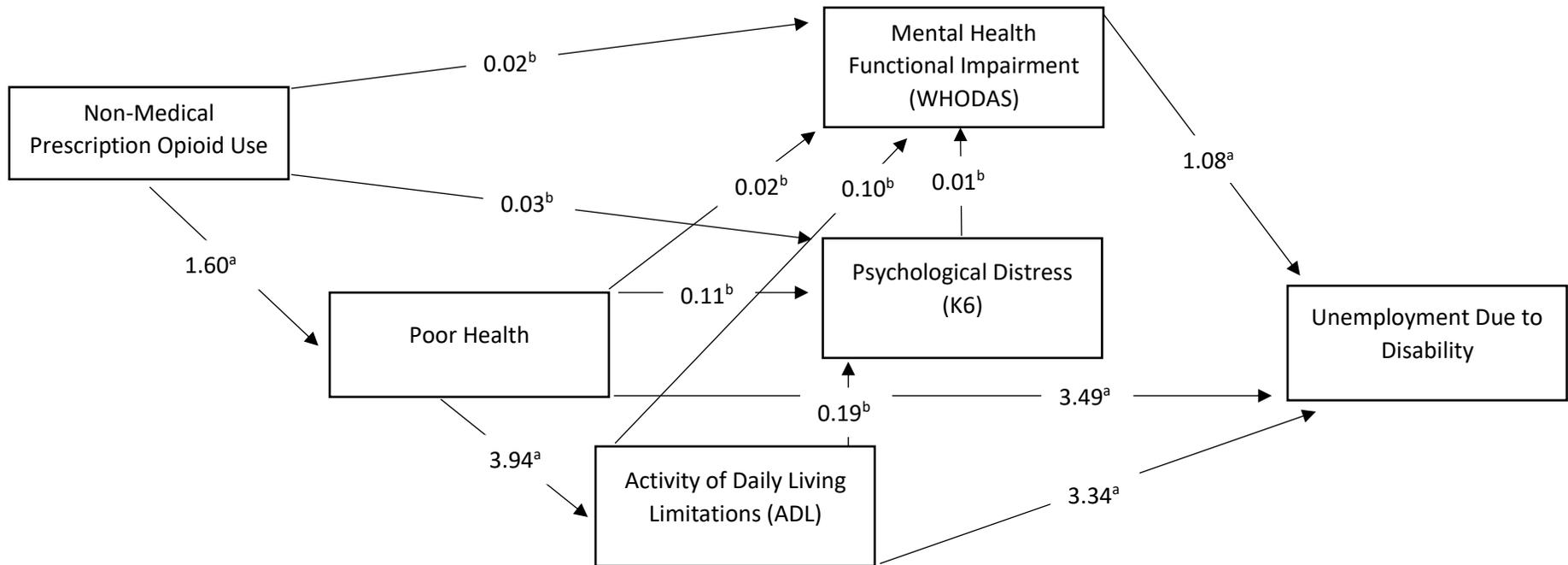
b. Model included age gender, race, poverty, other substance use (alcohol, marijuana, heroin, methamphetamine and tranquilizer), other mental health (depression and serious suicidal thoughts), and health insurance (see Table 3).

c. Model included age, gender, race, poverty, education, other substance use (alcohol, marijuana and stimulant), depression, and health insurance (See Table 4).

d. Model included age, gender, race, poverty, education other substance use (alcohol), depression, SSI and health insurance (see Table 5).

e. Model included age, gender, race, poverty, education, other substance use (crack cocaine and hallucinogen), serious suicidal thoughts and health insurance (see Table 6).

Figure 2. Path model showing the relationship of non-medical prescription opioid use on mediating variables and unemployment due to disability



—————> Signifies a significant predictive relationship.

a. The coefficients presented for the prediction of poor health, activity limitations and unemployment due to disability are the odds ratio (OR) obtained from weighted logistic regression.

b. The coefficients presented for the prediction of psychological distress and mental health functional impairment are the beta coefficients (β) obtained from weighted OLS regression.