



Frequency of prescription opioid misuse and suicidal ideation, planning, and attempts



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ABSTRACT

The goal of this study was to examine the relationship between past-year frequency of prescription opioid misuse and past-year suicidal ideation, suicide planning, and suicide attempts. Secondary data analyses were conducted using data from 41,053 participants of the 2014 National Survey of Drug Use and Health. Past-year frequency of prescription opioid misuse was grouped into 4 categories: none, less than monthly (1–11 times), monthly to weekly (12–51 times), and weekly or more (52 times or more). Binomial logistic regression analyses adjusted for demographics, overall health rating, depression, anxiety, and substance use disorders to test the associations between frequency of prescription opioid misuse and suicide-related variables. Compared to those who did not endorse prescription opioid misuse in the past year, prescription opioid misuse was significantly associated with suicidal ideation, suicide planning, and suicide attempts for each frequency of use category in unadjusted models ($p < 0.05$). In adjusted models, frequency of prescription opioid misuse remained significantly associated with suicidal ideation ($p < 0.05$ for each frequency category); however, only the group reporting weekly or more use on average was associated with suicide planning and attempts ($p < 0.05$). The findings provide novel specificity regarding prescription opioid use in relation to suicide-related outcomes further supporting enhanced access to suicide prevention and nonpharmacological approaches to pain management across various settings.

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1. Introduction

Suicide was the 10th leading cause of death in the United States in 2014 and the rate of suicide has increased more than 20% since 1999 (Curtin et al., 2016). Although death by firearm remains the most common method of suicide in the United States, intentional self-poisoning with substances such as prescription opioids account for over 5000 suicides per year (Centers for Disease Control and Prevention (CDC), 2016b). In addition, non-fatal suicide attempts most often involve intentional self-poisoning (CDC, 2016a) and prescription opioids are the most commonly observed means of poisoning among individuals admitted to emergency departments (Xiang et al., 2012). The dramatic increase in opioid

prescriptions (Dart et al., 2015), heightens concerns about their contribution to both unintentional overdose and suicide-related outcomes. Importantly, many individuals taking opioids who overdose may be misclassified as unintentionally overdosing instead of attempting suicide because of the need for evidence that may not be readily apparent to medical examiners or coroners (Rockett et al., 2014).

While possessing prescription opioids equates to de facto access to means of suicide, several other factors may increase suicide risk. For example, prescription opioids may also disinhibit risky, impulsive behavior, which may include attempting suicide (Ilgen et al., 2016). Research has also indicated that taking prescription opioids is associated with both the onset and the recurrence of depression (Scherrer et al., 2016a,b), which may increase suicide risk. Prescription opioid misuse (i.e., using prescription opioids that was not prescribed to the person or that a person took it only for the experience or feeling it caused (Hughes et al., 2016, September)),

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specifically, may be at the heart of these adverse outcomes. Prescription opioid misuse may, in part, represent a proxy for uncontrolled pain, which has been shown to be a risk factor of suicidal ideation, suicide planning, and fatal and non-fatal suicide attempts independent of psychiatric disorders (Tang and Crane, 2006; Ilgen et al., 2013). Prescription opioid misuse is associated with other independent risk factors for suicide including symptoms of anxiety and depression, higher pain intensity, poorer physical health, and sedative/hypnotic/tranquilizer use (Becker et al., 2008; Brower et al., 2011; Druss and Pincus, 2000; Ilgen et al., 2010; Nock et al., 2010; Price et al., 2011).

The relationship between prescription opioid misuse and suicide-related outcomes is not well-described. Borges, Walters and Kessler (Borges et al., 2000) found that suicide attempts were associated with lifetime use and abuse of “analgesics.” However, this study was conducted prior to the dramatic increases in prescription opioid use and associated adverse outcomes (Dart et al., 2015). In addition, it did not assess association between analgesic use and other suicide-related outcomes (e.g., suicidal ideation, suicide planning). One older meta-analysis reported that opioid use disorders are associated with suicide (Wilcox et al., 2004); however, the meta-analysis did not disentangle prescription opioids from illicit substances (e.g., heroin). This is an important distinction given research suggesting that individuals using heroin differ in many respects from those using prescription opioids (e.g., more intravenous drug use, more likely to have hepatitis C, more severe drug use) (Brands et al., 2004; Fischer et al., 2008; Moore et al., 2007; Sigmon, 2006; Subramaniam and Stitzer, 2009).

Two more recent studies have examined the independent relationship between suicidality and prescription opioid misuse in the general US population. Using data from the 2013 National Survey of Drug Use and Health (NSDUH) (Substance Abuse and Mental Health Services Administration, 2014), Ford and Perna (2015) found a bivariate association of past-year prescription opioid misuse and suicidal ideation, but did not assess the relationships after accounting for potential confounders, nor did they examine suicide planning or attempts. Kuramoto et al. (2012) examined data from the 2009 NSDUH to provide a more in-depth analysis examining the associations between suicidality and prescription opioid misuse. They found that past-year prescription opioid use disorder, misuse prior to the past year, and persistent misuse (operationalized as misuse reported in the past year and prior to the past year) were associated with suicidal ideation after accounting for demographics, substance use, and a past-year major depressive episode. There were no significant associations between prior and persistent prescription opioid misuse and suicide attempts among those reporting ideation.

While the extant literature provides important insights into the relationship between prescription opioid use generally, prescription opioid misuse, and suicidality among nationally representative US samples, there are several ways in which the literature can be strengthened and extended. Strengthening and extending the literature is critical because it can help provide evidence that adverse outcomes from prescription opioid misuse encompass not just psychiatric problems, substance use disorders, and unintentional overdose, but also suicidal thoughts and behaviors. An evaluation of the relationship between frequency of prescription opioid misuse and suicidality (i.e., suicidal ideation, suicide planning, suicide attempts) would provide additional nuance relative to crude yes-no assessments of prescription opioid misuse. Research can also further test the robustness of the relationship between frequency of prescription opioid misuse and suicidality by including additional key covariates in analyses. For example,

covariates such as general health and anxiety can be included, given research has supported them as independent risk factors of suicidality (Druss and Pincus, 2000; Nock et al., 2010). Furthermore, assessing associations between suicide planning and prescription opioid misuse would also be an important contribution. Although many individuals attempt suicide without having a plan (Nock et al., 2010), suicide planning is associated with elevated suicide risk and is a key aspect of suicide risk assessment in clinical settings (Assessment and Management of Risk for Suicide Working Group, 2013).

Accordingly, the current study aims to integrate previous research on the relationship between prescription opioid use and suicidality and areas of the literature that could be strengthened (e.g., including more specific information on frequency of use and inclusion of other key covariates). Using data from the 2014 NSDUH, we examined relationships between frequency of prescription opioid misuse and suicidal ideation, suicide planning, and suicide attempts in the past year.

2. Materials and method

2.1. Data source and participants

The most recent publicly available data from the 2014 NSDUH (Substance Abuse and Mental Health Service Agency, 2014) was accessed from ICPSR (<http://www.icpsr.michigan.edu>). The purpose of the NSDUH is to provide current data on the level, patterns, trends, consequences, and at-risk groups of substance use and abuse, for prevention, treatment, and research communities. Methods are detailed elsewhere (Substance Abuse and Mental Health Services Administration, 2014). Briefly, interviewers visited a random sample of households across the United States to increase generalizability of US non-institutionalized, civilian residents aged 12 years and older. Potential participants were provided with a study description, were assured of their confidentiality, and were informed they were free to withdraw at any point during the study during the consent procedures. If participants consented, surveys were administered via laptop and utilized computer-assisted software to increase the confidentiality of participant responses. Participants were compensated \$30 and the response rate was 71.2%. The total sample was 55,271, but 13,600 individuals aged 12 to 17 were removed for the present analysis because they were asked a separate set of suicide-related questions. An additional 618 respondents were not included in the analyses because of missing data leaving a total of 41,053 participants used in the analyses. The current study was approved by the University of Rochester Medical Center Institutional Review Board.

2.2. Variables

2.2.1. Suicide-related variables

Items that assessed respondents' past-year experiences of suicidal ideation, suicide planning, and suicide attempts were examined. Respondents were asked yes-no questions on whether they had seriously thought about trying to kill themselves, made any plans to kill themselves, and if they tried to kill themselves in the past 12 months. Only those endorsing past-year ideation were presented with the item on suicide planning and only those endorsing past-year planning were presented with the item on past-year attempts.

2.2.2. Prescription opioid misuse

Participants were asked if they had ever used pain relievers that

were either “not prescribed” to them or they “took only for the experience or feeling it caused.” The survey clarified that pain relievers did not refer to over-the-counter medications. If a participant indicated that he or she had used pain relievers in this way, an additional set of questions regarding the prescription opioid misuse were asked. To assess past-year frequency of prescription opioid misuse, participants were first asked if it would be easiest to answer the question in days per week, days per month or days per year. A past-year frequency of prescription opioid misuse variable was created based on the number of days in which participants reported misusing prescription opioids. The categories included none (0 times in the past year), less than monthly on average (1–11 times in the past year), monthly to less than weekly on average (12–51 times in the past year), and weekly or more on average (52 times or more in the past year).

2.2.3. General health

Participants were asked to rate their overall health level using the responses poor, fair, good, very good, and excellent. The dataset provided the following categorized responses: poor/fair, good, very good, and excellent.

2.2.4. Psychiatric distress and substance use disorders

Past-year anxiety and depression were identified using the items in which participants were told by a doctor or other medical professional if they had an anxiety disorder or depression in the last 12 months. Substance use was identified using the same methods used to measure prescription opioid misuse as described above and included the following substances: alcohol, hallucinogens, inhalants, stimulants, marijuana, sedatives, and tranquilizers. The dataset provided a variable to identify if participants met the criteria for abuse or dependence for any of the aforementioned substances, including prescription opioids. Endorsing past-year use of any of those substances led to additional questions that mapped onto the 10 *Diagnostic and Statistical Manual 4th Edition-Text Revision* criteria for substance abuse or dependence (American Psychiatric Association, 2000). Respondents were coded as having a substance use disorder if they had at least one affirmative response to one or more of four abuse criteria or three affirmative responses to six dependence criteria. We also examined prescription opioid use disorder separately to examine its unique association with suicide-related variables.

2.2.5. Sociodemographics

Data was collected regarding respondent age (categorized in the dataset as 18 to 25, 26 to 34, 35 to 49, 50 to 64, and 65 years and older), gender (male-female), household income (Less than \$20,000, \$20,000 to \$49,999, \$50,000 to \$74,000, or \$75,000 or higher), and race/ethnicity (White, Black/African American, Native American/Alaskan, Asian, Native Hawaiian/Other Pacific Islander, More than one race, and Hispanic [all races were specified as non-Hispanic]).

2.3. Data analysis

Frequencies and counts were calculated to describe the sample. Unadjusted logistic regression analyses were conducted to assess the bivariate relationships between frequency of prescription opioid misuse and each of the outcomes including suicidal ideation, suicide planning, and suicide attempts in separate models. These logistic regressions were repeated in models adjusting for measures of sociodemographics, overall health, psychiatric distress, and substance use disorders.

3. Results

3.1. Prescription opioid misuse and suicidality among the overall sample

In the overall sample, 5.0% ($n = 2070$) reported past-year suicidal ideation, 1.5% ($n = 617$) reported past-year suicide planning, and 0.7% ($n = 298$) reported a suicide attempt in the past year. Lifetime prescription opioid misuse was reported in 16.7% ($n = 6852$) of the sample, with 4.9% ($n = 1998$) reporting use in the past year. Prescription opioid use disorder was relatively uncommon with 0.9% ($n = 365$) of the sample meeting criteria for abuse or dependence. Among those reporting past-year prescription opioid misuse, 44.9% of the sample reported prescription opioid misuse on 1–11 days in the past year (less than monthly on average), 23.9% reported prescription opioid misuse on 12–51 days in the past year (monthly to weekly on average), and 31.2% reported prescription opioid misuse on 52 days or more in the past year (weekly or more on average). See Table 1 for demographic, physical health, mental health, and opioid-related characteristics by endorsement of suicidal ideation, planning, and attempts.

3.2. Unadjusted associations between prescription opioid misuse and suicidality

In unadjusted analyses, each frequency of prescription opioid misuse category was significantly associated with greater odds of suicidal ideation, planning, and attempt compared to participants reporting no prescription opioid misuse (see Table 2). For those reporting weekly or more prescription opioid misuse on average, odds ratios (OR) were 6.73 for suicide, attempts (95% Confidence Interval [CI] = 4.46–10.16), 5.49 for suicide planning (95% CI = 3.98–7.58), and 4.17 for suicidal ideation (95% CI = 3.36–5.17). See Table 2 for unadjusted OR of each independent variable for suicidal ideation, suicide planning, and suicide attempts, respectively.

3.3. Adjusted associations between prescription opioid misuse and suicidality

Table 3 shows adjusted OR of each independent variable for suicidal ideation, suicide planning, and suicide attempts. Adjusted analyses accounted for key mental health, general health, and sociodemographic characteristics. Although the odds ratios were attenuated, each frequency of prescription opioid misuse category remained significantly associated with suicidal ideation (Less than monthly use on average – OR = 1.52, 95% CI = 1.21–1.91; Monthly to weekly use on average – OR = 1.41, 95% CI = 1.04–1.93; Weekly use or more on average – OR = 1.62, 95% CI = 1.19–2.21). Additionally, the weekly or more on average group was the only frequency category that was significantly associated with suicide planning (OR = 1.76, 95% CI = 1.10–2.84) and suicide attempts (OR = 2.03, 95% CI = 1.11–3.71).

Odds of reported suicidal ideation were at least doubled for fair/poor health (OR = 2.99, 95% CI = 2.51–3.56), depression (OR = 5.15, 95% CI = 4.54–5.84), and past-year substance use disorder (OR = 2.35, 95% CI = 2.09–2.65). We found a similar pattern of results for suicide planning and suicide attempts; however, past-year anxiety (Planning – OR = 2.10, 95% CI = 1.68, 2.61; Attempts – OR = 2.13, 95% CI = 1.55, 2.92) was also associated with more than double the odds of reporting suicide planning and attempts.

4. Discussion

Using the most recently available data from the NSDUH, we

Table 1

Frequency of background characteristics by suicidal ideation, suicide planning, and suicide attempts.

Characteristics	Suicidal Ideation		Suicide Planning		Suicide Attempts	
	No	Yes	No	Yes	No	Yes
	(n = 38983)	(n = 2070)	(n = 40436)	(n = 617)	(n = 40775)	(n = 298)
Age						
65 or older	3519 (9)	65 (3)	3560 (9)	24 (4)	3575 (9)	9 (3)
50–64 years old	5101 (13)	200 (10)	5252 (13)	49 (8)	5286 (13)	15 (5)
35–49 years old	10641 (27)	448 (22)	10957 (27)	132 (21)	11024 (27)	65 (22)
26–34 years old	7895 (20)	352 (17)	8147 (20)	100 (16)	8205 (20)	42 (14)
18–25 years old	11827 (30)	1005 (49)	12520 (31)	312 (51)	12665 (31)	167 (56)
Gender						
Male	18162 (47)	875 (42)	18789 (47)	248 (40)	18927 (46)	110 (37)
Female	20821 (53)	1195 (58)	21647 (54)	369 (60)	21828 (54)	188 (63)
Race/Ethnicity						
White	24442 (63)	1350 (65)	25413 (63)	379 (61)	25631 (63)	161 (54)
Black/African Am.	4622 (12)	205 (10)	4748 (12)	79 (13)	4782 (12)	45 (15)
Native Am./Alaskan	622 (2)	39 (2)	646 (2)	15 (2)	649 (2)	13 (4)
Hawaiian/Pacific Isl.	197 (1)	6 (<1)	201 (1)	2 (<1)	203 (1)	0 (0)
Asian	1715 (4)	75 (4)	1770 (4)	20 (3)	1777 (4)	13 (4)
More than one race	1133 (3)	100 (5)	1205 (3)	28 (5)	1220 (3)	13 (4)
Hispanic	6252 (16)	295 (14)	6453 (16)	94 (15)	6494 (16)	53 (18)
Family Income						
\$75,000 or more	11817 (30)	421 (20)	12130 (30)	108 (18)	12203 (30)	35 (12)
\$50,000–\$74,999	6483 (17)	262 (13)	6685 (17)	60 (10)	6718 (17)	27 (9)
\$20,000–\$49,999	12317 (32)	699 (34)	12810 (32)	205 (33)	12907 (32)	109 (37)
Less than \$20,000	8366 (22)	688 (33)	8811 (22)	243 (39)	8927 (22)	127 (43)
General Health						
Excellent	9405 (24)	259 (13)	9611 (24)	53 (9)	9632 (24)	32 (11)
Very Good	14954 (38)	691 (33)	15454 (38)	191 (31)	1554 (38)	91 (31)
Good	10458 (27)	622 (30)	10897 (27)	183 (30)	10985 (27)	95 (32)
Fair/poor	4166 (11)	498 (24)	4474 (11)	190 (31)	4584 (11)	80 (27)
Past-year anxiety						
No	36344 (93)	1427 (69)	37399 (93)	372 (60)	37587 (92)	184 (62)
Yes	2639 (7)	643 (31)	3037 (8)	245 (40)	3168 (8)	114 (38)
Past-year depression						
No	36321 (93)	1262 (61)	37270 (92)	313 (51)	37421 (92)	162 (54)
Yes	2662 (7)	808 (39)	3166 (8)	304 (49)	3334 (8)	136 (46)
Past-year SUD						
No	35182 (90)	1473 (71)	36253 (90)	402 (65)	36485 (90)	170 (57)
Yes	3801 (10)	597 (29)	4183 (10)	215 (35)	4270 (11)	128 (43)
Past-year prescription opioid use disorder						
No	38706 (99)	1982 (96)	40107 (99)	581 (94)	40409 (99)	279 (94)
Yes	277 (1)	88 (4)	329 (1)	36 (6)	346 (1)	19 (6)
Frequency of past-year prescription opioid misuse						
None	37263 (96)	1792 (87)	38535 (95)	520 (84)	38804 (95)	251 (84)
Less than monthly ^a	788 (2)	110 (5)	863 (2)	35 (6)	886 (2)	12 (4)
Monthly to weekly ^b	413 (1)	64 (3)	458 (1)	19 (3)	468 (1)	9 (3)
Weekly or more ^c	519 (1)	104 (5)	580 (1)	43 (7)	597 (2)	26 (9)

SUD – Substance Use Disorder.

^a Refers to the average number of times used; 1–11 times.^b Refers to the average number of times used; 12–51 times.^c Refers to the average number of times used; 52 or more.

found that frequency of prescription opioid misuse was significantly associated with suicidal ideation, suicide planning, and suicide attempts for each of the frequency categories compared to those not endorsing any past-year prescription opioid misuse in unadjusted models. Odds ratios were somewhat attenuated in the adjusted analyses. In these models, participants reporting any past year misuse were at higher odds of reporting suicidal ideation. In addition, there was a 1.76 OR and 2.03 OR when assessing the association between those reporting weekly or more misuse on average and past-year suicide planning and attempts, respectively, compared to those reporting no use even after accounting for demographics, general health, depression, anxiety, and prescription opioid use disorders, other substance use disorders.

This study meaningfully extends the previous literature base in several ways. First, this study provides a more specific evaluation of past-year prescription opioid misuse and suicidality compared to previous research. For example, using older NSDUH data (Ford and

Perna, 2015; Kuramoto et al., 2012), researchers have importantly found that *any* prescription opioid misuse in the past year was associated with suicidal ideation and suicide attempts in the past year. On the other hand, research has also examined the relationship between *daily* use of illicit opioids (i.e., heroin) and suicide attempts and found no significant association (Darke et al., 2007). Our study provides some middle ground between *any* use and *daily* use as weekly or more frequency of prescription opioid misuse was associated with a greater likelihood of reporting suicidal ideation, planning, and attempts after accounting for covariates. Differences in findings between daily heroin use and frequency of prescription opioids misuse may reflect that the entire sample included individuals using heroin whereas our comparison group was participants who had not used prescription opioids in the past year. Frequency of use has also demonstrated mixed results in the alcohol literature. Studies have found that frequency of use is not associated with suicidal ideation (Mukamal et al., 2007), that it is

Table 2

Unadjusted models examining the associations between demographics, physical health, mental health, and opioid-related characteristics and suicide-related variables.

Characteristics	Suicidal Ideation OR (95% CI)	Suicide Planning OR (95% CI)	Suicide Attempt OR (95% CI)
Age	Reference group: 65 or older		
50–64 years old	2.12 (1.60–2.82)	1.38 (0.85–2.26)	1.13 (0.49–2.58)
35–49 years old	2.28 (1.75–2.97)	1.79 (1.16–2.77)	2.34 (1.17–4.71)
26–34 years old	2.41 (1.85–3.15)	1.82 (1.16–2.85)	2.03 (0.99–4.18)
18–25 years old	4.60 (3.57–5.93)	3.70 (2.44–5.61)	5.24 (2.68–10.25)
Gender	Reference group: Male		
Female	1.19 (1.09–1.30)	1.29 (1.10–1.52)	1.48 (1.17–1.88)
Race/Ethnicity	Reference group: White		
Black/African Am.	0.80 (0.69–0.93)	1.12 (0.87–1.43)	1.50 (1.08–2.09)
Native Am./Alaskan	1.14 (0.82–1.58)	1.56 (0.92–2.62)	3.19 (1.81–5.65)
Hawaiian/Pacific Isl.	0.55 (0.24–1.25)	0.67 (0.17–2.70)	—
Asian	0.79 (0.62–1.00)	0.76 (0.48–1.19)	1.17 (0.66–2.05)
More than one race	1.60 (1.29–1.98)	1.56 (1.06–2.30)	1.70 (0.96–2.99)
Hispanic	0.85 (0.75–0.97)	0.98 (0.78–1.23)	1.30 (0.95–1.77)
Family income	Reference group: \$75,000 or more		
\$50,000–\$74,999	1.13 (0.97–1.33)	1.01 (0.73–1.38)	1.40 (0.85–2.32)
\$20,000–\$49,999	1.59 (1.41–1.80)	1.81 (1.43–2.28)	2.94 (2.01–4.31)
Less than \$20,000	2.31 (2.04–2.61)	3.10 (2.47–3.89)	4.96 (3.41–7.22)
General health rating	Reference group: Excellent health rating		
Very Good	1.68 (1.45–1.94)	2.24 (1.65–3.04)	1.76 (1.18–2.64)
Good	2.16 (1.86–2.50)	3.05 (2.24–4.14)	2.60 (1.74–3.89)
Fair/poor	4.34 (3.72–5.07)	7.70 (5.67–10.46)	5.23 (3.48–7.93)
Past-year anxiety	Reference group: No past-year anxiety		
Yes	6.21 (5.61–6.87)	8.11 (6.87–9.57)	7.35 (5.80–9.31)
Past-year depression	Reference: No past-year depression		
Yes	8.74 (7.93–9.62)	11.43 (9.72–13.44)	9.42 (7.48–11.87)
Past-year SUD	Reference: No past-year SUD		
Yes	3.66 (3.30–4.05)	4.48 (3.78–5.32)	6.51 (5.17–8.22)
Past-year prescription opioid use disorder	Reference: No past-year prescription opioid use disorder		
Yes	6.20 (4.86–7.92)	7.55 (5.30–10.76)	7.95 (4.94–12.81)
Frequency of past-year prescription opioid misuse	Reference: No past-year prescription opioid misuse		
Less than monthly ^a	2.90 (2.37–3.56)	3.01 (2.12–4.26)	2.09 (1.17–3.75)
Monthly to weekly ^b	3.22 (2.47–4.22)	3.07 (1.93–4.90)	2.97 (1.52–5.82)
Weekly or more ^c	4.17 (3.36–5.17)	5.49 (3.98–7.58)	6.73 (4.46–10.16)

Bolded responses represent those odds ratios (OR) significant at $p < 0.05$. OR – Odds Ratios; CI – Confidence Intervals; SUD – Substance Use Disorder.^a Refers to the average number of times used; 1–11 times.^b Refers to the average number of times used; 12–51 times.^c Refers to the average number of times used; 52 or more.

associated with suicidal ideation (Conner et al., 2011), and that it moderates the relationship between drinking intensity and suicidal ideation (Conner et al., 2003). Importantly, these studies examine different substances that are not intended to have therapeutic effects as are prescription opioids.

In contrast to the findings on suicidal ideation, adjusted analyses revealed that only the weekly or more on average group was associated with past-year suicide planning and suicide attempts. This finding may be relevant when considered in the context of cognitive theory of suicide (Rudd et al., 2004). For example, one possibility is that those using more frequently may be at increased risk of suicide attempts because they experience more interpersonal conflict triggering suicidal ideation, negative affect, physical consequences (e.g., sleep disturbance, pain), leading to suicidal behavior. One of many examples is that cessation of use among the most frequent users may result in uncontrolled pain or withdrawal characterized, in part, by dysphoric mood and physical discomfort leading to suicide attempts. Further examination of the relationship between prescription opioid misuse and suicide-related outcomes is needed to clarify these theoretical considerations. While the current study does not provide evidence one way or another for these considerations, it does provide initial evidence of the independent association of frequent use and suicide attempts, warranting further research.

Additionally, when considered in the context of Interpersonal Theory of Suicide, an optimal state for suicide risk is created via an interaction among three key concepts: a perceived sense of burdensomeness, a sense of low belongingness, and the acquired

capacity to enact lethal self-injury (Joiner, 2005). In previous research among individuals with an opioid use disorder undergoing methadone maintenance treatment, researchers were able to distinguish between those with and without a history of suicide attempt using the construct of low belongingness (Conner et al., 2007). Placed in the context of this theory, results from the present study might suggest that frequent prescription opioid misuse may contribute to an increase in one's capacity to enact lethal self-injury through a gradual acclimation to self-harming behavior (i.e., substance use) combined with a low sense of belonging.

Another important consideration is that prescription opioid misuse may reflect or be a proxy of uncontrolled or poorly managed pain, which is also independently associated with suicidal thoughts and behaviors. Unfortunately, there are no questions in the survey that ask about type of pain, pain intensity, or pain interference and we are unable to examine the effect of or control for the variance explained by pain-related variables. Nonetheless, we took several measures to address this limitation given the variables available in the dataset. For example, this highlights the importance of including an overall health rating as a covariate as those with uncontrolled pain report poor health-related quality of life (McCarberg et al., 2008) and chronic health problems are also independently associated with suicide (Druss and Pincus, 2000; Scott et al., 2010). Relatedly, anxiety disorders increase the risk of suicidal thoughts and behaviors (Nock et al., 2010), are associated with prescription opioid misuse (Becker et al., 2008), and are more prevalent among chronic pain patients (McWilliams et al., 2003). The co-occurrence of pain and substance use is relatively high, and

Table 3

Adjusted models examining the associations between demographics, physical health, mental health, and opioid-related characteristics and suicide-related variables.

Characteristics	Model 1: Suicidal Ideation OR (95% CI)	Model 2: Suicide Planning OR (95% CI)	Model 3: Suicide Attempt OR (95% CI)
Age	Reference group: 65 or older		
50–64 years old	1.72 (1.18–2.30)	0.98 (0.60–1.62)	0.80 (0.35–1.85)
35–49 years old	2.11 (1.61–2.76)	1.48 (0.95–2.32)	1.82 (0.90–3.69)
26–34 years old	2.18 (1.65–2.88)	1.47 (0.93–2.34)	1.38 (0.66–2.89)
18–25 years old	4.38 (3.36–5.70)	3.06 (1.98–4.72)	3.43 (1.72–6.85)
Gender	Reference group: Male		
Female	0.95 (0.86–1.05)	0.95 (0.79–1.12)	1.19 (0.92–1.53)
Race/Ethnicity	Reference group: White		
Black/African Am.	0.89 (0.76–1.04)	1.37 (1.05–1.78)	1.67 (1.18–2.38)
Native Am./Alaskan	0.96 (0.68–1.37)	1.34 (0.77–2.34)	2.42 (1.32–4.44)
Hawaiian/Pacific Isl.	0.53 (0.23–1.23)	0.74 (0.18–3.05)	—
Asian	1.17 (0.92–1.50)	1.33 (0.84–2.13)	2.01 (1.12–3.61)
More than one race	1.28 (1.01–1.61)	1.17 (0.77–1.76)	1.21 (0.67–2.18)
Hispanic	0.85 (0.74–0.98)	1.05 (0.83–1.34)	1.33 (0.96–1.84)
Family income	Reference group: \$75,000 or more		
\$50,000–\$74,999	0.98 (0.83–1.16)	0.82 (0.59–1.13)	1.16 (0.70–1.94)
\$20,000–\$49,999	1.22 (1.07–1.39)	1.23 (0.96–1.57)	2.03 (1.37–3.01)
Less than \$20,000	1.33 (1.16–1.53)	1.49 (1.16–1.91)	2.34 (1.58–3.48)
General health rating	Reference group: Excellent health rating		
Very Good	1.39 (1.20–1.62)	1.74 (1.28–2.38)	1.33 (0.88–2.00)
Good	1.72 (1.47–2.01)	2.17 (1.58–2.97)	1.76 (1.16–2.66)
Fair/poor	2.99 (2.51–3.56)	4.28 (3.07–5.95)	2.66 (1.70–4.14)
Past-year anxiety	Reference group: No past-year anxiety		
Yes	1.89 (1.65–2.16)	2.05 (1.64–2.55)	2.09 (1.52–2.88)
Past-year depression	Reference: No past-year depression		
Yes	5.15 (4.54–5.84)	5.92 (4.77–7.35)	4.74 (3.46–6.48)
Past-year SUD	Reference: No past-year SUD		
Yes	2.35 (2.09–2.65)	2.58 (2.13–3.13)	3.91 (3.02–5.05)
Past-year prescription opioid use disorder	Reference: No past-year prescription opioid use disorder		
Yes	1.21 (0.85–1.73)	1.09 (0.64–1.86)	0.88 (0.44–1.80)
Frequency of past-year prescription opioid misuse	Reference: No past-year prescription opioid misuse		
Less than monthly ^a	1.52 (1.21–1.91)	1.44 (0.99–2.10)	0.90 (0.49–1.66)
Monthly to weekly ^b	1.41 (1.04–1.93)	1.12 (0.67–1.89)	0.97 (0.47–2.01)
Weekly or more ^c	1.62 (1.19–2.21)	1.76 (1.10–2.84)	2.03 (1.11–3.71)

Bolted responses represent those odds ratios (OR) significant at $p < 0.05$. OR – Odds Ratios; CI – Confidence Intervals; SUD – Substance Use Disorder.^a Refers to the average number of times used; 1–11 times.^b Refers to the average number of times used; 12–51 times.^c Refers to the average number of times used; 52 or more.

future iterations of the NSDUH should include items asking about respondents' experience with pain.

There are limitations associated with the present study and analyses. A significant percentage of potential respondents opted out of the survey (~30%). In addition, the data set did not allow for the structured assessment of mental health disorders and used DSM-IV criteria for establishing the presence of substance use disorders. The suicide-related variables are limited by the fact that the response tree necessitated that individuals who were planning suicide planners had to be ideators, and that attempters had to be both ideators and planners. This is relevant as prior studies have reported that suicide attempters without a plan differed from those with a plan (Nock et al., 2010). Furthermore, suicidal thoughts and behaviors are relatively uncommon, thus leading to small cell sizes in some cases (e.g., suicide planning and frequency of opioid use). The data is cross-sectional and self-reported so temporal associations between variables cannot be made and the data is susceptible to biases. Additionally, the 2014 NSDUH data does not collect information regarding amount of prescription opioids used. This is a key consideration given that an individual may use prescription opioids once, but take an excessive amount. The 2015 NSDUH has taken this into consideration and an item has been added to assess overuse of prescription opioids (Hughes et al., 2016; September).

The current study used a large, national sample that examined novel relationships between prescription opioid use and suicidal behaviors (i.e., varying categories of use; suicide planning). These findings have implications across several clinical settings including mental health services, primary care, and specialty pain clinics as

mental health may be treated in and/or opioid analgesics may be prescribed out of these settings. Many individuals who are at risk for suicide or die by suicide do not engaged in mental health care. Therefore, the identification of alternative settings from which to identify those at risk is critical. Settings where opioids are prescribed such as pain clinics or primary care may provide unique and timely settings to assess for suicidal thoughts among individuals who may otherwise not directly discuss suicidal thoughts with their healthcare providers. To this end, nonpharmacological strategies for pain management appear to be increasingly important given the adverse effects of opioids and their relationship with suicidal thoughts and behavior. In addition, the assessment and treatment of opioid use disorders or prescription opioid misuse in substance use disorder clinics or other settings (e.g., primary care) may provide a potential forum to assess for or safety plan around suicide as part of a broader approach to addressing mental health and relapse.

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Contributors

Dr. Ashrafioun was involved in all aspects of the data analysis and writing of the manuscript. Drs. Bishop and Conner were

involved with the conceptualization and writing of the manuscript. Dr. Pigeon was involved in the conceptualization of the analysis and the manuscript and was involved in the writing of the manuscript. All authors have approved the final manuscript.

Conflict of interest

WP is on the speaker's bureau for Merck, Sharpe & Dohme; the authors declare no other conflicts of interest. The other authors report no financial or other relationships relevant to the subject of this article.

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