

Original Investigation

Noncancer Pain Conditions and Risk of Suicide

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IMPORTANCE There are limited data on the extent to which suicide mortality is associated with specific pain conditions.

OBJECTIVE To examine the associations between clinical diagnoses of noncancer pain conditions and suicide among individuals receiving services in the Department of Veterans Affairs Healthcare System.

DESIGN Retrospective data analysis.

SETTING Data were extracted from National Death Index and treatment records from the Department of Veterans Affairs Healthcare System.

PARTICIPANTS Individuals receiving services in fiscal year 2005 who remained alive at the start of fiscal year 2006 (N = 4 863 086).

MAIN OUTCOMES AND MEASURES Analyses examined the association between baseline clinical diagnoses of pain-related conditions (arthritis, back pain, migraine, neuropathy, headache or tension headache, fibromyalgia, and psychogenic pain) and subsequent suicide death (assessed in fiscal years 2006-2008).

RESULTS Controlling for demographic and contextual factors (age, sex, and Charlson score), elevated suicide risks were observed for each pain condition except arthritis and neuropathy (hazard ratios ranging from 1.33 [99% CI, 1.22-1.45] for back pain to 2.61 [1.82-3.74] for psychogenic pain). When analyses controlled for concomitant psychiatric conditions, the associations between pain conditions and suicide death were reduced; however, significant associations remained for back pain (hazard ratio, 1.13 [99% CI, 1.03-1.24]), migraine (1.34 [1.02-1.77]), and psychogenic pain (1.58 [1.11-2.26]).

CONCLUSIONS AND RELEVANCE There is a need for increased awareness of suicide risk in individuals with certain noncancer pain diagnoses, in particular back pain, migraine, and psychogenic pain.

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Suicide is the tenth most common cause of death in the United States.¹ The annual age-adjusted rate of suicide mortality in the United States is 11.8 per 100 000,¹ and the rate of nonfatal lifetime serious suicide attempts is approximately 1800 per 100 000.^{2,3} Although a substantial proportion of the research on suicide has focused on the connection between psychiatric disorders and suicide,⁴⁻⁷ a small, but growing, body of literature suggests that chronic pain is associated with suicidal behaviors.⁸

Several studies have demonstrated a link between chronic pain and suicidal ideation, planning, and attempts, while controlling for concomitant psychiatric disorders in population-based⁹⁻¹³ and clinical¹⁴⁻¹⁶ samples. Fewer studies

have examined the relationship between pain and suicide death. In one of the first studies evaluating this relationship, Fishbain and colleagues¹⁷ presented 3 case studies of individuals who were seen in a pain clinic and had died by suicide. They hypothesized that patients who attend pain clinics were at substantially elevated risk for suicide relative to the general population. Several subsequent studies¹⁸⁻²² have found significant associations between some measures of pain and an increased risk of suicide death; however, each study had 1 or more key limitations, including use of a nonrepresentative sample, rudimentary assessments of pain, incomplete adjustment for psychiatric factors, or, in the psychological autopsy study,²¹ the potential for recall

bias. Also, in a case-control study of suicide in individuals older than 65 years, Juurlink and colleagues²³ found that having pain rated as moderate or severe was associated with a greater risk of suicide and that the total number of physical health problems (including pain) was associated with significant risk of suicide mortality.

The extent to which suicide is associated with specific pain conditions has received limited attention. Few studies allow for the comparison between types of self-reported pain and suicidal thoughts and nonfatal suicide attempts. These have found that suicide ideation, plans, and nonfatal attempts are more consistently associated with pain such as headaches and migraines than with pain such as arthritis.⁹⁻¹¹ In addition, migraines¹⁴ and abdominal pain²⁴⁻²⁶ have been associated with nonfatal suicide attempts after controlling for concomitant psychiatric problems. Studies of single pain conditions have reported positive associations between fibromyalgia and suicide death,¹⁸ and a study¹⁹ of Finnish farmers highlighted the potential importance of back pain as a risk factor for suicide. However, despite the fact that the literature contains several studies linking risk of suicide attempt or death to specific pain conditions, comparisons of the risks associated with these pain conditions is difficult because of differences in study designs, pain measures, and the populations examined.

More information is needed to identify the specific pain conditions that are associated with the greatest risk for suicide. This study used data from a large national sample of individuals who received services in the Department of Veterans Affairs (VA) Healthcare System, the Veterans Health Administration (VHA), to evaluate associations between pain-related clinical diagnoses (arthritis, back pain, migraine, headache or tension headache, psychogenic pain, neuropathy, and fibromyalgia) and suicide.

Methods

Study Population

The study population included all individuals who received services in the VHA during fiscal year 2005 (FY05) (October 1, 2004-September 30, 2005) and who were alive at the start of FY06 (N = 4 863 086). Death from suicide was ascertained for all cohort members during the next 3 years (FY06, FY07, and FY08). This project received approval from the Ann Arbor VA Human Subjects Committee.

Data Sources

Data from the VA National Patient Care Database were linked to data from the Centers for Disease Control and Prevention's National Death Index (NDI). The National Patient Care Database was used to identify all individuals who used any VHA inpatient, residential, or outpatient services in FY05 nationally. In addition to information on treatment use, the National Patient Care Database includes demographic characteristics and clinical diagnoses for all treatment contacts of patients seen anywhere in the VHA. The NDI contains data on date and cause of death for US decedents. Prior research²⁷ in-

dicates that, compared with other population-level sources of mortality data, the NDI has the greatest sensitivity in determining vital status.

To fully ascertain death from suicide (see full descriptions of the methods reported by McCarthy et al²⁸ and Ilgen et al²⁹), all members of the cohort were assessed for VHA services use in FY09 or FY10, which followed the end of the observation period (end of FY08). Individuals continuing to use VHA services were assumed to be alive and not included in the NDI search. The NDI searches were conducted for all individuals who received VHA services in FY05, were alive at the start of FY06, and did not have VHA service use in FY09 or FY10. When the NDI search yielded multiple death records as potential matches, the procedures of Sohn and colleagues³⁰ were used to identify true matches. Individuals who had VHA service use in FY05 and died in that year were excluded because they were not at risk for suicide in the observation period (FY06-FY08).

Measures

Primary Outcome: Suicide

The NDI data were used to identify the date and cause of death. Suicide mortality was based on deaths classified by the *International Statistical Classification of Diseases, 10th Revision* codes X60-X84 and Y87.0.³¹

Primary Predictors: Pain Conditions

The primary analyses focused on the association between pain conditions and suicide. Clinical diagnoses of pain conditions were based on *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*³² codes recorded during VHA encounters recorded in the 2 years prior to the observation period (ie, the beginning of FY04 through the end of FY05). The pain diagnoses examined were back pain (*ICD-9-CM* codes 720.0-724.9), arthritis (710.0-739.9, excluding back pain codes), migraines (346.0-346.9), headache or tension headache (784.0 and 307.81), psychogenic pain (307.80 and 307.89), neuropathy (256.60, 355.0, 355.9, 356.0, 357.2, and 357.9), and fibromyalgia (729.1). These indicators were not mutually exclusive; individuals could receive diagnoses in multiple pain categories. The initial selection of these pain conditions was based on the general categories used by Edlund and colleagues (arthritis, back pain, and headache).³³ For greater specificity, headache was divided into 2 categories: (1) migraine and (2) headache or tension headache. In addition, the analyses examined neuropathy, fibromyalgia, and psychogenic pain. These 3 conditions were selected because of either their relatively high prevalence within the VA (neuropathy), their previously established association with suicidal behaviors in the literature (migraine¹⁴), and/or the association of these or similar conditions with other mental health conditions with a previously established association with suicide (fibromyalgia and psychogenic pain³⁴⁻³⁷).

Covariates

Age in years was divided into the following categories to match existing research on suicide risk in veterans²⁸: 18 to 29, 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 to 79, and 80 years or older.

Table 1. Demographic Characteristics and Pain Conditions in VHA Patients

Characteristic	No. (%)		
	Total (n = 4 863 086)	Male (n = 4 460 447)	Female (n = 402 639)
Age, y			
18-29	158 967 (3.3)	110 376 (2.5)	48 591 (12.1)
30-39	245 266 (5.0)	182 128 (4.1)	63 138 (15.7)
40-49	514 083 (10.6)	410 439 (9.2)	103 644 (25.7)
50-59	1 161 916 (23.9)	1 057 552 (23.7)	104 364 (25.9)
60-69	955 689 (19.7)	915 564 (20.5)	40 125 (10)
70-79	1 136 095 (23.4)	1 118 723 (25.1)	17 372 (4.3)
≥80	691 070 (14.2)	665 665 (14.9)	25 405 (6.3)
Arthritis	2 076 514 (42.7)	1 926 375 (43.2)	150 139 (37.3)
Back pain	1 111 187 (22.8)	1 027 928 (23)	83 259 (20.7)
Migraine headache	82 807 (1.7)	57 873 (1.3)	24 934 (6.2)
Headache or tension headache	180 566 (3.7)	153 032 (3.4)	27 534 (6.8)
Neuropathic pain	263 141 (5.4)	253 673 (5.7)	9468 (2.4)
Fibromyalgia	79 359 (1.6)	65 767 (1.5)	13 592 (3.4)
Psychogenic pain	18 145 (0.4)	15 922 (0.4)	2223 (0.6)

Abbreviation: VHA, Veterans Health Administration.

Reliable information on other key factors (eg, race/ethnicity, employment status, marital status, and level of social support) was not available within the electronic medical records data.

Concomitant clinical diagnoses of psychiatric conditions from *ICD-9-CM* codes³² in FY04 to FY05 were included as covariates in multivariable models. On the basis of prior work on psychiatric dysfunction and suicide in veterans,²⁹ the following conditions were examined: depression (293.83, 296.2, 296.3, 296.90, 296.99, 298.0, 300.4, 301.12, 309.0, 309.1, and 311), schizophrenia (295.0-295.9), bipolar disorder (296.0-296.8), substance use disorders (alcohol use disorders or drug use disorders [291, 292, 303.0, 303.9, 304.0-304.9, 305.0, and 305.2-305.9]), posttraumatic stress disorder (309.81), and other anxiety disorders (300.00-300.09, 300.10, 300.20-300.23, and 300.29).

The Charlson Comorbidity Index³⁸ was used to measure medical comorbidity based on *ICD-9-CM* codes. In all models, Charlson scores were recoded as 0, 1, or 2 or more.

Statistical Analysis

All analyses were based on the closed cohort, defined as individuals who used VHA services in FY05 and were alive at the start of FY06. Because of the large sample size, $P < .01$ was used to indicate statistical significance and to emphasize effect sizes. A series of proportional hazards regression models yielded adjusted hazard ratios (HRs) to estimate the risk of suicide for each pain condition after adjusting for age group and sex, as well as the 99% CI for each estimate. A second series of proportional hazards regression models examined the risk of suicide for each pain condition after adjusting for age group, sex, and concomitant psychiatric conditions. Covariance sandwich estimators were used in all models to adjust for the clustered nature of the data, with patients nested within VHA facilities.

Results

Table 1 presents patient demographic and clinical characteristics and the prevalence of pain conditions. Of the pain conditions examined, the most common diagnoses were arthritis (2 076 514 [42.7%]) and back pain (1 111 187 [22.8%]). Psychogenic pain (18 145 [0.4%]) was the clinical diagnosis recorded least frequently. A total of 4823 of the 4 863 086 individuals (0.01%) who used VHA services in FY05 died by suicide in the 3 following fiscal years.

Table 2 describes the association between pain conditions and suicide mortality after controlling for age, sex, and Charlson score. In these analyses, back pain (HR, 1.33; 99% CI, 1.22-1.45), migraine (1.68; 1.28-2.20), headache or tension headache (1.38; 1.17-1.64), fibromyalgia (1.45; 1.16-1.81), and psychogenic pain (2.61; 1.82-3.74) were associated with more substantial risks of suicide death.

Table 3 describes the association between pain conditions and suicide mortality after controlling for age, sex, and Charlson score as well as psychiatric diagnoses (substance use disorders, bipolar disorder, depression, anxiety, posttraumatic stress disorder, and schizophrenia). After controlling for these psychiatric comorbidities, back pain (HR, 1.13; 99% CI, 1.03-1.24), migraine (1.34; 1.02-1.77), and psychogenic pain (1.58; 1.11-2.26) continued to be associated with an increased risk of suicide. The associations of other diagnoses with suicide were no longer statistically significant.

A series of supplementary analyses examined the impact of the number of pain conditions as well as the methods of suicide in patients with pain. First, guided by the finding of Juurlink et al²³ that concomitant physical problems were associated with suicide, we examined the relative impact of different pain conditions in models that included age, sex, Charlson score, and concomitant psychiatric conditions and then

included all pain conditions simultaneously in the same model. The results of this analysis were broadly similar to those reported within Table 3. Specifically, only back pain, migraine, and psychogenic pain were significantly associated with increased risk for suicide in this model. Using a count of the number of pain conditions, we found that 46.9% (n = 2 281 059) of the sample had no pain conditions, 33.2% (n = 1 616 542) had only 1 pain condition, and 19.8% (n = 965 485) had 2 or more pain conditions. We then ran models that controlled for age, sex, and Charlson score as well as additional models that controlled for age, sex, Charlson score, and concomitant psychiatric conditions to examine the impact of count of pain conditions (coded as 0, 1, or ≥2) on risk of suicide. In none of these models was the relationship between number of pain conditions and suicide significant. To better understand the findings related to psychogenic pain, we examined the percentage of patients who had another pain condition. These results indicate that 95.6% (17 349 of 18 145) of those who had psychogenic pain also had diagnoses of 1 or more additional pain conditions.

Overall, in patients with a pain condition who died by suicide (n = 2838), the 2 most common methods of suicide were firearms (67.9% [1928]) and poisoning (16.6% [472]). Examining just pain conditions that were associated with suicide risk in the fully adjusted models in Table 3, the percentages of suicide by firearm and poisoning were broadly consistent with the overall rates for those with back pain (firearms, 64.4% [917 of 1423]; poisoning, 20.0% [284 of 1423]) and psychogenic pain (firearms, 70.6% [36 of 51]; poisoning, 19.6% [10 of 51]). However, the methods of suicide were more evenly distributed in patients with migraine (firearms, 44.1% [56 of 127]; poisoning, 38.6% [49 of 127]).

Discussion

This study sought to examine the associations of specific noncancer pain conditions with risk of suicide in a large national cohort of VHA patients. Most clinical diagnoses of pain conditions were associated with an increased risk for suicide after controlling for demographic characteristics. Several pain diagnoses (migraines, back pain, and psychogenic pain) maintained a statistically significant association with suicide after additional adjustment for psychiatric diagnoses. Of these diagnoses, risk of suicide was greatest for individuals with a diagnosis of psychogenic pain, followed by migraines and back pain.

The observed associations between most of the noncancer pain conditions examined and suicide death were broadly consistent with prior research⁸ linking pain, measured with a variety of methods, with suicidal behaviors. However, most of this prior research^{9-12,14-16} focused on the association between self-reported pain and suicide attempts. The few studies of associations between pain and suicide death examined only one type of pain (ie, back pain¹⁹ or fibromyalgia¹⁸) or used broad measures that failed to distinguish between different types of pain.²⁰⁻²²

A recent study²² of the association between self-report severity of pain and subsequent suicide death in a sample of VHA patients found a significant, although modest, association be-

Table 2. Association Between Pain Conditions and Suicide Mortality Controlling for Age, Sex, and Charlson Score

Diagnosis	Hazard Ratio (99% CI)	P Value
Arthritis	1.08 (0.99-1.18)	.03
Back pain	1.33 (1.22-1.45)	<.001
Migraine	1.68 (1.28-2.20)	<.001
Neuropathy	1.12 (0.97-1.28)	.04
Headache or tension headache	1.38 (1.17-1.64)	<.001
Fibromyalgia	1.45 (1.16-1.81)	<.001
Psychogenic pain	2.61 (1.82-3.74)	<.001

Table 3. Association Between Pain Conditions and Suicide Mortality Controlling for Age, Sex, Charlson Score, and Concomitant Psychiatric Conditions

Diagnosis	Hazard Ratio (99% CI)	P Value
Arthritis	0.95 (0.87-1.04)	.17
Back pain	1.13 (1.03-1.24)	<.001
Migraine	1.34 (1.02-1.77)	.005
Neuropathy	1.01 (0.88-1.16)	.84
Headache or tension headache	1.07 (0.91-1.27)	.28
Fibromyalgia	1.16 (0.92-1.44)	.09
Psychogenic pain	1.58 (1.11-2.21)	<.001

tween pain severity and suicide after controlling for demographic characteristics and concomitant psychiatric disorders. The present study used a similar cohort design in the population of VHA patients during a 3-year period. Study findings suggest that the different associations between pain conditions and suicide may explain why a broad indicator of pain severity (eg, a self-report pain level) was associated with only a modest increase in risk. The most common pain diagnosis among VHA patients, arthritis, was only weakly associated with suicide risk in models controlling for demographic characteristics, and it was not associated with suicide risk after controlling for concomitant psychiatric disorders. These results are similar to prior work⁹ that found no connection between self-report of arthritis and recent nonfatal suicide attempt in a nationally representative sample. In addition, supplementary analyses did not find evidence for a dose-response relationship between the number of pain conditions (coded as 0, 1, or ≥2) and risk of suicide. Taken together, these findings suggest that there may be important differences in types of pain in their associations with suicide risks. Several of the conditions with the largest associations with suicide in the present analyses (eg, psychogenic pain and migraines) are also linked to greater risk of concomitant psychiatric problems.³⁴⁻³⁷ In the present analyses, controlling for concurrent psychiatric diagnoses partially attenuated, yet did not entirely account for, the significant associations between these conditions and suicide.

Several factors may explain why these pain conditions remained associated with suicide after controlling for psychiatric diagnoses. Potentially, diagnoses of psychiatric disorders, in clinical records, may not be sufficiently sensitive to fully control for associated psychiatric problems (ie, residual confounding was present). Perhaps more careful and thorough diagnos-

tic assessments, based on structured clinical interviews, would have more completely accounted for the associations between these pain conditions and suicide.

However, there may be underlying biological mechanisms for pain conditions, such as migraine (eg, serotonergic dysfunction³⁹), that might be associated with increased risk of suicide, even in individuals with subthreshold psychiatric disorders. Patients with these pain conditions also may be more likely to feel hopeless and to have impairments in occupational or social functioning that could lead more directly to suicidal thoughts and behaviors. Negative expectations about one's ability to effectively manage or treat pain could lead to suicidal ideation, and these effects might be greatest for certain conditions, such as psychogenic pain, that do not have clear and/or effective treatments and may be stigmatized. Exposure to painful stimuli over time also has been hypothesized to increase an individual's acquired capacity to engage in suicidal behaviors in the presence of stressors and/or suicidal thoughts.⁴⁰

For psychogenic pain in particular, the ambiguity related to the causes and treatments of the condition may be a core part of the relationship between this diagnosis and increased suicide risk. It is notable that more than 95% of all patients with psychogenic pain also had another pain condition diagnosis. This likely reflects the overall severity of the pain-related problems in those with psychogenic pain as well as a high degree of uncertainty about the appropriate diagnosis based on clinical presentation. However, psychogenic pain was associated with a significantly increased risk for suicide even in supplementary analyses that controlled for other concomitant pain conditions, suggesting that there is something unique in terms of suicide risk about the diagnosis of psychogenic pain beyond just the likelihood of other pain-related problems. It is possible that the burden of having a significant pain condition with an ambiguous cause is particularly difficult for patients, thus increasing their hopelessness, frustration, and risk for suicide. In addition, when treatment providers believe that a patient has pain without a clear cause or that they attribute mostly to a psychiatric problem, they may be less likely to provide active pain treatment in the form of pharmacologic or behavioral interventions. This undertreatment of pain could also increase the risk of suicide over time.

In addition, pain is frequently treated with prescription opioid medications, which may provide patients with the means to make a potentially lethal suicide attempt. However, supplementary analyses of methods of suicide indicate that, for the overall group of VHA patients with pain, most deaths involve the use of a firearm (67.9% of suicides), with poisoning as the second most common method of suicide (16.6% of suicides). This was true for all specific pain conditions with the exception of patients with migraine, who had a more even distribution of suicide by firearm (44.1% of suicides) relative to poisoning (38.6% of suicide). Restriction of lethal means often is listed as a key component of suicide prevention.^{41,42} The present results indicate that means restriction strategies may have different targets and differential effects in certain subsets of patients, such as those with migraines.

Although the present findings did not support a link between the most common pain condition in the VHA, arthritis, and an increased risk of suicide mortality, the second most common pain condition in this sample, back pain, was modestly associated with suicide risk in all models. This is consistent with prior work¹⁹ linking back pain to suicide in Finnish farmers. The general pattern of the findings with arthritis and back pain in the VHA may reflect the difficulty of predicting a rare event (ie, suicide) with predictors that are very common in the population. These conditions likely affect individuals with a wide range of pain severity. Improved measures of severity of arthritis and back pain, or measures of impairment due to the pain, could be important to identify patients with these conditions who are at elevated risk for suicide.

There are several limitations of the present study. The study is based on the national population of all individuals who received VHA health services over the course of a year. This population is predominantly older men, and our study findings may not generalize to other patient populations. Prior research⁷ has consistently established that older men are at greater risk for suicide, and risk factors may function differently in this population. Also, other aspects of the VHA population may have influenced the results. For example, veterans may have greater access to firearms and lower-cost prescriptions, and, as noted previously, these potential means of suicide could influence the likelihood of suicide mortality. These factors could be particularly salient in patients with other risk factors, such as pain, and could strengthen the association between pain and suicide risk in this population. In addition, the analyses focused on clinical diagnoses of physical and mental health conditions, and the reliability and validity of these diagnoses in this population are unknown. In addition, the degree of reliability and validity of the specific conditions may vary among different types of providers (eg, primary care, pain specialty care, and psychiatry). However, the limitations of these indicators of pain conditions in this study make the significant associations between these conditions and suicide more striking. Also, this study analyzed diagnoses as recorded within the VA's National Patient Care Database, which may differ from the specific information reported in the text of the provider's note. The extent to which pain conditions relate to suicide likely varies depending on the timing and severity of the pain condition, which could not be fully modeled in study analyses.

To our knowledge, this study is the largest and most comprehensive analysis to date of associations between noncancer pain and suicide mortality. The findings indicate that associations between pain and suicide differ by the specific pain condition. The most common condition, arthritis, had a modest association with suicide that did not remain significant after controlling for psychiatric comorbidity, whereas some less common conditions, including psychogenic pain and migraines, were significantly associated with increased risk in all models. Providers treating patients with these conditions should be aware of the increased risk for suicide observed with these conditions and note that this risk may not be fully explained by concomitant psychiatric disorders. It may be useful to conduct a thorough suicide risk assessment in these patients and attend to other potential indicators of risk in those with pain, such as hopelessness and suicidal ideation.

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