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Title

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<https://escholarship.org/uc/item/5mw887zz>

Journal

Journal of the American Pharmacists Association, 62(4)

ISSN

1544-3191

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Publication Date

2022-07-01

DOI

10.1016/j.japh.2022.04.013

Peer reviewed



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Contents lists available at ScienceDirect

Journal of the American Pharmacists Association

journal homepage: www.japha.org

RESEARCH

Longitudinal analysis of suicides among pharmacists during 2003–2018

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ARTICLE INFO

Article history:

Received 15 February 2022

Accepted 12 April 2022

Available online 13 May 2022

ABSTRACT

Background: Suicide is one of the leading causes of death worldwide, and estimates of suicide among health professionals are higher than the general population. High rates of suicide among physicians and nurses have been described previously, but there is a lack of data for suicides completed by pharmacists.

Objective: The purpose of this study was to quantify the incidence, means, and characteristics of pharmacist suicides in the United States.

Methods: Data were obtained from the Centers for Disease Control and Prevention's National Violent Death Reporting System (NVDRS) for the years 2003–2018. The dataset contained all suicides, coded by occupation, reported by medical examiners and law enforcement from 39 states and Washington DC and Puerto Rico. Suicide characteristics were compared between pharmacists and nonpharmacists. Age-adjusted rates were calculated for 2004, 2009, and 2014.

Results: During 2003–2018, the NVDRS contained 316 pharmacist suicides compared with 213,146 nonpharmacist suicides. The age-adjusted rates per 100,000 people were 19.6, 20.1, and 18.2 for 2004, 2009 and 2014, respectively. The most common means of suicide was firearm. Associated factors for suicide included job problems, current mental illness treatment, and suicide note.

Conclusion: Suicide rates among pharmacists are higher than the general population. Future research is needed to evaluate the context of job-related problems to mitigate risk. Encouraging help-seeking behaviors to identify and treat pharmacist depression is warranted.

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Background

Suicide is the 17th leading cause of death worldwide with approximately 700,000 deaths by suicide annually.^{1,2} From 1999 to 2017, the age-adjusted suicide rate of the general population in the United States has increased 33% from 10.5 individuals per 100,000 to 14 individuals per 100,000.³ Suicide

among health professionals is estimated to be higher than the general population.^{4,5} Davis et al.⁴ found that suicide was more common among nurses than the general population and female physicians had higher suicide rates than the general population, whereas male physicians have roughly the same rate as the general population. However, physicians⁶ and nurses^{4,7,8} who die by suicide have been found to be 10 years older than the general population and more likely to have a physical illness history along with job problems. Within the nursing profession, both male and female nurses have higher suicide rates than the male and female general population.⁹

Little is known about pharmacist suicide. Outside of the United States, suicides completed by pharmacists have been described in 2 countries. In New Zealand, mortality ratios were elevated for female pharmacists and both male nurses and female nurses.¹⁰ In a Danish study of suicides among medical and related occupational groups, pharmacists, nurses, and physicians had elevated ratios for suicide compared with

Disclosure: The authors declare no relevant conflicts of interest or financial relationships.

Data availability: The National Violent Death Reporting System dataset is available to investigators from the Centers for Disease Control and Prevention.

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<https://doi.org/10.1016/j.japh.2022.04.013>

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Key Points**Background:**

- Suicide is one of the leading causes of death worldwide.
- Suicide rates among nurses and physicians are high.

Findings:

- Rates of suicide among pharmacists are higher than nonpharmacists.
- Most common means of suicide among pharmacists include firearms, poisoning, and hanging/strangulation/suffocation.
- Associated factors for suicide among pharmacists include job problems, current mental illness treatment, and suicide note.

teachers.¹¹ In both New Zealand and Denmark, pharmacologic poisoning was the most common means for suicide. Pharmacists are among the most visible and accessible front-line health workers in the community, but suicide data among pharmacists in the United States have not been published to date. Previous studies in nurses and physicians suggest that pharmacists may also be at higher risk. Increasing awareness and knowledge of suicides among pharmacists are the first steps to developing interventions to prevent this potential tragedy.

Objectives

In this report, we aim to describe the incidence and characteristics of pharmacist suicide and present potential strategies for suicide prevention for pharmacists.

Methods*National Violent Death Reporting System sample*

The Centers for Disease Control and Prevention's (CDC) National Violent Death Reporting System (NVDRS) is a surveillance system that pools suicide data collected from death certificates, medical examiners and law enforcement reports, and toxicology results into an anonymous database by state. The NVDRS is a restricted dataset provided by CDC that contains all suicides reported by the medical examiners from 2003 to 2018. At the time of the study, the 2003–2018 data were available for analysis. The dataset provides an opportunity to explore pharmacists who died by suicide in the United States. Access was granted through a data use agreement that was completed by all team members. Descriptive statistics of all pharmacists in the dataset were calculated. Focused analyses were performed for the years 2004, 2009, and 2014 where denominator workforce data were available for comparison. The total number of states reporting into the dataset started with 13 in 2004, then 16 in 2009, and finally 18 states in 2014. The 2003–2018 dataset contained all suicides reported by medical examiners from 39 states and Washington, DC, and

Puerto Rico (AL, AK, AZ, CA, CO, CT, DC, DE, GA, IL, IN, IA, KS, KY, LA, MA, ME, MD, MI, MN, MO, NE, NV, NH, NC, NJ, NM, NY, OH, OK, OR, PA, PR, RI, SC, UT, VA, VT, WA, WI, and WV).

The following available variables from the NVDRS were used to characterize the nature of suicides among pharmacists: age, gender, race, ethnicity, marital status, injury at work, medication, suspected substance use including alcohol, means of suicide, toxicology findings for medications, toxins, substances of abuse, current or history of mental health or substance use disorders or diagnosis, relationship or interpersonal problems, suicide attempt history, legal problems, physical health problems, occupational problems, financial problems, recent suicide of a friend/family, death of a friend/family, recent crisis, past abuse history, history of suicidality, and substance or medication at time of suicide. Interested readers can find full descriptions of all variables in the NVDRS codebook.¹²

Occupation codes

The study team used a method successfully deployed to isolate physician and nurse data from the NVDRS dataset in previous studies.^{6,8} The occupation code reported in the NVDRS was used in conjunction with free text entered into the database for occupation. Two investigators manually reviewed the free text fields to identify pharmacists. First, the occupation column was sorted alphabetically, and then the search function was used using the word “pharm.” Next, the column was scanned row by row to detect other derivatives of the terms. The medical examiner and law enforcement narrative fields were also reviewed to confirm the occupation code. Another term that was considered a derivative term of “pharm” was “druggist.” Of note, pharmacy technicians, student pharmacists, and pharmacy interns were excluded from this analysis. The final list was critiqued by other members of the research team.

Deaths missing occupation data and whose investigational narratives made no indication the decedent was a pharmacist were considered nonpharmacists. Decedents with missing gender were excluded from the analysis. Decedents with missing age were only excluded from the statistical analysis that specifically evaluated age.

Denominators

Denominators of pharmacists were obtained from the National Association of Boards of Pharmacy (NABP) using the number of pharmacists with “in-state addresses” for most states to avoid duplication of individuals with multiple licenses.^{13–28} Four states only reported total number of licensed pharmacists regardless of residence. Denominators represent active licensed practitioners (not necessarily employed). Gender and age data were estimated from the National Pharmacist Workforce Surveys (NPWS) during 2004, 2009, 2014, and 2019.^{29–31} The NPWS have only been administered and collected during 2004, 2009, 2014, and 2019. Gender and age were not available through the NABP census data for 2003, 2005–2008, 2010–2013, and 2015–2018. Where comparisons were made between pharmacists and the nonpharmacists, the denominator was age matched for years of age (≥ 22 for pharmacists given that the

Table 1
Suicide methods among pharmacists and nonpharmacists (2003-2017)

Method	Occupation		P value ^a
	Pharmacists (n = 269), n (%)	Nonpharmacists (n = 180,670), n (%)	
Firearm	134 (49.8)	92,578 (51.0)	1.00
Poisoning	79 (29.4)	30,366 (16.7)	< 0.001
Hanging, strangulation, suffocation	35 (13.0)	44,495 (24.5)	0.007
Drowning	7 (2.60)	1919 (1.06)	0.495
Sharp instrument	6 (2.23)	3648 (2.01)	1.00
Fall	5 (1.86)	3678 (2.03)	1.00
Motor vehicle	2 (0.74)	1108 (0.61)	1.00
Other transport vehicle	1 (0.37)	1289 (0.71)	1.00
Fire or burns	0	800 (0.44)	1.00
Unknown	0	320 (0.18)	1.00
Other	0	282 (0.16)	1.00
Blunt instrument	0	102 (0.06)	1.00
Nonpowder gun	0	35 (0.02)	1.00
Explosives	0	21 (0.01)	1.00
Intentional neglect	0	22 (0.01)	1.00
Biological weapons	0	3 (0)	1.00
Personal weapons	0	4 (0)	1.00

Note: Other includes taser, electrocution, and nail gun. Unknown includes methods that were uncoded or not available.

^a Adjusted by Holm-Bonferroni correction.

percentage of licensed pharmacists during 2014-2019 aged < 22 years ranged from 0.6% to 2.56%).³²

Adjusted rate calculation

Age-adjusted suicide rates were calculated with participating NVDRS states for 2004, 2009, and 2014, with the pharmacist population restricted to participating NVDRS states for the respective years. The number of pharmacists licensed in each state was obtained from NABP, and pharmacist counts by age group (5-year bins) were obtained from the NPWS. Age-adjusted suicide rates were calculated according to the standard age adjustment procedure, with the proportion of pharmacists in each age group for each year calculated from the age distributions. Owing to the small number of pharmacist suicides, we did not calculate gender-specific suicide rates.

Data analysis

Suicide characteristics were compared between pharmacist and nonpharmacist (overall and stratified by gender) occupation groups with the Pearson chi-squared tests with Yates' correction for categorical variables and a 2-sample *t* test for continuous variables (i.e., age differences). Unconditional maximum likelihood estimates (Wald) of odds ratios (ORs) and their 95% CI were calculated for binary categorical characteristics using the epitools R package.³³ Age-adjusted suicide rates for pharmacists were calculated per 100,000 pharmacists in the years for which data were available (2004, 2009, and 2014).

Descriptive statistics were used to characterize demographics of suicides between pharmacists and nonpharmacists. Means of suicide, factors associated with suicide, and substances contributing to suicide death were compared between pharmacists and nonpharmacists using the Pearson chi-squared tests with Yates' correction. We corrected for multiple hypothesis testing using a Holm-Bonferroni correction. Detailed analysis of substances used as a mean for

pharmacologic poisoning is reported with descriptive statistics. Owing to reporting and data harmonization differences for death causes between the 2003-2017 dataset and the 2018 dataset, means of suicide (Table 1) are only reported for the years 2003-2017 in this work.

Ethics

This project was exempted from investigational review board oversight (#170165) because it is a study of deceased deidentified humans. CDC's NVDRS department provided ethical oversight for use of these data.

Results

Demographics

During 2003-2018, there were 316 suicides by pharmacists in the NVDRS dataset compared with 213,146 for nonpharmacists (Table 2). Of the 316 pharmacists who died by suicide, 75% were men and 85% were white. The mean age of pharmacists was 53.5 (SD = 15.7) years compared with 49.0 (SD = 16.7) for nonpharmacists ($P < 0.001$). The total number of pharmacist deaths in the targeted years where denominator data were available were as follows: 2004 (n = 12), 2009 (n = 16), and 2014 (n = 16).

Incidence

The age-adjusted rates for pharmacist suicides in 2004, 2009, and 2014 were 19.6, 20.1, and 18.2, respectively, per 100,000.

Means of suicide

Of the 316 suicides among pharmacists in the 2003-2018 dataset, the most common means of suicide were firearm (134, 49.8%) followed by poisoning (79, 29.4%) and hanging/

Table 2
Demographics

Characteristic	Pharmacist (N = 316)	Nonpharmacist (N = 213,146)
Gender, n (%)		
Female	79 (25.0)	47,480 (22.3)
Male	237 (75.0)	165,666 (77.7)
Ethnicity (%)		
White	268 (84.8)	189,051 (88.7)
Black/African American	16 (5.06)	12,773 (5.99)
Asian/Pacific Islander	22 (6.96)	4056 (1.90)
American Indian/Alaska Native	4 (1.27)	2394 (1.12)
Two or more races	4 (1.27)	2826 (1.32)
Other/unspecified/unknown	2 (0.633)	2046 (0.96)
Age, y, mean ± SD	53.5 ± 15.7	49.0 ± 16.7

strangulation/suffocation (35, 13.0%) (Table 1). Compared with nonpharmacists, the use of firearms was similar to nonpharmacists (49.8% vs. 51.0%, $P > 0.999$) but poisoning was more common among pharmacists (29.4% vs. 16.7%, $P < 0.001$), and hanging, strangulation, or suffocation was more common among nonpharmacists (13.0% vs. 24.5%, $P = 0.007$).

The most common substances implicated in those who died by poisoning were opioids, benzodiazepines, antidepressants, and alcohol (Table 3). Compared with nonpharmacists, 5 types of substances that were statistically significant associated with suicides by pharmacists were antidepressants, barbiturates, benzodiazepines, nonbenzodiazepine sedatives, and opioids.

Characteristics associated with suicide

When comparing suicides between male and female pharmacists, male pharmacists were more likely to have a physical health problem associated with the suicide (OR 2.81 [OR range: 1.28–6.19], $P = 0.238$), but this difference was not

statistically significant. Male pharmacists were significantly less likely to have a history of suicide attempt (OR 0.34 [OR range: 0.18–0.62], $P = 0.018$) compared with female pharmacists. Male pharmacists were less likely to have a recorded mental health problem, current mental illness treatment, history of mental illness treatment, history of suicide thoughts, or recent suicide of family or friend; however, these were not statistically significant.

When comparing pharmacists and nonpharmacists, job problems were the most significant features associated with suicide (OR 1.77 [OR range: 1.32–2.37], $P = 0.011$) (Table 4). Other significant associations among pharmacists compared with nonpharmacists were current mental illness treatment ($P = 0.008$) and suicide note ($P = 0.009$).

Discussion

To our knowledge, this is the first study to describe pharmacist suicides in the United States and confirms there is a higher suicide rate in this group of health professionals than nonpharmacists. The age-adjusted rate of suicides among pharmacists per 100,000 during 2004, 2009, and 2014 was higher than the suicide rate reported in the general population and consistent with other studies that were not based in the United States.³ In a Danish case population-based registry study, the crude age- and gender-adjusted rate ratio for suicide among pharmacists compared with teachers (comparison group) was 1.91 (95% CI 1.26–2.87).¹¹ The crude rate ratios of suicides were higher for female pharmacists (2.06 [95% CI 1.12–3.79]) than male pharmacists (1.79 [95% CI 1.03–3.12]), which was consistent with other occupations. In another study using national occupational mortality statistics in England and Wales, researchers found that pharmacists were ranked fourth in the highest suicide rates per 100,000 during 1979–1980 and 1982–1983 (suicide rate of 46.3 per 100,000 worker-years).³⁴

Table 3
Detailed methods of suicide by substance

Substance	Pharmacist (N = 316), n (%)	Nonpharmacist (N = 213,146) n, (%)	P value ^a
Alcohol	61 (19.3)	38,453 (18.0)	> 0.999
Anticonvulsants	16 (5.06)	6323 (2.97)	0.452
Antidepressants	68 (21.5)	27,022 (12.7)	< 0.001
Antihistamine	10 (3.16)	11,248 (5.28)	> 0.999
Antipsychotics	11 (3.48)	5398 (2.53)	> 0.999
Acetaminophen	10 (3.16)	5087 (2.39)	> 0.999
Barbiturates	19 (6.01)	4617 (2.17)	< 0.001
Benzodiazepines	69 (21.8)	30,438 (14.3)	0.002
Caffeine	11 (3.48)	7254 (3.40)	> 0.999
Diverted substances	2 (0.63)	965 (0.45)	> 0.999
Inhalants	9 (2.85)	5941 (2.79)	> 0.999
Miscellaneous	25 (7.91)	11,466 (5.38)	0.604
Muscle relaxants	4 (1.27)	3329 (1.56)	> 0.999
Nicotine	5 (1.58)	6161 (2.89)	> 0.999
Nonbenzodiazepine sedatives	14 (4.43)	3266 (1.53)	< 0.001
Opioids	118 (37.3)	46,575 (21.9)	< 0.001
Poison	16 (5.06)	6590 (3.09)	0.604
Stimulants	20 (6.33)	11,834 (5.55)	> 0.999
Substances of abuse	12 (3.80)	13,417 (6.29)	0.812
Tetrahydrocannabinol/marijuana/cannabis	10 (3.16)	13,024 (6.11)	0.452
Unknown	8 (2.53)	3699 (1.74)	> 0.999

Note: Individuals could have been exposed to more than one substance.

^a Adjusted by Holm-Bonferroni correction.

Table 4

Factors associated with suicide among pharmacists compared with non-pharmacists (n = 316)

Factor	OR	OR range	P value ^a
Job problem	1.77	1.32–2.37	0.011
Current mental illness treatment	1.56	1.24–1.96	0.008
Suicide note	1.53	1.22–1.92	0.009
Depressed mood	1.41	1.13–1.77	0.077
History of mental illness treatment	1.42	1.14–1.78	0.073
Mental health problem	1.32	1.06–1.65	0.402
Substance abuse (other) ^b	0.622	0.427–0.906	0.299

Abbreviation used: OR, odds ratio.

Note: Nonpharmacists treated as reference group.

^a Adjusted by Holm-Bonferroni correction.^b Substance abuse (other) includes any nonalcohol-related substance abuse problem.

In the current total sample, white men were the predominant gender and race categories, respectively, although there has been an increasing number of women and nonwhite pharmacists nationally. In the most recent NPWS,³⁵ there was a decreased percentage of licensed pharmacists who were white in 2019 compared with 2009 (78.2% vs. 86.5%, respectively). In 2019, 57% of pharmacists were female compared with 46.4% in 2009.^{29,35} The changing trend in the demographics of pharmacists may change the landscape of suicide rates in the future based on previous reports that female pharmacists had higher rate of suicides than male pharmacists.¹¹

These findings depicting a higher suicide rate among pharmacists are consistent with previous publications on suicide by nurses in the United States. In a landmark study, Davidson et al.⁸ reported that, between 2005 and 2016, female nurse incident rate ratio (IRR) was 1.395 (95% CI 1.323–1.470, $P < 0.001$) compared with non-nurse women and the male nurse IRR was 1.205 (95% CI 1.083–1.338, $P < 0.001$) compared with non-nurse men. The same troubling findings were reported by Davis et al.,⁴ extending the analysis to 2017 and 2018: among female nurses, the incidence was 17.1 per 100,000, 10.1 for women physicians versus 8.6 per 100,000 non-nurse/women physicians.

Compared with physicians, the age-adjusted suicide rates for pharmacists were lower.⁶ In the only overlapping year (2014), the age-adjusted rates for pharmacists (18.2 per 100,000) were lower than 23.7 per 100,000 among physicians. This could be caused by gender differences given that there were more female pharmacists in 2014 who died by suicide than female physicians. It is also unknown whether the lower rate of suicides could be caused by under-reporting of suicides among pharmacists. A more thorough comparison between pharmacists and physicians is needed.

The increased rates of suicide among pharmacists, nurses, and women physicians are concerning given the national attention on health professional burnout and negative impact on the mental health of our health care workers from the pandemic. Although recruitment and retention of our health professionals in the workforce are important, more attention and vigilance toward maintaining the well-being of our caregivers should also be paramount.

Although the overall demographics of the pharmacist group were strikingly similar to the makeup of the general population during the study years, the one notable exception

is mean age. Pharmacists' mean age at the time of death was statistically significantly higher than the general population. This higher average age trend was also reported among nurses who died by suicide^{4,7,8} and among physicians.⁶

The most common means of suicide among pharmacist decedents in this study was firearms. Previous studies reported that medicinal drugs were commonly used by pharmacists in suicides.^{11,36} In nurses, pharmaceutical poisoning was the most common means of suicide. Among nurses for whom substances were implicated in death, they were far more likely to be positive at the time of death for substances across all drug classifications.^{7,8} However, the pharmacists in this sample used firearms more frequently than poisoning. It may have been thought that pharmacists would use pharmaceuticals to complete suicide owing to their easy access to prescription drugs, but perhaps pharmacists chose to use a means that was deemed more lethal, given that suicide attempt with a firearm is far more likely to result in death than by poisoning.³⁷ This difference could also be accounted for because men are more likely to use more lethal means than women,³⁸ and most pharmacists in this study were men.³⁹ In a previous report of nurse suicide by firearms, male nurses used firearms more often (50% of men used a firearm vs. 28% of women).⁴⁰ This means of suicide is consistent with the general population where death by firearms is much more common than death by poisoning.^{6,40,41} Similar to nursing but different from physicians, benzodiazepines, antidepressants, and opioids were the most common substances found in the pharmacist suicides.^{6,8}

Although caution must be exercised when trying to understand the characteristics of suicide in this small sample, it is worthwhile to examine the significant findings in this study. Pharmacists were significantly more likely to have a reported job problem, current treatment for mental illness, and suicide note and less likely to have a substance abuse issue. The job problem and mental illness issues present in this sample are consistent with previously reported findings among nurses who died by suicide⁷ and indicate a need for further investigation of the specific work-related issues that may precede a pharmacist death by suicide. In the most recent NPWS,³⁵ 42% of pharmacists reported low levels of job satisfaction, especially among those working in chain, mass merchandiser, and supermarket settings. Attitudes toward work were generally lower among full-time pharmacists in 2019 than 2014. Women pharmacists also reported lower levels of professional fulfillment and higher levels of work exhaustion than full-time pharmacists. Increased stress owing to the pandemic will undoubtedly affect job satisfaction, and incidence of suicide will need to be closely monitored. Unemployment was reported by approximately 5% of respondents, and 61% of pharmacists reported that their unemployment was not voluntary.

It is estimated that more than 70% of people who die by suicide had contact with mental health services before death,^{42,43} and 80% of those people were not receiving active treatment.⁴⁴ In this study, pharmacists were more likely to have a known mental health issue, yet still completed suicides, implying an opportunity for improved recognition and treatment of depression. Evidence-based approaches exist to encourage help-seeking behaviors of health care workers through anonymous screening and referral to treatment.⁴⁵ Replication of this type of screening program at a national

Textbox 1

Trigger Alert: The National Suicide Hotline may be contacted at 1-800-273-8255. Information for suicide prevention among health care workers may be found at <https://afsp.org/suicide-prevention-for-healthcare-professionals>.

scale could identify pharmacists with untreated or under-treated depression with the goal of preventing suicide. The following strategies as outlined in the recently published Surgeon General's Report should be tailored for pharmacists and other health professionals: (1) activate a broad-based public health response to suicide, (2) address upstream factors that affect suicide, (3) ensure lethal means safety, (4) support adoption of evidence-based care for suicide risk, (5) enhance crisis care and care transitions, and (6) improve the quality, timeliness, and use of suicide-related data.⁴⁶

Limitations

The low number of suicides among pharmacists in this study limited the ability to conduct additional analyses for pharmacists. The pattern of suicides may differ if additional data were obtained beyond the 18 states and over a longer sampling period. Potential reasons for the low number of suicides among pharmacists could be incomplete or inaccurate reporting of occupation in the NVDRS. Pharmacists work in diverse settings other than traditional community pharmacy settings such as hospitals, academia, managed care, pharmaceutical industry, and others⁴⁷ that may not be traditionally viewed as a pharmacist role and could have caused errors in reporting. Other limitations to using the NVDRS have been previously reported.^{4,6,8}

One important analysis that could not be conducted with additional data was the impact of gender and means of suicide. The gender-adjusted rates of suicides could not be calculated for pharmacists in this study owing to a lack of gender data for all years in the NABP dataset. The NABP does not collect age or gender data for licensed pharmacists. Age and gender calculations could only be performed using data available from the NPWS data published during discrete years. Similar issues were encountered with physician and nurse workforce data. It would benefit future research if workforce data were consistently gathered on an annual basis to include gender and age.

The study is limited by the small number of suicides reported for pharmacists. Owing to fluctuations in suicide rates over time, longitudinal analysis is warranted and planned. The NVDRS dataset is also limited by the number of states and geographic variation.

In the states that submit to the NVDRS, medical examiners and law enforcement officials enter their analyses of the case into the records. As in all suicide research, there is suspected under-reporting of suicide owing to family preference not to declare suicide (due to stigma) and the workload, volume, bias, or training of the medical examiner/law enforcement officer assigned to the case.

As data become available, the study will be replicated with more states represented. A lack of workforce gender demographic data made it impossible to examine the proportion of suicides between men and women among pharmacists, as would have been desired. Confidence in results would be improved if workforce data were available to conduct more robust gender-specific analyses. Caution should be taken with generalizing findings owing to the cross-sectional nature of this study in a limited set of states.

Conclusion

Pharmacists were at higher risk than age-matched controls to die by suicide and had greater incidence of known job-related problems before death. Pharmacists' common means of suicide were by firearms, poisoning and hanging/strangulation/suffocation. Removal of lethal means, proactive suicide screening, and crisis support are necessary actions (Textbox 1). Encouraging help-seeking behaviors to identify and treat pharmacist depression is warranted. Future research is needed to determine the nature of job-related problems to develop mitigation strategies for suicide. Future analysis of pharmacist suicides compared with other health care professionals would also be insightful.

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