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Chronic Pain Among Suicide Decedents, 2003 to 2014: Findings From the National Violent Death Reporting System

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Background: More than 25 million adults in the United States have chronic pain. Chronic pain has been associated with suicidality, but previous studies primarily examined nonfatal suicidal behaviors rather than suicide deaths associated with chronic pain or the characteristics of such deaths.

Objective: To estimate the prevalence of chronic pain among suicide decedents in a large multistate sample and to characterize suicide decedents with and without chronic pain.

Design: Retrospective analysis of National Violent Death Reporting System (NVDRS) data. The NVDRS links death certificate, coroner or medical examiner, and law enforcement data collected by investigators, who often interview informants who knew the decedent to gather information on precipitating circumstances surrounding the suicide. Information is abstracted by using standard coding guidance developed by the Centers for Disease Control and Prevention.

Setting: 18 states participating in the NVDRS.

Participants: Suicide decedents with and without chronic pain who died during 1 January 2003 to 31 December 2014.

Measurements: Demographic characteristics, mechanism of death, toxicology results, precipitating circumstances (mental health, substance use, interpersonal problems, life stressors), and suicide planning and intent.

Results: Of 123 181 suicide decedents included in the study, 10 789 (8.8%) had evidence of chronic pain, and the percentage increased from 7.4% in 2003 to 10.2% in 2014. More than half (53.6%) of suicide decedents with chronic pain died of firearm-related injuries and 16.2% by opioid overdose.

Limitation: The results probably underrepresent the true percentage of suicide decedents who had chronic pain, given the nature of the data and how they were captured.

Conclusion: Chronic pain may be an important contributor to suicide. Access to quality, comprehensive pain care and adherence to clinical guidelines may help improve pain management and patient safety.

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More than 25 million adults (11.2%) in the United States have some level of daily pain; 10.5 million (4.6%) have considerable pain every day (1). Chronic pain costs $600 billion annually in medical care and lost productivity (2, 3), exceeding the costs associated with heart disease, cancer, or diabetes (3). Despite this societal toll, these statistics do not describe the effect of chronic pain on each person who has a diminished quality of life (2). The burden of chronic pain is difficult and imprecise to measure and often is undervalued in research, management, prevention, and policy development (2, 4).

Suicide has been increasing since 1999 (5) and is now the 10th leading cause of death in the United States (6). Recent findings suggest that chronic pain is associated with suicide (7, 8), and patients with chronic pain commonly have risk factors for suicide, including comorbid psychiatric conditions (such as depression and anxiety) (9, 10) and access to opioids used to treat chronic pain (7). However, previous studies primarily examined nonfatal suicidal behaviors rather than suicide deaths associated with chronic pain or the characteristics of such deaths (11–14). The purpose of our analysis was to better understand the burden of chronic pain among suicide decedents, thereby providing an indication of one effect that chronic pain may have on individuals and their quality of life.

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METHODS

Data Sources

We analyzed data from 18 states participating in the National Violent Death Reporting System (NVDRS) for at least 1 year from 1 January 2003 to 31 December 2014. The NVDRS, described elsewhere (15), is an active, state-based surveillance system that links data on violent deaths (including suicides) from death certificates, coroner or medical examiner reports, and law enforcement reports into a single incident record (15). Information is abstracted by using standard coding guidance developed by the Centers for Disease Control and Prevention (CDC). The NVDRS defines suicide as a death resulting from the intentional use of force against oneself, classified by the International Classification of Diseases, 10th Revision, cause-of-death codes X60 to X84, Y87.0, and U03 (16). Statewide NVDRS data have been collected in Maryland, Massachusetts, New Jersey, Oregon, South Carolina, and Virginia since

2003; Alaska, Colorado, Georgia, North Carolina, Oklahoma, Rhode Island, and Wisconsin since 2004; Kentucky, New Mexico, and Utah since 2005; Ohio since 2011; and Michigan since 2014.

More than 600 standard variables are coded in the NVDRS, including circumstances identified as directly contributing to the death (such as a physical health problem). Data on these precipitating circumstances often originate from investigators' interviews with informants who knew the decedent. In addition, the NVDRS abstractors enter separate narratives based on reports from both coroners or medical examiners and law enforcement officers to summarize the events of the fatal incident and other pertinent information, including health conditions affecting the decedent.

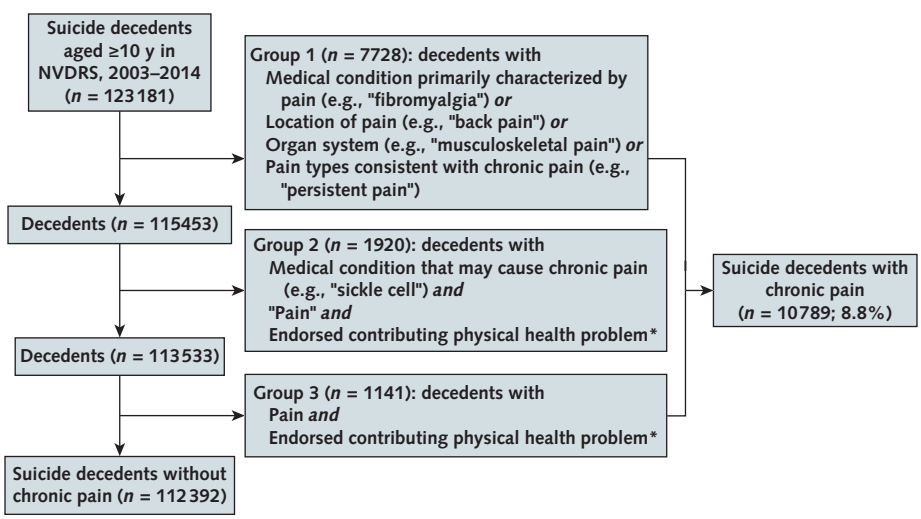
Case Selection

We included decedents aged 10 years or older who died by suicide during 2003 to 2014 in this analysis. We identified cases with evidence of chronic pain by using keyword searches for 120 medical conditions and 9 pain types (allowing for common misspellings) in the coroner or medical examiner and law enforcement narratives. We selected these keywords on the basis of medical conditions and pain types associated with chronic pain from the American Chronic Pain Association (ACPA) (17).

We selected cases 3 ways (**Figure 1**). First, we selected cases that reported at least 1 medical condition primarily associated with chronic pain (such as "fibromyalgia"), pain classified by anatomical location (such as "back pain") or organ system (such as "musculoskeletal pain"), or pain type consistent with chronic pain (such as "persistent pain") (group 1). Second, we selected cases with medical conditions frequently associated with chronic pain, but not necessarily as the primary symptom (such as "sickle cell"), if the keyword "pain" (excluding "emotional" and "acute" pain) also was present and a contributing physical health problem was endorsed (group 2). Third, we selected cases with the keyword "pain" (excluding "emotional" and "acute" pain) and a contributing physical health problem (group 3) to maximize the capture of decedents with chronic pain. "Contributing physical health problem" is a standard NVDRS variable indicating that any physical health condition, such as terminal disease, debilitating condition, or chronic pain, was determined to be a contributing factor. This variable alone is too broad for defining cases of chronic pain but was used in groups 2 and 3 to increase specificity. We separately categorized pain by anatomical structure and medical condition by organ system by using a pain taxonomy prepared by the American Pain Society (18). Decedents may have had more than 1 medical condition in more than 1 pain category.

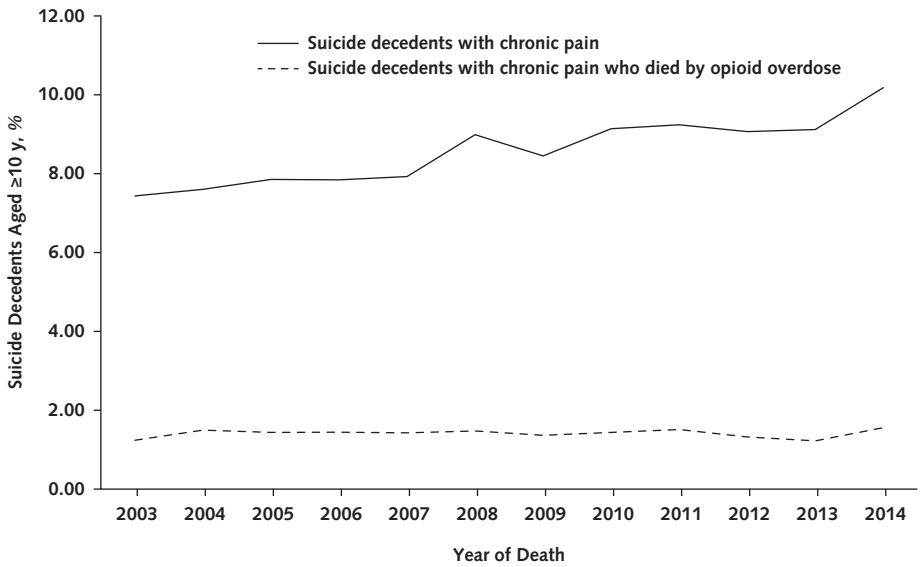
We reviewed the narratives of randomly selected decedents (n = 100 each from groups 1, 2, and 3) by using an iterative approach to further refine and validate our keyword search. Criteria for chronic pain cases were met if the decedent had any of the ACPA medical conditions or pain types described earlier, or if the narrative specifically indicated chronic pain. Cases were excluded if the pain duration was documented as less than 3 months, the described pain referred exclusively to emotional pain, or the condition or pain type described applied to someone other than the decedent. Rater pairs conducted a final review of 216 randomly selected cases (2.0%). Interrater agreement ranged from 92.6% to 96.2% (κ range, 0.63 to 0.65); discrepancies were discussed and coded to consensus. In this analysis, 199 decedents (92.1%) were true cases of chronic pain.

Figure 1. Case selection process for suicide decedents with chronic pain.



NVDRS = National Violent Death Reporting System.
* Circumstance variable indicating that the decedent was having physical health problems (e.g., chronic pain, terminal disease, debilitating condition) that seem to have contributed to the death.

Figure 2. Percentage of suicide decedents with chronic pain aged 10 years or older, by year, in 18 states—NVDRS, 2003–2014.



The solid line indicates the percentage of suicide decedents with chronic pain (all mechanisms). The dashed line shows the percentage of suicide decedents with chronic pain who died by opioid overdose, among all suicides (n = 123 181) during 2003 to 2014. NVDRS = National Violent Death Reporting System.

We also reviewed narratives of a random sample of 200 decedents with chronic pain who left suicide notes to determine whether the notes offered insights regarding the role of pain in precipitating suicide. Pain was determined to be a contributing factor if the suicide note included documentation that the decedent's decision to die by suicide was because of pain. (For coding guidance used for the narrative review of suicide notes, see **Appendix Table 1**, available at Annals.org.)

Measures

We assessed the percentage of suicide decedents with chronic pain over time as well as the subset who died of prescription or illicit opioid overdose. We examined suicide decedents with and without chronic pain by demographic characteristics, mechanism of death, toxicology results, and precipitating circumstances.

Statistical Analysis

We examined the percentage of suicide decedents with evidence of chronic pain over time and used descriptive statistics to examine characteristics of suicide decedents with and without chronic pain across 12 data years (2003 to 2014). We used U.S. Census population data to calculate crude suicide rates per 100 000 persons by age group. Because of small sample sizes during 2003 to 2004, resulting in unstable rates, all reported rates represent annualized averages across 10 data years (2005 to 2014). We used SAS, version 9.3 (SAS Institute), for all analyses.

Role of the Funding Source

This study used data collected as part of routine injury surveillance and was not funded.

RESULTS

During 2003 to 2014, the NVDRS identified 123 181 suicide decedents aged 10 years or older, 10 789 (8.8%) of whom had evidence of chronic pain. The percentage of decedents with chronic pain increased from 7.4% in 2003 to 10.2% in 2014, but the percentage who died by opioid overdose remained low overall (<2.0%) (**Figure 2**).

Table 1 presents 7 pain categories and the 3 most common conditions within each category among suicide decedents with chronic pain. (For a full list of conditions and categories, see the **Appendix and Appendix Tables 2 to 10**, available at Annals.org.) The most common categories were spine pain (24.4%) and musculoskeletal pain (20.8%). The most common conditions were back pain (22.6%), cancer (12.5%), and arthritis (7.9%). More than half (54.4%) of decedents with chronic pain had 1 medical condition, 15.7% had 2 conditions, and 5.7% had 3 or more conditions; the remaining decedents (24.2%) did not have a medical condition noted but had a qualifying keyword in the narrative.

Table 2 presents characteristics of suicide decedents. Those with chronic pain were older on average, and suicide rates increased with age and were highest among those aged 80 years or older. Nearly 1 in 3 suicide decedents (31.9%) with chronic pain were female, as were 21% of those without chronic pain. Of decedents both with and without chronic pain, most were non-Hispanic white (91.7% and 83.6%, respectively). More than a quarter of decedents (27.1%) with chronic pain had ever served in the military. The most common mechanism of death was firearm among de-

cedents with chronic pain (53.6%) and those without it (51.4%), followed by opioid overdose (16.2%), other poisoning (13.3%), and hanging or suffocation (12.9%) among decedents with chronic pain, versus hanging or suffocation (25.6%), other poisoning (11.8%), and opioid overdose (3.9%) among those without chronic pain. Of decedents who had drug testing, 51.9% of those with chronic pain, but only 18.8% of those without it, had results positive for opioids; nearly half (47.2%) of those with and 31.7% of those without chronic pain had results positive for benzodiazepines.

More than half (51.7%) of suicide decedents with and 44.1% of those without chronic pain had a known mental health condition, with depression being the most common diagnosis in both groups. Most suicide decedents were not known to have problematic substance use. Approximately 20% of decedents with chronic pain and 31.2% of those without it had suspected alcohol use at the time of death. Abuse of substances other than alcohol was noted in 17.6% of decedents with and 14.8% of those without chronic pain.

A subset of decedents with chronic pain also were known to have life stressors related to job (10.5%) or financial problems (11.6%) or to interpersonal issues, such as intimate partner problems (16.9%) or an argument preceding the death (7.2%). However, 31.9% of decedents without chronic pain had intimate partner problems, and 12.0% had an argument preceding the death. Nearly one third of decedents with and without chronic pain had recent crises (27.7% and 29.3%, respectively).

Many decedents with and without chronic pain left suicide notes (41.4% and 32.8%, respectively), had a history of suicidal thoughts or plans (39.5% and 31.1%, respectively), had a history of suicide attempts (21.1% and 19.8%, respectively), or disclosed their intent to die by suicide (33.0% and 27.4%, respectively). In a random sample of 200 decedents with chronic pain who left suicide notes, approximately half (47.5%) of the narratives reported the contents of the notes; among these, 67.4% of decedents indicated that a pain condition or pain itself played a role in their decision to die by suicide. In the remaining notes, pain was not mentioned or the extent to which pain was a precipitating factor for the suicide was unclear.

Table 1. Pain Categories and the 3 Most Common Medical Conditions per Category in 18 States–NVDRS, 2003–2014 (n = 10 789)*

Pain Categories and the 3 Most Common Medical Conditions per Category	Value, *n (%)*
Spine pain	2637 (24.4)
Back pain	2441 (22.6)
Degenerative disc disease	135 (1.3)
Spinal stenosis	60 (0.6)
Musculoskeletal pain	2245 (20.8)
Arthritis	855 (7.9)
Fibromyalgia	549 (5.1)
Lower limb pain	203 (1.9)
Disease-associated pain conditions not classified elsewhere	1708 (15.8)
Cancer	1347 (12.5)
Chronic obstructive pulmonary disease	282 (2.6)
Systemic lupus erythematosus	63 (0.6)
Orofacial and head pain	1073 (9.9)
Migraine	559 (5.2)
Headache	500 (4.6)
Temporomandibular joint syndrome	12 (0.1)
Peripheral nervous system	873 (8.1)
Diabetes (including diabetic neuropathy)	531 (4.9)
Neuropathy	122 (1.1)
Herpes zoster and postherpetic neuralgia	78 (0.7)
Abdominal, pelvic, and urogenital pain	404 (3.7)
Abdominal pain	254 (2.4)
Inflammatory bowel disease	54 (0.5)
Pancreatitis	43 (0.4)
Central nervous system	352 (3.3)
Cerebrovascular accident	150 (1.4)
Multiple sclerosis	95 (0.9)
Parkinson disease	57 (0.5)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition in >1 pain category.

DISCUSSION

We found that nearly 9% of suicide decedents in 18 states from 2003 to 2014 had documentation of chronic pain in their incident records and that the percentage of decedents with chronic pain increased during the study period. Our results highlight the importance of pain in quality of life and premature death, and contribute to the growing body of evidence indicating that chronic pain might be an important risk factor for suicide (11–14).

We identified a wide variety of medical conditions and pain types among decedents, with back pain, cancer, and arthritis being the most common. Many chronic pain conditions have been associated with suicidality (9, 19–23), but the strength of association might differ by the specific pain condition (8). We did not stratify by medical condition or pain type when describing the characteristics of decedents, but future research might use the NVDRS to learn more about the pain conditions most strongly associated with suicide.

Establishing the causal role of pain in suicide was beyond our study's scope. However, our results were consistent with the known epidemiology of chronic pain in terms of temporal trends, age, and sex (24). Other factors known to contribute to suicide risk, including interpersonal problems (25) and life stressors (26), were less frequent among decedents with chronic pain, which might indicate that chronic pain was the dominant stressor in this group. Also, although we cannot draw definitive conclusions regarding the proportion of suicides directly attributable to chronic pain, our narrative review of suicide notes suggests that the proportion was not trivial.

The proportion of suicide decedents with chronic pain increased during the study period. Chronic pain has increased in the general population by a similar magnitude (24), which may partially explain this finding.

Table 2. Characteristics of Suicide Decedents in 18 States–NVDRS, 2003–2014 (*n* = 123 181)*

Characteristic	Suicide Decedents With Chronic Pain (*n* = 10 789 [8.8%])		Suicide Decedents Without Chronic Pain (*n* = 112 392 [91.2%])	
	Value, *n* (%)	Rate per 100 000 Persons†	Value, *n* (%)	Rate per 100 000 Persons†
Demographic characteristics				
Median age (IQR), *y*	55 (45–68)	–	45 (31–56)	–
Age group				
10–17 y	63 (0.6)	0.1	3585 (3.2)	3.4
18–29 y	549 (5.1)	0.3	21 884 (19.5)	13.6
30–39 y	1002 (9.3)	0.8	19 025 (16.9)	14.7
40–49 y	2163 (20.0)	1.6	23 713 (21.1)	17.0
50–59 y	2774 (25.7)	2.1	21 926 (19.5)	16.7
60–69 y	1839 (17.0)	2.0	11 274 (10.0)	12.5
70–79 y	1298 (12.0)	2.5	6476 (5.8)	12.3
≥80 y	1101 (10.2)	3.3	4509 (4.0)	13.4
Sex				
Male	7342 (68.1)	–	88 803 (79.0)	–
Female	3447 (31.9)	–	23 582 (21.0)	–
Race/ethnicity				
Non-Hispanic white	9890 (91.7)	–	93 947 (83.6)	–
Non-Hispanic black	236 (2.2)	–	7702 (6.9)	–
Hispanic‡	321 (3.0)	–	5303 (4.7)	–
American Indian/Alaska Native	75 (0.7)	–	1456 (1.3)	–
Asian/Pacific Islander	98 (0.9)	–	1467 (1.3)	–
Other	167 (1.5)	–	2331 (2.1)	–
Ever served in the military§	2722 (27.1)	–	19 961 (20.4)	–
Mechanism				
Firearm	5776 (53.6)	–	57 431 (51.4)	–
Opioid overdose‖	1745 (16.2)	–	4415 (3.9)	–
Other poisoning	1432 (13.3)	–	13 212 (11.8)	–
Hanging or suffocation	1394 (12.9)	–	28 653 (25.6)	–
Other (single method)	422 (3.9)	–	7734 (6.9)	–
Toxicology results¶				
Opioids tested‖	5717 (53.0)	–	50 314 (44.8)	–
Positive results	2936 (51.9)	–	9343 (18.8)	–
Benzodiazepines tested	1197 (44.3)	–	8248 (32.6)	–
Positive results	750 (47.2)	–	3536 (31.7)	–
Alcohol tested	7224 (67.0)	–	72 924 (64.9)	–
Positive results	1744 (24.4)	–	26 229 (36.3)	–
Antidepressants tested	4724 (43.8)	–	41 732 (37.1)	–
Positive results	1821 (39.1)	–	10 781 (26.2)	–
Precipitating circumstances**				
Mental health				
Current diagnosed mental health problem	5541 (51.7)	–	43 815 (44.1)	–
Mental health diagnosis††				
Depression	4536 (81.9)	–	32 698 (74.6)	–
Anxiety disorder	1043 (18.8)	–	4554 (10.4)	–
Bipolar disorder	670 (12.1)	–	6546 (14.9)	–
Other‡‡	655 (11.8)	–	6623 (15.1)	–
Multiple diagnoses§§	1630 (31.4)	–	10 580 (26.8)	–
Current depressed mood	4966 (46.4)	–	40 038 (40.3)	–
Current mental health treatment	4342 (40.5)	–	31 501 (31.7)	–
Substance use				
Suspected alcohol use at time of death	1878 (20.3)	–	25 837 (31.2)	–
Alcohol problem	1536 (14.3)	–	18 054 (18.2)	–
Substance use problem (other than alcohol)	1882 (17.6)	–	14 739 (14.8)	–
Interpersonal problem				
Intimate partner problem	1806 (16.9)	–	31 695 (31.9)	–
Argument or conflict	487 (7.2)	–	7115 (12.0)	–
Life stressor				
Crisis within previous or upcoming 2 wk	2971 (27.7)	–	29 172 (29.3)	–
Job problem‖‖	1115 (10.5)	–	12 805 (13.3)	–
Financial problem	1241 (11.6)	–	11 619 (11.7)	–

Continued on following page

Table 2–Continued

Characteristic	Suicide Decedents With Chronic Pain (*n* = 10 789 [8.8%])		Suicide Decedents Without Chronic Pain (*n* = 112 392 [91.2%])	
	Value, *n (%)*	Rate per 100 000 Persons†	Value, *n (%)*	Rate per 100 000 Persons†
Suicide planning and intent				
Left a suicide note	4432 (41.4)	–	32 608 (32.8)	–
History of suicidal thoughts or plan¶¶	1060 (39.5)	–	6918 (31.1)	–
History of suicide attempt	2259 (21.1)	–	19 709 (19.8)	–
Disclosed suicide intent	3538 (33.0)	–	27 282 (27.4)	–

IQR = interquartile range; NVDRS = National Violent Death Reporting System.
* Data were abstracted from death certificates, coroner/medical examiner reports, and law enforcement reports for suicide deaths in Alaska, Colorado, Georgia, Kentucky, Maryland, Massachusetts, Michigan, North Carolina, New Jersey, New Mexico, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Virginia, and Wisconsin.
† Annualized averages between 2005 and 2014.
‡ Of any race.
§ Percentages represent the proportion of decedents aged ≥18 y with known military service. *n* = 10 062 suicide decedents (93.3%) with chronic pain and 97 928 (87.1%) without chronic pain.
‖ Includes prescription and/or illicit opioids.
¶ Percentages represent the proportion of decedents who had positive results on tests for alcohol and other substances.
** Percentages represent the proportion of decedents with ≥1 precipitating circumstance. *n* = 10 710 suicide decedents (99.3%) with chronic pain and 99 412 (88.5%) without chronic pain.
†† The most common diagnoses are presented. Percentages represent the proportion of decedents with any diagnosed mental health condition.
‡‡ Includes schizophrenia, posttraumatic stress disorder, attention deficit disorder, eating disorder, and obsessive–compulsive disorder.
§§ Includes those with >1 diagnosed mental health condition.
‖‖ Percentages represent the proportion of decedents aged ≥18 y with ≥1 precipitating circumstance. *n* = 10 648 suicide decedents (98.7%) with chronic pain and 96 241 (85.6%) without chronic pain.
¶¶ Added in 2013. Percentages represent the proportion of decedents from 2013 or later. *n* = 2683 suicide decedents (24.9%) with chronic pain and 24 374 (21.7%) without chronic pain.

In general, suicide rates are higher among males and peak in middle age (5). However, suicide rates among decedents with chronic pain increased by age group and remained high among older persons. Health problems late in life are particularly associated with elevated suicide risk (27), and the prevalence of chronic pain, especially severe chronic pain, increases with age (24). Overall, we found considerably more suicides among males than females, regardless of chronic pain status, in agreement with the suicide literature (5). However, the difference was smaller among decedents with chronic pain, consistent with reports that chronic pain is more common in females (24).

Although opioid prescribing to treat chronic pain has increased in recent years (28), we found that the percentage of decedents with chronic pain who died by opioid overdose did not change over time. This finding suggests that increases in opioid availability are not associated with greater suicide risk from opioid overdose among patients with chronic pain. Additional research is needed to explore factors other than opioid availability that might be associated with suicide among persons living with chronic pain. Mental health disorders, particularly depression, were prevalent among decedents with chronic pain, consistent with previous findings (21, 29). Chronic pain and depression have complex and bidirectional associations: Depression is a risk factor for chronic pain (30), and chronic pain, in turn, is a risk factor for depression (31, 32). Disentangling this complexity was not possible in our analysis. However, providers should be alert to and possibly screen for depression and suicidal behaviors among patients with chronic pain (29), especially older patients (27, 29). Indeed, a history of suicidal thoughts, plans, and attempts and disclosure of suicidal intent were more common among decedents with chronic pain than those without it, indicating that opportunities for intervention may have been available.

A recent study suggests that among patients with chronic pain, a belief in a medical cure for their pain may act as a protective factor against suicidal ideation (33). This finding underscores the importance of access to quality, comprehensive pain care and adherence to best practices to improve both pain management and patient safety. The "CDC Guideline for Prescribing Opioids for Chronic Pain," released in 2016, provides recommendations for prescribing opioid pain medication for patients aged 18 years or older in primary care settings (34). The recommendations, based on a systematic review of the existing scientific evidence, focus on the use of opioids in treating chronic pain outside active cancer treatment, palliative care, and end-of-life care (34). The guideline's goal is to ensure that patients receive appropriate treatment for pain while considering the risks and benefits of treatment options (34). Integrated pain management and coordination of primary care, mental health care, and specialist services are essential for these patients. Other guidelines recommend behavioral health consultation for any patient with a history of suicide attempt or psychiatric disorder and advise against initiating opioid therapy during acute psychiatric instability or uncontrolled suicide risk (35).

In addition, the CDC's suicide prevention technical package describes several evidence-based prevention strategies relevant to patients with chronic pain: strengthening economic supports (such as disability benefit programs), strengthening access to and delivery of suicide care (such as mental health insurance coverage), and creating protective environments (such as reducing access to lethal means) (36). More than half

of all suicide decedents, with and without chronic pain, died by firearm, whereas approximately 16% of those with chronic pain died by opioid overdose. Safe storage of firearms might reduce the risk for suicide in this population by separating persons at risk for suicide from easy access to lethal means (36). Safe storage practices may include education and counseling for storing firearms locked in a secure place, unloaded, and separated from ammunition for persons who may be at risk for suicide (36).

This analysis had limitations. First, data were obtained from 18 states and are not nationally representative, and the states included in the study varied over time. Second, our results probably underrepresent the true percentage of suicide decedents who had chronic pain, given the nature of the data and how they were captured. The reliability and validity of the medical diagnoses endorsed in the investigative reports also are unknown. Historically, patient reports and self-reported survey data have been the primary sources for pain estimates (1). Third, our case selection method led to relatively few false-positive results in our narrative review of selected cases, but a small percentage may have been misclassified, especially if pain was not a prominent issue reported by informants who knew the decedent. Fourth, we did not have information to assess pain characteristics, such as intensity and duration, or to determine medical treatment, and we could not distinguish prescription from illicit opioids. Finally, we could not assess other factors commonly associated with chronic pain that affect quality of life, such as disability, sleep disturbance, and in the case of terminal illness, the mental and physical effects of coping with end-of-life concerns.

Chronic pain is a public health problem that has been garnering increased attention since the 2016 publication of "National Pain Strategy: A Comprehensive Population Health-Level Strategy for Pain" (4). Chronic pain also has implications for health care. Providers caring for patients with chronic pain should be aware of the potential increased risk for suicide, and more effort may be needed to diagnose, manage, and treat chronic pain and comorbid mental health conditions. Continued surveillance and research are needed to better understand the burden of chronic pain in the United States.

From Centers for Disease Control and Prevention, Atlanta, Georgia (E.P., R.H., K.A.F., M.K.B., C.G.H., K.Y., C.J.B.).

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Reproducible Research Statement: *Study protocol and statistical code:* Available from Dr. Petrosky (e-mail, xfq7@cdc.gov). *Data set:* Not available; however, eligible researchers who want to conduct their own analyses may access the NVDRS Restricted Access Database at www.cdc.gov/violenceprevention/nvdrs/RAD.html.

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Appendix: Description of the Appendix Tables

The purpose of Appendix Tables 2 through 10 is to provide a comprehensive overview of all the medical conditions and pain categories by anatomical location used in the keyword search for this study, as well as the frequencies of each condition identified. Appendix Table 2 lists all the medical conditions and pain categories by anatomical location included in the keyword search, by decreasing order of frequency. Appendix Table 3 categorizes all the identified medical conditions by organ system and pain by anatomical location, and Appendix Tables 4 through 10 list the medical conditions by each organ system and pain by anatomical location, by decreasing order of frequency.

Appendix Table 1. Suicide Note Narrative Review Coding Manual

Variable	Valid Codes	Definition	Skip Pattern	Examples*
Reason present	y = yes n = no	Decedent included a reason for dying by suicide in the suicide note. The reason may or may not be related to chronic pain.	If code no, stop coding.	Code yes: `In a note to his wife, decedent says he has so much pain and discomfort from his cancer and decided to kill himself because he did not want his children to see him like this.' `Decedent left a note for her ex-boyfriend saying that she was sorry and that she could no longer live without him.' Code no: `Decedent left a note.' (No other information about suicide note is in narrative.) `Decedent left suicide notes and a song consistent with suicidal intent.' (However, content of notes does not include decedent's reason for dying by suicide.) `Decedent left a note for his mother that said he could not go on.'
Direct attribution to pain	y = yes n = no u = unknown	Decedent directly attributes decision to die by suicide to chronic pain.	If code yes or no, stop coding. If code unknown, proceed to #3.	Code yes: `In the notes, she described excruciating pain due to fibromyalgia and said her life was full of misery as a result.' Code no: `Decedent left a note saying his wife recently died, and he could not live without her.' (The reason for dying by suicide is given, but it is unrelated to chronic pain.) Code unknown: `Decedent left several notes indicating that she could not take it anymore.' (It is unclear based on note alone if "it" refers to pain or something else.)
Narrative informs attribution to pain	y = yes n = no u = unknown	Remaining narrative provides enough information to suggest that the decedent's reason for dying by suicide was chronic pain.	Code if answer unknown to #2.	Code yes: `Decedent left notes for his children where he said he was tired of hurting and that his body would not hold out any longer.' (In the same narrative, it says that the decedent `often talked about his back pain.') Code no: `Decedent left several notes indicating that she couldn't take it anymore.' (In the same narrative, it says the decedent had recently lost her job and could no longer afford her diabetes medication. There is no mention of pain.) Code unknown: same note content as "yes" example, but different narrative. `Decedent left notes for his children where he said he was tired of hurting and that his body would not hold out any longer.' (In the same narrative, it states that according to the decedent's brother, `he could not handle the pain of losing his girlfriend' and that his heart failure was preventing him from doing the things he used to do. Decedent is also noted to have arthritis. Thus, it is unclear whether the "hurting" or "body would not hold out any longer" refers to the loss of his girlfriend, heart failure, or arthritis.)

* All examples consist of composite or fictional narratives.

Appendix Table 2. Medical Conditions and Pain by Anatomical Location or Organ System in Suicide Decedents With Chronic Pain Aged ≥10 Years—NVDRS, 18 States, 2003–2014 (n = 10 789)*

Medical Condition and Location of Pain	Value, *n* (%)
Back pain	2441 (22.6)
Injury	1408 (13.1)
Cancer	1347 (12.5)
Arthritis	855 (7.9)
Migraine	559 (5.2)
Fibromyalgia	549 (5.1)
Diabetes (includes diabetic neuropathy)	531 (4.9)
Headache	500 (4.6)
Chronic obstructive pulmonary disease	282 (2.6)
Abdominal pain	254 (2.4)
Lower limb pain (e.g., leg, foot, or ankle pain)	203 (1.9)
Neck pain (includes "neck problem")	186 (1.7)
Gout	166 (1.5)
Cerebrovascular accident (includes "stroke")	150 (1.4)
Degenerative disc disease (includes "degenerative spine disease")	135 (1.3)
Pain syndrome (nonspecific)	126 (1.2)
Neuropathy (includes "neuropathic pain," excludes diabetic neuropathy)	122 (1.1)
Knee pain (includes "knee injury")	105 (1.0)
Hip pain	95 (0.9)
Multiple sclerosis	95 (0.9)
Herpes zoster and postherpetic neuralgia (includes "shingles")	78 (0.7)
Shoulder pain	74 (0.7)
Systemic lupus erythematosus	63 (0.6)
Spinal stenosis	60 (0.6)
Parkinson disease	57 (0.5)
Joint pain (includes "arthralgia")	55 (0.5)
Sciatica	55 (0.5)
Inflammatory bowel disease (ulcerative colitis or Crohn disease)	54 (0.5)
Herniated disc	53 (0.5)
Pancreatitis	43 (0.4)
Scoliosis	42 (0.4)
HIV/AIDS	39 (0.4)
Nerve damage	31 (0.3)
Traumatic brain injury	28 (0.3)
Irritable bowel syndrome	23 (0.2)
Endometriosis	21 (0.2)
Nerve compression	21 (0.2)
Trigeminal neuralgia (includes "tic douloureux")	21 (0.2)
Complex regional pain syndrome (includes "reflex sympathetic dystrophy," "causalgia")	20 (0.2)
Lyme disease	20 (0.2)
Neuralgia (excludes trigeminal neuralgia)	18 (0.2)
Radiculopathy (includes "radicular pain")	17 (0.2)
Chronic fatigue syndrome	17 (0.2)
Muscle pain (includes "myofascial pain")	16 (0.1)
Gallbladder pain	16 (0.1)
Polio	14 (0.1)
Pelvic pain	13 (0.1)
Dystonia	12 (0.1)
Temporomandibular joint disorder	12 (0.1)
Carpal tunnel syndrome	11 (0.1)
Spondylosis	10 (0.1)
Restless leg syndrome	9 (0.1)
Sjögren syndrome	8 (0.1)
Avascular necrosis (includes "osteonecrosis")	7 (0.1)
Spinal cord injury	7 (0.1)
Hand pain	6 (0.1)
Ankylosing spondylitis	6 (0.1)
Pneumothorax (includes "collapsed lung")	6 (0.1)
Sarcoidosis	6 (0.1)
Spina bifida	6 (0.1)
Interstitial cystitis	5 (<0.1)
Polymyalgia rheumatica	5 (<0.1)
Whiplash	5 (<0.1)
Amyotrophic lateral sclerosis	5 (<0.1)
Cerebral palsy	5 (<0.1)
Burning mouth syndrome	–†
Chronic chest pain	–†
Burn injury	–†
Ehlers–Danlos syndrome	–†
Myositis	–†
Autoimmune disease (nonspecific)	–†
Bursitis	–†
Raynaud disease	–†
Arachnoiditis	–†
Dental pain	–†
Musculoskeletal pain	–†
Postlaminectomy syndrome	–†
Connective tissue disease	–†
Polymyositis	–†
Sickle cell disease	–†
Thoracic outlet syndrome	–†
Phantom limb pain	–†
Prostate pain	–†
Vulvodynia	–†
Cauda equina syndrome	–†
Dermatomyositis	–†
Encephalomyelitis	–†
Primary lateral sclerosis	–†
Adiposis dolorosa (e.g., Dercum disease)	0 (0)
Arthrofibrosis	0 (0)
Breakthrough pain	0 (0)
CADASIL	0 (0)
Cerebrospinal fluid leaks	0 (0)
Charcot–Marie–Tooth disease	0 (0)
Corneal neuropathic pain	0 (0)
Erythromelalgia	0 (0)
Failed back surgery syndrome	0 (0)
Hydrocephalus	0 (0)
Intercostal neuralgia	0 (0)
Loin pain hematuria syndrome	0 (0)
Lumbar Stenosis	0 (0)
Medullary sponge kidney	0 (0)
Meralgia paresthetica	0 (0)
Mitochondrial disorder	0 (0)
Nontraumatic joint disorder	0 (0)
Occipital neuralgia	0 (0)
Paget disease	0 (0)
Pinched nerve	0 (0)
Postherniorrhaphy pain syndrome	0 (0)
Postmastectomy pain syndrome	0 (0)
Postthoracotomy pain syndrome	0 (0)
Sacroiliac joint dysfunction	0 (0)
Soft tissue syndrome	0 (0)
Sphincter of Oddi dysfunction	0 (0)
Spinal cerebellum ataxia	0 (0)
Syringomyelia	0 (0)
Tarlov cysts	0 (0)
Torticollis	0 (0)
Transverse myelitis	0 (0)
Vascular pain	0 (0)

CADASIL = cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy; NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition or pain by anatomical location or organ system.
† Value is not reported when number of deaths is <5.

Appendix Table 3. Pain Categories by Organ System and Anatomical Structure in Suicide Decedents With Chronic Pain Aged ≥10 Years–NVDRS, 18 States, 2003–2014 (*n* = 10 789)*

Pain Category	Value, *n* (%)
Spine pain	2637 (24.4)
Musculoskeletal pain	2245 (20.8)
Disease-associated pain conditions not classified elsewhere	1708 (15.8)
Orofacial and head pain	1073 (9.9)
Peripheral nervous system	873 (8.1)
Abdominal, pelvic, and urogenital pain	404 (3.7)
Central nervous system	352 (3.3)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition in >1 pain category. Medical condition was not identified in 2612 decedents (24.2%).

Appendix Table 4. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Spine Pain Category–NVDRS, 18 States, 2003–2014 (*n* = 2637)*

Spine Pain Condition	Value, *n* (%)
Back pain	2441 (92.6)
Degenerative disc disease	135 (5.1)
Spinal stenosis	60 (2.3)
Herniated disc	53 (2.0)
Scoliosis	42 (1.6)
Radiculopathy	17 (0.6)
Spondylosis	10 (0.4)
Ankylosing spondylitis	6 (0.2)
Arachnoiditis	–†
Postlaminectomy syndrome	–†
Failed back surgery syndrome	0 (0)
Lumbar stenosis	0 (0)
Sacroiliac joint dysfunction	0 (0)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.

Appendix Table 5. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Musculoskeletal Pain Category–NVDRS, 18 States, 2003–2014 (*n* = 2245)*

Musculoskeletal Pain Condition	Value, *n* (%)
Arthritis	855 (38.1)
Fibromyalgia	549 (24.5)
Lower limb pain	203 (9.0)
Neck pain	186 (8.3)
Gout	166 (7.4)
Pain syndrome (nonspecific)	126 (5.6)
Knee pain	105 (4.7)
Hip pain	95 (4.2)
Shoulder pain	74 (3.3)
Joint pain	55 (2.5)
Chronic fatigue syndrome	17 (0.8)
Muscle pain	16 (0.7)
Restless leg syndrome	9 (0.4)
Avascular necrosis	7 (0.3)
Hand pain	6 (0.3)
Polymyalgia rheumatica	5 (0.2)
Whiplash	5 (0.2)
Burn injury	–†
Myositis	–†
Bursitis	–†
Raynaud disease	–†
Polymyositis	–†
Musculoskeletal pain	–†
Dermatomyositis	–†
Adiposis dolorosa	0 (0)
Arthrofibrosis	0 (0)
Erythromelalgia	0 (0)
Nontraumatic joint disorder	0 (0)
Paget disease	0 (0)
Soft tissue syndrome	0 (0)
Torticollis	0 (0)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.

Appendix Table 6. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Disease-Associated Pain Conditions Not Classified Elsewhere Category—NVDRS, 18 States, 2003–2014 (*n* = 1708)*

Disease-Associated Pain Condition Not Classified Elsewhere	Value, *n* (%)
Cancer	1347 (78.9)
Chronic obstructive pulmonary disease	282 (16.5)
Systemic lupus erythematosus	63 (3.7)
Lyme disease	20 (1.2)
Polio	14 (0.8)
Dystonia	12 (0.7)
Sjögren syndrome	8 (0.5)
Pneumothorax	6 (0.4)
Sarcoidosis	6 (0.4)
Chronic chest pain	–†
Ehlers-Danlos syndrome	–†
Autoimmune disease (nonspecific)	–†
Connective tissue disease	–†
Sickle cell disease	–†
Mitochondrial disorder	0 (0)
Sphincter of Oddi dysfunction	0 (0)
Vascular pain	0 (0)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.

Appendix Table 7. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Orofacial and Head Pain Category—NVDRS, 18 States, 2003–2014 (*n* = 1703)*

Orofacial and Head Pain Condition	Value, *n* (%)
Migraine	559 (52.1)
Headache	500 (46.6)
Temporomandibular joint disorder	12 (1.1)
Burning mouth syndrome	–†
Dental pain	–†
Corneal neuropathic pain	0 (0)
Hydrocephalus	0 (0)
Occipital neuralgia	0 (0)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.

Appendix Table 8. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Peripheral Nervous System Category—NVDRS, 18 States, 2003–2014 (*n* = 873)*

Peripheral Nervous System Condition	Value, *n* (%)
Diabetes (includes diabetic neuropathy)	531 (60.8)
Neuropathy	122 (14.0)
Herpes zoster and postherpetic neuralgia	78 (8.9)
Sciatica	55 (6.3)
HIV/AIDS	39 (4.5)
Nerve damage	31 (3.6)
Nerve compression	21 (2.4)
Trigeminal neuralgia	21 (2.4)
Complex regional pain syndrome	20 (2.3)
Neuralgia	18 (2.1)
Carpal tunnel syndrome	11 (1.3)
Thoracic outlet syndrome	–†
Phantom limb pain	–†
Charcot-Marie-Tooth disease	0 (0)
Intercostal neuralgia	0 (0)
Meralgia paresthetica	0 (0)
Pinched nerve	0 (0)
Postherniorrhaphy pain syndrome	0 (0)
Postmastectomy pain syndrome	0 (0)
Postthoracotomy pain syndrome	0 (0)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.

Appendix Table 9. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Abdominal, Pelvic, and Urogenital Pain Category—NVDRS, 18 States, 2003–2014 (*n* = 404)*

Abdominal, Pelvic, and Urogenital Pain Condition	Value, *n* (%)
Abdominal pain	254 (62.9)
Inflammatory bowel disease	54 (13.4)
Pancreatitis	43 (10.6)
Irritable bowel syndrome	23 (5.7)
Endometriosis	21 (5.2)
Gallbladder	16 (4.0)
Pelvic pain	13 (3.2)
Interstitial cystitis	5 (1.2)
Prostate pain	–†
Vulvodynia	–†
Loin pain hematuria syndrome	0 (0.0)
Medullary sponge kidney	0 (0.0)

NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.

Appendix Table 10. Medical Conditions by Organ System and Pain by Anatomical Location in Suicide Decedents With Chronic Pain Aged ≥10 Years in the Central Nervous System Category–NVDRS, 18 States, 2003–2014 (*n* = 352)*

Central Nervous System Condition	Value, *n (%)*
Cerebrovascular accident	150 (41.6)
Multiple sclerosis	95 (27.0)
Parkinson disease	57 (16.2)
Traumatic brain injury	28 (8.0)
Spinal cord injury	7 (2.0)
Spina bifida	6 (1.7)
Amyotrophic lateral sclerosis	5 (1.4)
Cerebral palsy	5 (1.4)
Cauda equina syndrome	–†
Encephalomyelitis	–†
Primary lateral sclerosis	–†
CADASIL	0 (0)
Cerebrospinal fluid leaks	0 (0)
Spinal cerebellum ataxia	0 (0)
Syringomyelia	0 (0)
Tarlov cysts	0 (0)
Transverse myelitis	0 (0)

CADASIL = cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy; NVDRS = National Violent Death Reporting System.
* Decedents could have had >1 medical condition.
† Value is not reported when number of deaths is <5.