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# Misuse of Prescription Medications among Individuals with Mobility Disability

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**ABSTRACT**

*Background:* The ability of walking a quarter mile is predictive of subsequent disability, mortality, and health care costs. Individuals with mobility disability are at increased risk of chronic conditions and unmet care needs. Thus they may misuse prescription medications to self-medicate. *Objectives:* We aimed to explore the difference of misuse of four types of prescription medications (sedatives, tranquilizers, painkillers, depression medications) and overall misuse by mobility status and identify the correlates of overall misuse. *Methods:* A national probability sample from the survey Midlife in the United States (MIDUS) was used to assess the difference in misuse by mobility status during 2011–2014. To assess the correlates of misuse, mobility status, usual source of care, unmet care needs, insurance coverage, sociodemographic variables, and clinical conditions were added to a survey weighted logistic regression model with backward selection. *Results:* Compared to those without mobility disability, individuals with mobility disability had higher risk of misuse in most types of medications and in overall misuse. Mobility disability, lower education, unmarried status, the emergency room or public health clinic as the most often used care, pain, and depressed affect were identified as correlates of overall misuse of studied medications. *Conclusions:* Individuals with mobility disability are a vulnerable group susceptible to medication misuse, which warrants the urgent need for interventions to ameliorate misuse and reduce risks in this population.

**KEYWORDS**

Medication; misuse; mobility; disability; usual source of care

## Introduction

Prescription medication misuse, defined as taking medication not prescribed to the user, using them in a way other than prescribed, or using it to feel euphoric, constitutes a serious public health issue (National Institute on Drug Abuse (NIDA), 2021a). Since the 1990s, there has been a significant increase in the misuse of prescription drugs, particularly opioids and benzodiazepines (Bachhuber et al., 2016; Dart et al., 2015). During this time, there was a substantial increase in fatal opioid overdoses due in part to the over-prescribing of opioids (the common treatment of pain) (Centers for Disease Control and Prevention (CDC), 2021a). Between 1999 and 2008, most of the increase in overdose death rates has been attributed to prescription drug misuse, and opioid pain relievers were a major cause of overdose deaths (CDC, 2011). The number of overdose deaths involving prescription opioids between 1999 and 2019 was close to 247,000 in the United States, and the number of deaths from overdoses involving prescription opioids was more than quadrupled over this period (CDC, 2021b).

Benzodiazepines are a type of sedative typically prescribed for anxiety or insomnia (NIDA, 2021b). Commonly used benzodiazepines include diazepam (Valium), alprazolam (Xanax), and clonazepam (Klonopin). Among general adults, benzodiazepine misuse without a prescription was the most common type of misuse (Maust et al., 2019). From 1996 to 2013, the number of adults who filled a benzodiazepine prescription increased by 67%, from 8.1 million to 13.5 million (Bachhuber et al., 2016). Between 2001 and 2013, people who used opioids have increased concurrent use of benzodiazepines and opioids from 9% to 17%. The estimated misuse of prescription tranquilizers or sedatives and pain reliever among US persons aged 12 or older in 2018 is 2.4% and 3.6% respectively (Substance Abuse and Mental Health Services Administration (SAMHSA), 2019). As a result of increased prescription drug misuse, related emergency department use increased steadily between 2004 and 2011 in the US (SAMHSA, 2011a).

Misuse of opioids and benzodiazepines is associated with disabilities involving activities of daily living (ADLs) and instrumental activities of daily living (IADLs) (Ford et al., 2018). ADLs describe the physical functions performing common daily tasks required for independent living and self-care (Wiener et al., 1990). IADLs involve cognitive functioning such as managing money, making phone calls, doing housework, and shopping. ADL disabilities such as difficulty in walking are associated with opioid misuse. IADL disabilities such as difficulty doing errands alone are associated with benzodiazepine misuse and concurrent opioid and benzodiazepine misuse. Other risk factors of substance use among people with disabilities are identified as pain

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associated with physical disabilities, chronic health conditions, and psychological distress (Brown, 2015; Ives et al., 2006). It has been documented that individuals with disabilities often develop substance use disorders to offset emotional and mental disorders (SAMHSA, 2011b).

CDC (2018) estimated that 19.4 million (7.8%) US adults are unable to walk a quarter mile, and 40.7 million (16.3%) US adults have difficulty with any physical functioning. Inability to walk a quarter mile is predictive of mortality, healthcare costs, in addition to impairment in ADLs (Hardy et al., 2011). Impairment in basic ADLs, including the ability to walk independently, may lead to greater health care resource utilization, including hospitalization and use of long-term care, and lower receipt of recommended care among older adults (Hennessy et al., 2015; Kurichi et al., 2017; Na et al., 2017; Na et al., 2017), as well as underuse of preventive care among eligible populations (Iezzoni, 2011). Individuals with disabilities also reported disparities in access to proper health care, ranging from recommended medical care (Kurichi et al., 2017), a usual source of care, dental care, to prescription medicines (Iezzoni, 2011). Among adults aged 65 years or older, disability was associated with the receipt of potentially inappropriate prescription medications (Iezzoni, 2011).

Prescription medication misuse has been studied in the geriatric population, among which about 27% reported having mobility disability (Okoro et al., 2018). Severe pain, depressive symptoms, and greater severity of physical disability were significantly associated with increased misuse of opioid medications among older adults with chronic pain (Park & Lavin, 2010). Among community-dwelling older women with mobility disability, multimorbidity, heart diseases, cancer, possession of insurance, and difficulty shopping for personal items were associated with increased use of prescription drugs (Crentsil et al., 2010).

Because prescription medication misuse has been found to be associated with non-medical sources of issuance (e.g. friends or relative) (Evans & Sullivan, 2014) and emergency care due to overdose (Maust et al., 2019; SAMHSA, 2011a), it raises the question whether individuals with mobility disability who misuse prescription medications may have unmet care needs or lack a usual source of care. Previous research shows that older adults with impairment in basic ADLs including mobility are at an elevated risk for chronic conditions (Stineman et al., 2014) and experience trouble getting needed care (Na et al., 2017). Both factors may increase their chance of medication misuse. On the other hand, having a usual source of care from a regular doctor may increase the chance of obtaining prescription drugs, thus increasing the chance of misuse. The link between health care access, specifically a usual source of care and unmet care needs, and medication misuse is an understudied area, especially among individuals with mobility disability.

The CDC classifies the opioid epidemic into three waves, which began in the 1990s with the expanded practice of prescribing of opioid drugs. The second wave started in 2010 due to increased availability and use of heroin. The third wave arose in 2013, with fatalities involving synthetic opioids such as fentanyl, which is said to be 50 times more potent than heroin (CDC, 2021a). Accordingly, the misuse of prescription opioids was a focus of this study. The purposes of this study were to assess: (1) the difference of misuse of prescription medications by mobility status, (2) the associations of mobility status with potential correlates of misuse, including unmet care needs, usual source of care, insurance coverage, clinical characteristics, and sociodemographic characteristics, and (3) significant correlates of misuse of prescription medications.

## Methods

### Data source

The data used for this study came from the national survey of Midlife in the United States (MIDUS) conducted in 2011–2014, which assessed well-being as an integrated bio-psycho-social process (Radler, 2014). MIDUS was initiated in 1995/1996 with a Random Digit Dial (RDD) national sample of non-institutionalized, English-speaking US adults aged 24–74 years (MIDUS, 2011). The data were collected with survey and non-survey instruments such as bioindicators and included a wide range of variables pertaining to different scientific topics. The 2011–2014 survey recruited a national probability sample of 3577 adults aged 25–74 years.

### Measurement

#### Mobility disability

Mobility disability was assessed with the question "How much does your health limit you in walking several blocks?" The respondents rated their mobility on the scale: a lot, some, a little, and not at all. Mobility disability was categorized as a dichotomous variable (0 = *no*, 1 = *yes*): participants who reported "a lot of difficulty" were classifed as having mobility disability; otherwise they were classified as having no disability (Chen et al., 2018). Prior research shows that the ability to walk several blocks or a quarter mile was critical for independence of adults living in the community, and it predicted subsequent disability, mortality, and health care costs (Hardy et al., 2011). As a sensitivity analysis, mobility disability was defined as at least some difficulty (a lot, some, or a little difficulty) walking one block, and no disability was defined as otherwise (Tang et al., 2017).

#### Misuse of prescription medications

Misuse of individual medication class was assessed by the question "Did you ever use any of the following substances on your own during the past 12 months?" According to the survey instruction, "on your own" means "either without a doctor's prescription, in larger amounts than prescribed, or for a longer period than prescribed." The four classes of substances were listed as sedatives (barbiturates or sleeping pills; e.g. Seconal, Halcion, and methaqualone), tranquilizers or "nerve pills" (e.g. Librium, Valium, Ativan, and Xanax), analgesics or other prescription painkillers (not including

normal use of aspirin, Tylenol without codeine, and so on, but including use of Tylenol with codeine and other prescribed painkillers like Demerol, Darvon, and Percodan), and Prozac or other similar prescription medications to treat depression. Misuse of each medication class was classified as a dichotomous outcome (0 = *no*, 1 = *yes*). Overall misuse was coded as a dichotomous outcome (0 = *no*, 1 = *yes*) if any misuse of aforementioned medications was present.

### Unmet health care needs and usual source of care

The unmet health care needs were assessed with the question "Was there a time in the past 12 months when you needed medical care but couldn't get it?" The response was a dichotomous variable (0 = *no*, 1 = *yes*). For usual source of care, the respondents were asked where they usually went if they were sick or needed advice about their health. Each source of care was treated as a dichotomous outcome, including private clinic, HMO, public clinic, outpatient hospital, emergency room, urgent care, and other. Another usual source of care measure asked the most often visited health care place as a single variable with 8 categories, including seven aforementioned health care places plus "no usual source."

### Other correlates

Potential correlates with misuse of prescription medication included chronic conditions, including psychiatric disorders, health insurance coverage, and sociodemographic variables. Chronic conditions listed in the survey included cancer, diabetes, heart disease, lung conditions, digestive conditions, bone conditions, bladder problems, gall bladder problems, HIV/AIDS, autoimmune diseases, hypertension, neurological problems, stroke, disease of the mouth, gum and teeth, thyroid conditions, hay fever, migraines, ulcers, hernia, and sleep problems. Each chronic condition was a dichotomous variable (0 = *no*, 1 = *yes*). The number of health conditions was calculated by taking the sum of "yes" to these conditions.

Psychiatric measures included depressed affect, anxiety disorder, and panic attack. MIDUS provided psychometric measures based on clinical evidence (Wang et al., 2000) and derived scales for diagnosis categories. Depressed affect was measured by 7 items with binary responses (0 = *no*, 1 = *yes*). The depressed affect was measured by taking the total number of "yes" responses to these items (range 0–7). For instance, respondents were asked during two weeks in the past 12 months, when they felt sad, blue, or depressed, whether they "lost interest in most things," "felt more tired out or low on energy than usual," or "lost the appetite." The anxiety disorder measure was based on 10 items, such as "Over the past 12 months, how often were you restless because of your worry?" Responses were most days, about half the days, less than half the days, and never. Anxiety disorder was measured as the total number of "most days" out of the 10 items (range 0–10). Panic attack was calculated based on six items with binary responses (0 = *no*, 1 = *yes*). This measure took the sum of "yes" responses (range 0-6). Example survey questions were "when you have attacks, your heart pounds" and "when you have attacks, you have tightness, pain, or discomfort in your chest or stomach."

Current health insurance coverage, mental health insurance coverage, and dental coverage were included as dichotomous variables (0 = *no*, 1 = *yes*). Sociodemographic variables were coded as categorical or continuous, including age (25–34, 35–49, 50–64, 65 and above), gender (male vs. female), race/ethnicity (non-Hispanic White, non-Hispanic black, Hispanic, and other), education (less than high school, high school graduate, some college/trade school, and university degree), household income (in thousands), and marital status (married vs. unmarried).

### Statistical analysis

To examine the difference of misuse of prescription medications among those with mobility disability and those without, first we presented the prevalence of overall misuse (misuse of any of the prescription medications) and misuse in each medication class by mobility status.

Subsequently individuals with mobility disability were compared to others according to each aspect of sociodemographic and clinical characteristics, health care utilization (unmet care needs, usual sources of care, and insurance coverage), and misuse of prescription drugs. Statistical comparisons were conducted with the Chi-Square tests. We then employed a logistic regression model with backward elimination to assess the significant correlates of overall misuse. We did not model misuse of each class of medication due to a very small number of respondents indicating misuse in each type of medication, which would not provide adequate power to detect effects. Because usual sources of care and most often visited health care place were highly collinear, most often visited health care place as a single variable was kept in the selected model. Cases with missing data were excluded. The proportion of missingness for each variable ranged from 0% to 30% except one variable with missingness of 45% (mental health insurance), which was excluded from subsequent modeling. Sociodemographic variables such as age, sex, race, education, and marital status had no or minimum missing (<1%), whereas mobility, income, insurance status, misuse had more than 25% missing values. In the final complete case analysis ($n = 2312$), individuals who were older, non-Hispanic White, married, with higher education, more chronic conditions, or lower psychiatric scores were less likely to be missing ($p < .05$). Prior to backward elimination, the univariate association of each covariate with overall misuse was assessed in a logistic regression model. Covariates with $p$ value < .20 were kept in the final multivariable logistic model for variable selection. Subsequently, covariates were removed by backward selection starting from the one with the largest $p$-value, until all $p$-values were < .05. Multiple imputation (MI) was employed to validate the adjusted models ($N = 20$). The missing values on the outcome variable of overall misuse were not imputed. Each final imputed dataset contained 2597 individuals. MI was performed with the Fully Conditional Specification (FCS): binary logistic regression for

dichotomous variables, multinomial logistic regression for nominal variable with more than 2 categories, and predictive mean matching (PMM) for continuous variables. Backward selection was applied to 20 imputed datasets. The final set of correlates included the variables that remained in all imputed datasets after backward selection (100% inclusion frequency). The estimates from each dataset were combined into the final estimates. Results of this model were expressed as the adjusted odds ratio (AOR) and 95% confidence interval (95% CI). All statistical analyses incorporated post-stratification sampling weights provided by MIDUS and were conducted in SAS version 9.4 (SAS Institute, Inc., Cary, NC). Sensitivity analyses were conducted on the alternative definition of mobility limitation and reported in supplementary tables with complete case analysis and multiple imputation.

## Results

### Mobility-related disparities in medication misuse by survey period

First, misuse of medications by mobility status was compared in the survey sample. Table 1 shows that during 2011–2014, those with mobility disability were more likely to misuse sedatives, tranquilizers, and painkillers compared to their counterparts with no disability. Overall misuse was more pronounced among those with mobility disability (24.6% vs. 10.0%, $p < .0001$). The sensitivity analysis shows that during 2011–4, mobility-restricted individuals had greater misuse in all types of medications and in overall misuse as compared to those without mobility disability (Supplementary Table 1).

### Sociodemographic and clinical characteristics and health care access by mobility status

Correlates of prescription medication misuse were identified with the survey data (effective sample size $n = 2469$ to 2596). First, we show the sociodemographic and clinical characteristics by mobility status in Table 2. Those with mobility disability were more likely to be older (e.g. 30.7% vs. 15.8% aged 65 and above), female (67.0% vs. 52.7%), Non-Hispanic Black (15.0% vs. 8.1%) or Hispanic (7.8% vs. 5.4%), and unmarried (52.9% vs. 34.3%). They had lower education (e.g. 16.7% vs. 6.0% below high school education) and mean income ($44.15k vs. $81.04k) and were more likely to report pain (68.7% vs. 32.4%). They experienced greater (Mean[95%CI]) depressed affect (1.54[1.16, 1.92] vs. 0.63[0.53, 0.72]), anxiety (0.77[0.42, 1.13] vs. 0.23[0.16, 0.29]), and panic disorder (0.59[0.39, 0.80] vs. 0.38[0.32, 0.44]), and reported more health conditions (4.18[3.81, 4.55] vs. 1.74[1.64, 1.84]), as compared to those without mobility disability. Results from the sensitivity analysis were generally consistent with the main analysis results (Supplementary Table 2).

Usual sources of care, the most often visited care place, insurance coverage, and unmet care needs by mobility status derived from the 2011 to 2014 sample are shown in Table 3. Those with mobility disability were more likely to report using the private clinic (82.6% vs. 75.8%), outpatient hospital (11.7% vs. 4.6%) and emergency room (30.5% vs. 15.2%) as their usual sources of health care as compared to those without mobility disability. Conversely, those without mobility disability tended to use HMO and urgent care as their usual sources of care compared to their mobility-restricted counterparts. The most often visited health care place was significantly different by mobility status ($p = .0027$), and those with disability were more likely to choose private clinic (75.5% vs. 68.5%), public clinic (6.5% vs. 5.7%) and emergency room (4.3% vs. 2.1%) as the most visited care place than those without disability. Current insurance coverage, medication coverage, and mental health visits coverage did not differ by mobility status. However, those with mobility disability were under-covered by dental care insurance (44.0% vs. 66.0%, $p < .0001$), and expressed greater unmet health care needs (17.8% vs. 7.0%, $p < .0001$). Results from the sensitivity analysis were largely consistent, except several distinctions: (1) two mobility groups were equally likely to endorse private clinics and HMO as their usual sources of care, (2) those with mobility disability tended to report the public health clinic as a usual source of care, (3) those without mobility disability were more likely to have no usual source of care, (4) and those with mobility disability reported a lack of mental health insurance (Supplementary Table 3).

### Correlates of medication misuse

The significant correlates of prescription medication misuse included mobility disability, marital status, education, most often visited health care place, pain, and depressed affect, as shown in Table 4 (effective sample size n = 2312). Specifically, those with mobility disability had higher adjusted odds of misuse of medications compared to those without the disability, with AOR (95% CI) as 1.78 (1.09, 2.91). Unmarried status and lower education were also associated with misuse. Most often visited health care place as

**Table 1.** Misuse of prescription medications.

| Medication class | Total | No disability n (wt. %) | Disability *n* (wt. %) | *P* value |
|---|---|---|---|---|
| Sedatives | 113 (5.1) | 89 (4.4) | 24 (10.3) | .0006 |
| Tranquilizers | 79 (3.7) | 57 (2.9) | 22 (9.6) | <.0001 |
| Painkillers | 128 (6.0) | 92 (4.6) | 36 (16.6) | <.0001 |
| Depression medications | 37 (2.0) | 28 (1.8) | 9 (3.4) | .1431 |
| Overall | 259 (11.7) | 202 (10.0) | 57 (24.6) | <.0001 |

*Note*: Raw number and weighted percentage (in parentheses) were reported. Overall misuse is defined any misuse in sedatives, tranquilizer, painkillers, and depression medications. Due to missing data on mobility status the effective sample size varied from n = 2584 to 2586.

**Table 2.** Sociodemographic and clinical characteristics by mobility status.

| | | No disability | Disability | *P* value |
|---|---|---|---|---|
| Age *n* (wt %) | 25–34 | 422 (19.3) | 17 (8.8) | < .0001 |
| | 35–49 | 626 (28.1) | 44 (19.2) | |
| | 50–64 | 745 (36.9) | 96 (41.3) | |
| | 65 and above | 525 (15.8) | 121 (30.7) | |
| Sex *n* (wt %) | Female | 1199 (52.7) | 182 (67.0) | < .0001 |
| | Male | 1119 (47.3) | 96 (33.0) | |
| Race *n* (wt %) | Non-Hispanic White | 1902 (82.3) | 213 (75.3) | .0007 |
| | Non-Hispanic Black | 137 (8.1) | 31 (15.0) | |
| | Hispanic | 163 (5.4) | 23 (7.8) | |
| | Other | 101 (4.3) | 7 (1.8) | |
| Marital status *n* (wt %) | Unmarried | 753 (34.3) | 150 (52.9) | < .0001 |
| | Married | 1558 (65.7) | 127 (47.1) | |
| Education *n* (wt %) | Below HS | 76 (6.0) | 36 (16.7) | < .0001 |
| | HS graduate | 382 (29.0) | 89 (45.6) | |
| | Some college / 2 year university | 659 (26.7) | 99 (24.9) | |
| | University | 1198 (38.2) | 54 (12.9) | |
| Income mean (95%CI) | Range 0-300k | 81.04 (78.16, 83.92) | 44.15 (37.17, 51.13) | < .0001 |
| Pain n (wt %) | No | 1585 (67.6) | 75 (31.3) | < .0001 |
| | Yes | 704 (32.4) | 201 (68.7) | |
| Depressed affect mean (95%CI) | Range 0-7 | 0.63 (0.53, 0.72) | 1.54 (1.16, 1.92) | .0029 |
| Anxiety mean (95%CI) | Range 0-10 | 0.23 (0.16, 0.29) | 0.77 (0.42, 1.13) | < .0001 |
| Panic disorder mean (95%CI) | Range 0-6 | 0.38 (0.32, 0.44) | 0.59 (0.39, 0.80) | .0491 |
| Number of Health Conditions Mean (95%CI) | Range 0-15 | 1.74 (1.64, 1.84) | 4.18 (3.81, 4.55) | < .0001 |

*Note*. n (wt %) refers to raw number and weighted percentage (in parentheses) for categorical variables; mean (95%CI) for continuous variables. HS refers to high school. Effective sample size $n = 2469$ to $n = 2596$.

**Table 3.** Usual sources of care, unmet care needs, and insurance coverage by mobility status.

| | | No disability | Disability | *P* value |
|---|---|---|---|---|
| Usual sources of care n (wt %) | Private clinic | 1796 (75.8) | 235 (82.6) | .0337 |
| | HMO | 200 (9.4) | 14 (5.1) | .0316 |
| | Public clinic | 168 (9.3) | 22 (9.9) | .7782 |
| | Outpatient hospital | 101 (4.6) | 30 (11.7) | < .0001 |
| | Emergency room | 318 (15.2) | 79 (30.5) | < .0001 |
| | Urgent care | 444 (18.8) | 31 (11.1) | .0048 |
| | Other | 151 (6.1) | 17 (5.5) | .7323 |
| | None | 125 (5.8) | 8 (3.3) | .1645 |
| Most often visited health care place n (wt %) | Private clinic | 1643 (68.5) | 212 (75.5) | .0027 |
| | HMO | 172 (8.3) | 11 (4.3) | |
| | Public clinic | 103 (5.7) | 16 (6.5) | |
| | Outpatient hospital | 25 (1.0) | 6 (2.6) | |
| | Emergency room | 35 (2.1) | 13 (4.3) | |
| | Urgent care | 103 (4.7) | 2 (0.8) | |
| | Other | 103 (4.3) | 11 (3.6) | |
| | None | 118 (5.3) | 5 (2.5) | |
| Insurance coverage n (wt %) | Current insurance | 2111 (88.9) | 256 (89.6) | .7782 |
| | Dental | 1498 (65.9) | 120 (44.0) | < .0001 |
| | Medication | 1935 (83.0) | 240 (83.9) | .7747 |
| | Mental | 1481 (79.6) | 153 (76.7) | .4270 |
| Unmet Care needs n (wt %) | Yes | 135 (7.0) | 41 (17.8) | < .0001 |

*Note*: *n* (wt %) refers to raw number and weighted percentage (in parentheses). Effective sample size for each variable ranges from $n = 2536$ to 2578.

hospital emergency rooms or public health clinics, as compared to no usual source of care, were both associated with increased risk of misuse of medications, with AOR (95% CI) as 4.18 (1.21, 14.41), and 2.88 (1.06, 7.82), respectively. Compared to no usual source of care, the private clinic as the most often visited care place was not associated with increased medication misuse. In addition, persistent pain and depressed affect increased the risk of misuse, with AOR (95% CI) as 1.76 (1.23, 2.53) and B (95% CI) of 1.14 (1.06, 1.23), respectively. The C-statistic for this model was 0.69. Estimates derived from multiply imputed datasets were close to those derived from the complete case analysis, with AOR (95% CI) of 1.84 (1.18, 2.88) for overall misuse among those with mobility disability versus no disability. The sensitivity analysis however did not select mobility disability and most often visited place of care as significant correlates of misuse in the complete case analysis or MI analysis. We noticed that the *p* value of the place of care was between 0.06 and 0.07 in the MI analysis, and thus was eventually eliminated. The final correlates of misuse from the sensitivity analysis included marital status, education, pain, chronic conditions, and depression (Supplementary Table 4).

## Discussion

This study based on a national probability sample shows that misuse of certain prescription medications (e.g. sedatives and depression medications) differed significantly among individuals with mobility disability compared to those without such disability. Individuals with mobility disability during 2011–14 reported higher risk of misuse of most prescription medication and of overall misuse.

**Table 4.** Correlates of misuse of prescription medications.

| | | Complete case analysis $N = 2312$ | Multiple imputation $N = 2597$ per dataset |
|---|---|---|---|
| | Class | Overall misuse AOR (95% CI) | Overall misuse AOR (95% CI) |
| Mobility disability | Yes | 1.78 (1.09, 2.91) | 1.84 (1.18, 2.88) |
| | No | 1 | 1 |
| Marital status | Married | 1 | 1 |
| | Unmarried | 1.48 (1.05, 2.08) | 1.47 (1.07, 2.03) |
| Education | Below HS | 1.79 (0.87, 3.71) | |
| | HS graduate | 1.79 (1.20, 2.66) | Not included |
| | Some college /2-year University | 1.37 (0.95, 1.97) | |
| | University | 1 | |
| Most often visited health care place | Private clinic | 1.67 (0.72, 3.86) | 1.91 (0.85, 4.28) |
| | HMO clinic | 11.06 (0.37, 3.06) | 11.32 (0.49, 3.58) |
| | Public health clinic | 2.88 (1.06, 7.82) | 3.28 (1.27, 8.48) |
| | Hospital outpatient dept. | 3.20 (0.71, 14.45) | 3.63 (0.82, 16.05) |
| | Hospital emergency room | 4.18 (1.21, 14.41) | 5.41 (1.68, 17.42) |
| | Urgent care center | 0.92 (0.29, 2.99) | 1.17 (0.39, 3.54) |
| | Other | 1.09 (0.36, 3.32) | 1.15 (0.40, 3.30) |
| | No usual place | 1 | 1 |
| Pain | Yes | 1.76 (1.23, 2.53) | 1.83 (1.31, 2.56) |
| | No | 1 | 1 |
| Depressed affect | | 1.14 (1.06, 1.23) | 1.17 (1.09, 1.25) |

*Note*: AOR refers adjusted odds ratio; 95% CI refers to 95% confidence interval. The logistic model uses backward elimination. The C-statistic is 0.69.

Individuals with mobility disability differed in sociodemographic and clinical characteristics and health care from their more mobile counterparts. Consistent with previous research, individuals with mobility restrictions were more likely to be older, racial/ethnic minorities, unmarried, with lower educational attainment, and reported greater depressed affect, anxiety, panic attack, pain, and more chronic health conditions compared to those without mobility limitation (Hennessy et al., 2015; Na et al., 2017). Their usual sources of care were more likely to be the private clinic, outpatient hospital, and emergency room, and less likely to be HMO clinic and urgent care, and their most often visited health care place was more likely to be the private clinic, public clinic, hospital emergency room, as compared to those without mobility disability. The tendency to choose emergency room as their most often visited care place showed that the individuals with mobility disability may have greater unmet care needs. Indeed, these individuals reported having more unmet care needs and were less likely to have dental insurance compared to their counterparts. Mobility disability, unmarried status, pain, depressed affect, the emergency room or public health clinic as the most often visited health care place as compared to no usual source of care were associated with overall prescription medication misuse. These correlates would be a good starting point for intervention of prescription medication misuse.

The reasons for the greater misuse of prescription drugs among those with mobility disability can be multifaceted, including expanded availability of prescription drugs obtained online or from social ties and greater social acceptance (Evans & Sullivan, 2014). It may be a repercussion of increased prescription of opioid pain relievers since the late 1990s, which may have disproportionally affected persons with disabilities, as the medical community was misled by pharmaceutical companies to believe such drugs were non-addictive when they were indeed highly addictive (NIDA, 2018). Individuals with mobility disability may be at increased risk for opioid and depression prescription drug misuse perhaps due to their higher rates of pain and depression than people who do not struggle with such issues (SAMHSA, 2011b); however, more research is needed in this area. Similar to recent research (Leslie et al., 2020), our results indicate individuals with mobility disability are more likely to struggle with prescription drug misuse, warranting the need for primary and secondary prevention with this unique population.

Our study and other research suggest that individuals with mobility disability have unmet care needs (Mahmoudi & Meade, 2015; McClintock et al., 2017; Na et al., 2017), suggesting persistent disparities in health care access and quality between individuals with and without disability. As a result, those with mobility disability are more likely to develop preventable secondary conditions and complications and need hospitalization or emergent care (Iezzoni, 2011; Mahmoudi & Meade, 2015). Iezzoni (2011) posits that structural barriers within the health care system (e.g. lower rates of screening, substandard health care, more difficulty accessing services), stigma, and entrenched socioeconomic disadvantages may contribute to the health disparities experienced by people with mobility disability. Our results further highlight that individuals with disabilities are faced with multiple social and environmental challenges. Within the health system, physical therapy to help with mobility has only been provided on a limited basis and insurance restricted, therefore is less accessible to the marginalized or socioeconomic disadvantaged populations. Outside of the health system, deprived community resources and compromised safety in disadvantaged neighborhoods, which are found to be over-represented by individuals with mobility disability and other marginalized groups (Schmitz et al., 2009), usually do not meet the need for managing chronic conditions and prevent further injuries (Durfey et al., 2019). Such unmet care needs not only worsen disease outcomes, but also exacerbate the mental health and substance use issues as they add to the cumulative stress already experienced among individuals with disability (Turner et al., 2006). As a result, self-medication that leads to greater likelihood of using

illicit drugs and misusing prescription drugs is more likely among these individuals (Broman et al., 2019).

In this study, mobility disability is disproportionately distributed among the elderly, racial/ethnic minorities, and individuals with lower educational attainments. Unmet care needs were disproportionally greater among those with mobility disability. The synergy of these factors exacerbates health disparities within certain vulnerable populations. For example, underlying structural factors (e.g. racism and residential segregation) may expose racial/ethnic minorities to multiple risk factors simultaneously (e.g. compromised health care access and quality and diminished job and educational opportunities) (Iezzoni, 2011; Paradies et al., 2015; Boyd et al., 2020), which increase the risks of disability in these populations or take further toll on the health of individuals with mobility disability.

Regarding the relationship between health care access and medication misuse, the results indicate that the emergency room and public health clinic as the most often visited health care place were associated with overall medication misuse, as compared to no usual source of care. Compared to those without mobility disability, a greater percentage of mobility-restricted individuals reported the private clinic, outpatient hospital, and emergency room as usual sources of care. Thus, having a regular physician and potentially higher availability of prescription medications, did not seem to have an association with greater overall prescription medication misuse, at least during the study period (2011–14), even though a link may well have existed for prescription opioid misuse due to the increased prescriptions in this period. On the other hand, having a regular physician does not mean having health care needs met, so some individuals with mobility disability still had to resort to the hospital and emergency room for regular care, in addition to the private clinic. A variety of factors may disproportionately affect those with mobility disability, such as lack of transportation to the care place, inadequate social support, and low health literacy. Emergency room use is a known factor associated with medication misuse. Data from 355 nonfederal US hospitals that have 24-h emergency departments showed that in 2011, the majority of emergency department visits involving nonmedical use of prescription medications or over-the-counter medications were related to opioids, followed by anxiolytics, sedatives, and hypnotics, and antidepressants (SAMHSA, 2013). The public health clinic as the most often visited care place was also associated with increased risk of medication misuse. The users who rely on public health clinics for routine care are likely to be uninsured or under-insured, low-income, and urban-living (Redelings et al., 2012). Policy makers may further explore the root causes and allocate appropriate resources to these clinics for prevention and treatment purposes.

Our sensitivity analysis showed that having a greater number of chronic conditions was a correlate of medication misuse. According to prior research, having comorbidities and taking multiple medications are major risk factors for misuse of Benzodiazepine (Airagnes et al., 2016). Individuals with mobility disability are likely to have comorbidities and thus may get multiple prescriptions simultaneously from their physicians, which increased their chance of medication misuse. The most often visited care place was excluded from the final model in the last selection step due to its slightly higher $p$ value. The correlates derived from the sensitivity analysis seem inherently coherent with those derived from the main analysis. Nonetheless, we want to point out that the significance of the association between mobility disability and medication misuse can be sensitive to the definition of such disability. In fact, 97.5% of the group that self-reported as having a lot of difficulty walking several blocks (in the main analysis) was nested within the group that self-reported as having at least a little difficulty walking one block (in the sensitivity analysis). Thus, mobility disability defined in the second way (in the sensitivity analysis) may be a broader and more relaxed category.

This study has a few limitations, so the results should be interpreted with caution. Prescription medication misuse and mobility measures were assessed by self-report, which could be biased or under-reported. Using the objective major mobility disability test (400-m walk test), one study found that self-report indices of major mobility disability had high specificity but suboptimal sensitivity (Chen et al., 2018). Although self-report is a convenient measure, especially when time and resources are limited, future study may consider using objective mobility measures. The classification of mobility status was done at a single point in time, which may be inadequate in distinguishing the nature and severity of such disability. Our study adopted the cross-sectional design to identify correlates of misuse, but such design cannot ascertain causality. Although multiple imputation under the assumption of missing at random (MAR) was implemented to account for partial missing data, it is likely that the data were missing not at random (MNAR). Under such circumstances, remedies that account for MNAR data would be desirable. The covariates in the variable selection procedure for overall medication misuse were indicated by the health conditions for misuse of certain medications. For instance, pain is a cause for use of painkillers and depression is a cause for use of depression medications. Thus, both conditions are likely to be correlates of overall misuse. However, our main focus was mobility disability as a correlate of misuse, instead of other covariates.

In summary, this scientific inquiry quantified the association of mobility disability with prescription medication misuse with a national probability sample. We assessed the roles of usual sources of care and unmet care needs in determining prescription medication misuse. The findings will help inform future social and clinical interventions to ameliorate medication misuse among high-risk groups, such as those living with mobility disability and multiple chronic conditions.

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