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Assessment of Risk Factors for Suicide Among US Health Care Professionals

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IMPORTANCE Burnout among health care professionals has been increasingly associated with suicide risk. An examination of possible risk factors may help in the prevention of suicide among health care professionals.

OBJECTIVE To assess suicide risk factors for 3 categories of health care professionals (surgeons, nonsurgeon physicians, and dentists) compared with non-health care professionals.

DESIGN, SETTING, AND PARTICIPANTS Data from the National Violent Death Reporting System were reviewed to identify all individuals who died by suicide in the United States between January 1, 2003, and December 31, 2016. Individuals were divided into health care professionals and non-health care professionals (general population), with the health care professionals further categorized into surgeons, nonsurgeon physicians, and dentists. The covariates of suicide decedents included demographic characteristics (age, sex, race, and marital status), medical history (mental illness, substance use, and physical health), and documented factors associated with the suicide death (job, intimate partner, financial, legal, and other problems). Data were analyzed from October 2 to December 17, 2019.

MAIN OUTCOMES AND MEASURES In this analysis, the outcome variable was occupation, with health care professionals overall and by category compared with the general population. Multiple logistic regression analyses with backward stepwise selection were performed.

RESULTS A total of 170 030 individuals who died by suicide between 2003 and 2016 were identified. Of those, 767 individuals (0.5%) were health care professionals (mean [SD] age, 59.6 [15.6] years; 675 men [88.0%]; 688 white [89.7%]), with the remainder of the sample (95.5%) comprising the general population (mean [SD] age, 46.8 [31.5] years; 77.7% men; 87.8% white). A total of 485 health care professionals (63.2%) were nonsurgeon physicians, 179 professionals (23.3%) were dentists, and 103 professionals (13.4%) were surgeons. Compared with the general population, risk factors for suicide among health care professionals included having Asian or Pacific Islander ancestry (odds ratio [OR], 2.80; 95% CI, 1.96-3.99; $P < .001$), job problems (OR, 1.79; 95% CI, 1.49-2.17; $P < .001$), civil legal problems (OR, 1.61; 95% CI, 1.15-2.26; $P = .006$), and physical health problems (OR, 1.40; 95% CI, 1.19-1.64; $P < .001$) and currently receiving treatment for mental illness (OR, 1.45; 95% CI, 1.24-1.69; $P < .001$). Compared with the general population, health care professionals had a lower risk of suicide if they had black ancestry (OR, 0.55; 95% CI, 0.36-0.84; $P < .001$) or were female (OR, 0.44; 95% CI, 0.35-0.55; $P < .001$) or unmarried (OR, 0.36; 95% CI, 0.31-0.42; $P < .001$). Health care professionals who died by suicide were also less likely to have problems with intimate partners (OR, 0.71; 95% CI, 0.60-0.86; $P < .001$) or alcohol use (OR, 0.58; 95% CI, 0.45-0.73; $P < .001$) compared with the general population. Surgeons had a higher risk of suicide compared with the general population if they were older, male, married, had Asian or Pacific Islander ancestry, were currently receiving treatment for mental illness, or had problems with their job or alcohol use. Compared with their nonsurgeon physician colleagues, surgeons had a higher risk of suicide if they were male, older, married, or currently receiving treatment for mental illness.

CONCLUSIONS AND RELEVANCE This study highlights risk factors for suicide among health care professionals, with additional analyses of surgeon-specific risk factors. The results may be useful in improving the detection of burnout and the development of suicide prevention interventions among health care professionals.

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Burnout among health care professionals is defined as “emotional exhaustion, depersonalization, and low personal accomplishment”^{1(p1131)} associated with job-related stress. In a national survey of the general working population in the United States, the rate of physician burnout increased from 46% in 2011 to 54% in 2014.² Among physicians, specific subgroups of professionals are at an increased risk. Female physicians experience burnout 17% more frequently than male physicians.³ Physicians who spend less than 20% of the work week on an activity they find meaningful have higher rates of burnout compared with their peers (53.8% vs 29.9%, respectively).⁴ Trainees in general surgery, emergency medicine, and neurology have higher rates of burnout than internists.³ Burnout has personal and system-level costs in addition to economic losses and patient safety concerns. The economic burden from personnel burnout has been estimated at \$15 544 000 to \$55 506 000 per year for an academic medical center.⁵ Physicians experiencing burnout have poorer patient safety outcomes and lower patient satisfaction scores, and they are more likely to display unprofessional behavior.⁶⁻⁹

The risk factors for burnout overlap with the risk factors for suicide.¹ Surveys, such as the Maslach Burnout Inventory, evaluate burnout through questions regarding depressed mood, feelings of depersonalization, and stressors in the work environment.¹ These domains overlap with risk factors described in the National Violent Death Reporting System (NVDRS), including the risks of depressed mood and job problems. By evaluating common risk factors of both burnout and suicide, the progression from burnout to suicide may be more clearly delineated.

The objective of this study was to evaluate risk factors for suicide among health care professionals compared with the general population using data from the NVDRS database and to further investigate the differential risk among various categories of health care professionals. We aimed to identify vulnerable subgroups and modifiable risk factors to inform hospitals and residency training programs of ongoing challenges and identify potential areas for targeted intervention. To our knowledge, this is the first national study to evaluate suicide risk factors and outcomes in surgeons, nonsurgeon physicians, and dentists.

Methods

This retrospective study used the NVDRS data set to identify individuals who died by suicide from January 1, 2003, to December 31, 2016. The NVDRS database is a compilation of data from coroner and medical examiner records, toxicologic test results, and law enforcement reports. Data collection was initiated by the NVDRS in 2003 and originally included data from 6 US states; collection has since expanded to include 32 states.¹⁰ In addition to quantitative data, the NVDRS database includes a narrative of events associated with the suicide death that are drawn from medical examiner and law enforcement records. The study was approved by the institutional review board of Harvard Medical School. A waiver of consent

Key Points

Question Are there differences in risk factors for suicide among health care professionals (surgeons, nonsurgeon physicians, and dentists) compared with the general population?

Findings In this cohort study of 170 030 individuals who died by suicide, health care professionals who died by suicide were more likely to have problems with their jobs, physical health, and civil legal issues and to have Asian or Pacific Islander ancestry compared with individuals in the general population who died by suicide. A direct comparison between surgeons and nonsurgeon physicians revealed that surgeons had a higher risk of suicide if they were older, male, married, or currently receiving treatment for mental illness.

Meaning Results of this study suggest that, of those who died by suicide, health care professionals have a higher likelihood of experiencing problems with their jobs and physical health compared with the general population.

was granted because the study presented minimal risk to participants, no medical procedures were conducted among participants, and all data in the NVDRS database is anonymous. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cohort studies.

The sample was divided into 2 cohorts: health care professionals and non-health care professionals (general population). The health care professional cohort was then divided by occupation into 3 subcohorts: surgeons, nonsurgeon physicians, and dentists. Surgeons were further categorized by subspecialty. The variables examined included demographic characteristics (age, sex, race, and marital status), medical and psychiatric factors (physical health problems, mental illness, and substance use history), and factors associated with the suicide death (job, intimate partner, financial, civil legal, and other problems). The race of the suicide decedent was obtained from the death certificate, coroner or medical examiner records, and law enforcement reports. Marital status was defined as married or unmarried (single, divorced, widowed, or never married). Job problems were defined as poor performance, work pressure, fear of being fired or demoted, conflict with colleagues or superiors, or joblessness that appeared to be associated with the suicide death. If the decedent left their job as part of their suicide plan, this event was not considered a job problem. Results of toxicologic tests were described for surgeons when applicable.

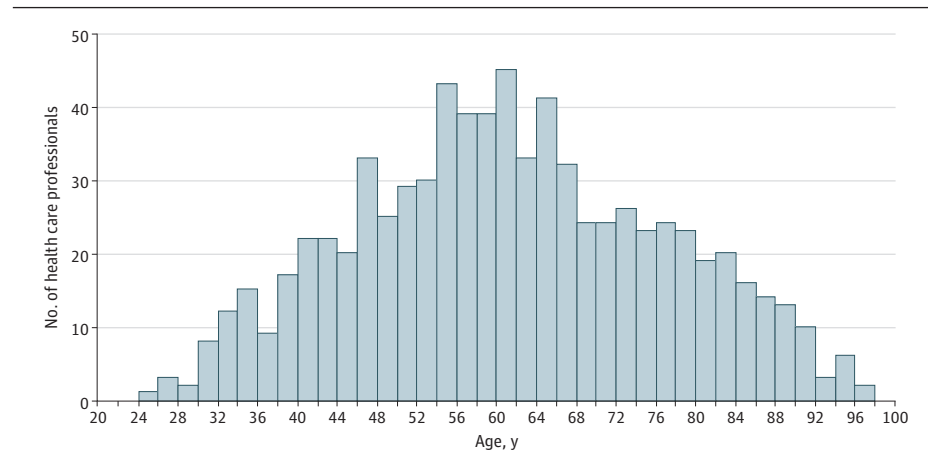
The primary outcome variable was the type of occupation. Three analyses were performed. First, we compared health care professionals with the general population. Second, we compared surgeons with the general population, nonsurgeon physicians with the general population, and dentists with the general population (eAppendix in the Supplement). Third, we compared surgeons with nonsurgeon physicians.

The following search terms were used to identify the occupations of health care professionals: *physician* or *medical doctor* for nonsurgeon physicians; *dentists*, *doctor of dental medicine*, or *doctor of dental surgery* for dentists; and *surgery*, *general surgery*, *orthopedic surgery*, *oral and maxillofacial*

Table 1. Demographic Characteristics of General Population, Dentists, Nonsurgeon Physicians, and Surgeons Who Died by Suicide

Characteristic	No. (%)			
	General population	Dentists	Nonsurgeon physicians	Surgeons
Total No.	169 263	179	485	103
Age, mean (SD), y	46.8 (31.5)	61.7 (14.3)	59.7 (15.6)	64.2 (15.5)
Sex				
Male	131 509 (77.7)	167 (93.3)	409 (84.3)	99 (96.1)
Female	37 696 (22.3)	12 (6.7)	76 (15.7)	4 (3.9)
Unknown	58 (<0.1)	0	0	0
Race				
White	148 567 (87.8)	167 (93.3)	432 (89.1)	89 (86.4)
Black	10 824 (6.4)	3 (1.7)	17 (3.5)	2 (1.9)
Asian/Pacific Islander	2705 (1.6)	3 (1.7)	22 (4.5)	8 (7.8)
Other ^a	7167 (4.2)	6 (3.3)	14 (2.9)	4 (3.9)
Marital status				
Married	58 002 (34.3)	114 (63.7)	276 (56.9)	81 (78.6)
Unmarried	111 261 (65.7)	65 (36.3)	209 (43.1)	22 (21.4)

^a Other race includes individuals with American Indian, native Alaskan, unknown, and mixed (≥ 2 races) ancestry.

Figure. Age Distribution of Health Care Professionals Who Died by Suicide

surgery, ENT, otolaryngology, surgeon, and other surgical specialty terms for surgeons.

The χ^2 and 2-sided unpaired *t* tests were used to compare demographic characteristics between cohorts. A multiple logistic regression analysis with backward stepwise selection allowed for the comparison of characteristics between the general population and all health care professionals (ie, the pooled subcohorts of surgeons, nonsurgeon physicians, and dentists). We also tested previously published variables associated with physician suicide by including substance use (antipsychotic, opioid, muscle relaxant, benzodiazepine, barbiturate, and antidepressant medications as well as cocaine and marijuana) in the model.¹⁰ The significance threshold for the analyses comparing health care professionals with the general population and surgeons with nonsurgeon physicians was $P < .05$. The Bonferroni-corrected significance threshold for the analyses comparing each separate health care professional group with the general population was $P = .0167$. Statistical analyses were performed using JMP Pro software,

version 14 (SAS Institute). Data were analyzed from October 2 to December 17, 2019.

Results

From 2003 to 2016, 170 030 individuals who died by suicide were recorded in the NVDRS database. Of those, 169 263 individuals (99.5%) were non-health care professionals (mean [SD] age, 46.8 [31.5] years; 77.7% men; 87.8% white), and 767 individuals (0.5%) were health care professionals (mean [SD] age, 59.6 [15.6] years; 675 men [88.0%]; 688 white [89.7%]). A total of 485 health care professionals (63.2%) were nonsurgeon physicians, 179 professionals (23.3%) were dentists, and 103 professionals (13.4%) were surgeons (Table 1; eAppendix and eTable 1 in the Supplement). The Figure depicts the age distribution of health care professionals who died by suicide. The predominant method of suicide among both the general population and

Table 2. Multiple Logistic Regression Analysis of Health Care Professionals vs General Population

Variable	Health care professionals vs general population	
	OR (95% CI)	P value ^a
Age ^b	1.003 (1.003-1.004)	<.001
Sex		
Male	1 [Reference]	NA
Female	0.44 (0.35-0.55)	<.001
Race		
White	1 [Reference]	NA
Black	0.55 (0.36-0.84)	<.001
Asian or Pacific Islander	2.80 (1.96-3.99)	<.001
Other ^c	0.93 (0.62-1.40)	.74
Marital status		
Married	1 [Reference]	NA
Unmarried	0.36 (0.31-0.42)	<.001
Type of problem		
Mental illness		
No	1 [Reference]	NA
Yes	1.45 (1.24-1.69)	<.001
Depressed mood		
No	1 [Reference]	NA
Yes	1.21 (1.03-1.41)	.01
Physical health		
No	1 [Reference]	NA
Yes	1.40 (1.19-1.64)	<.001
Job		
No	1 [Reference]	NA
Yes	1.79 (1.49-2.17)	<.001
Civil legal		
No	1 [Reference]	NA
Yes	1.61 (1.15-2.26)	.006
Alcohol use		
No	1 [Reference]	NA
Yes	0.58 (0.45-0.73)	<.001
Intimate partner		
No	1 [Reference]	NA
Yes	0.71 (0.60-0.86)	<.001

Abbreviations: NA, not applicable; OR, odds ratio.

^a Significance threshold, $P < .05$.

^b Odds ratio for age is expressed per year.

^c Other race includes individuals with American Indian, native Alaskan, unknown, and mixed (≥ 2 races) ancestry.

health care professionals was self-harm by firearm discharge (*International Classification of Diseases, Ninth Revision*, code X74) (eTable 2 in the [Supplement](#)).

Among the 103 surgeons, specialties included orthopedic surgery (19 surgeons [18.5%]), neurosurgery (13 surgeons [12.6%]), ophthalmologic surgery (6 surgeons [5.8%]), plastic surgery (4 surgeons [3.9%]), general surgery (4 surgeons [3.9%]), oral and maxillofacial surgery (4 surgeons [3.9%]), cardiac surgery (2 surgeons [1.9%]), otolaryngologic surgery (1 surgeon [1.0%]), and pediatric surgery (1 surgeon [1.0%]); 49 surgeons (47.6%) practiced in specialties that were not specified in the database.

Health Care Professionals

Suicide decedents in the health care professional group were older (mean [SD] age, 59.6 [15.6] years) compared with those in the general population (mean [SD] age, 46.8 [31.5] years;

$P < .001$). In a multiple logistic regression analysis of health care professionals compared with individuals in the general population who died by suicide, health care professionals were more likely to have Asian or Pacific Islander ancestry (odds ratio [OR], 2.80; 95% CI, 1.96-3.99; $P < .001$), job problems (OR, 1.79; 95% CI, 1.49-2.17; $P < .001$), civil legal problems (OR, 1.61; 95% CI, 1.15-2.26; $P = .006$), and physical health problems (OR, 1.40; 95% CI, 1.19-1.64; $P < .001$); to be older (OR, 1.003 per year; 95% CI, 1.003-1.004; $P < .001$); and to be currently receiving treatment for mental illness (OR, 1.45; 95% CI, 1.24-1.69; $P < .001$) (Table 2).

Compared with the general population, health care professionals were less likely to have the following suicide risk factors: intimate partner problems (OR, 0.71; 95% CI, 0.60-0.86; $P < .001$), alcohol use problems (OR, 0.58; 95% CI, 0.45-0.73; $P < .001$), black ancestry (OR, 0.55; 95% CI, 0.36-0.84; $P < .001$), female sex (OR, 0.44; 95% CI, 0.35-0.55; $P < .001$),

Table 3. Multiple Logistic Regression Analysis of Dentists, Nonsurgeon Physicians, and Surgeons vs General Population

Variable	Dentists		Nonsurgeon physicians		Surgeons	
	OR (95% CI)	P value ^a	OR (95% CI)	P value ^a	OR (95% CI)	P value ^a
Age ^b	1.003 (1.002-1.005)	.002	1.003 (1.002-1.004)	<.001	1.004 (1.002-1.006)	<.001
Sex						
Male	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Female	0.24 (0.13-0.43)	<.001	0.61 (0.48-0.79)	<.001	0.12 (0.04-0.33)	<.001
Race						
White	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Black	0.31 (0.10-0.97)	.04	0.66 (0.41-1.08)	.10	0.43 (0.11-1.77)	.24
Asian or Pacific Islander	1.08 (0.35-3.41)	.89	2.92 (1.90-4.51)	<.001	5.41 (2.60-11.25)	<.001
Other ^c	0.96 (0.42-2.18)	.93	0.84 (0.49-1.44)	.53	1.37 (0.50-3.76)	.54
Marital status						
Married	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Unmarried	0.33 (0.24-0.45)	<.001	0.44 (0.35-0.52)	<.001	0.16 (0.10-0.26)	<.001
Type of problem						
Mental illness						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	1.46 (1.06-2.00)	.02	1.32 (1.09-1.61)	.005	2.12 (1.41-3.18)	<.001
Depressed mood						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	1.42 (1.04-1.95)	.03	1.08 (0.89-1.31)	.41	1.52 (1.00-2.30)	.05
Physical health						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	1.21 (0.86-1.70)	.27	1.53 (1.25-1.87)	<.001	1.20 (0.77-1.96)	.42
Job						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	1.71 (1.16-2.51)	.006	1.72 (1.35-2.20)	<.001	2.19 (1.37-3.49)	.001
Civil legal						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	1.20 (0.55-2.58)	.65	1.80 (1.19-2.71)	.006	1.59 (0.63-3.97)	.32
Alcohol use						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	0.61 (0.38-0.98)	.04	0.63 (0.47-0.84)	.002	0.31 (0.13-0.71)	.006
Intimate partner						
No	1 [Reference]	NA	1 [Reference]	NA	1 [Reference]	NA
Yes	0.78 (0.54-1.12)	.78	0.71 (0.56-0.89)	.003	0.65 (0.40-1.06)	.08

Abbreviations: NA, not applicable; OR, odds ratio.

^a Bonferroni-corrected significance threshold, $P < .0167$.^b Odds ratio for age is expressed per year.^c Other race includes individuals with American Indian, native Alaskan, unknown, and mixed (≥ 2 races) ancestry.

and unmarried status (OR, 0.36; 95% CI, 0.31-0.42; $P < .001$) (Table 2). We did not find an association between suicide death among health care professionals and the previously published physician suicide risk factors of substance use (antipsychotic, muscle relaxant, opioid, benzodiazepine, barbiturate, and antidepressant medications as well as cocaine and marijuana) among either health care professionals overall or surgeons alone in comparison with the general population.¹⁰

Nonsurgeon Physicians and Surgeons

In a comparison of nonsurgeon physicians with the general population, the risk factors for suicide included having Asian or Pacific Islander ancestry (OR, 2.92; 95% CI, 1.90-4.51; $P < .001$), civil legal problems (OR, 1.80; 95% CI, 1.19-2.71;

$P = .006$), job problems (OR, 1.72; 95% CI, 1.35-2.20; $P < .001$), physical health problems (OR, 1.53; 95% CI, 1.25-1.87; $P < .001$), older age (OR, 1.003 per year; 95% CI, 1.002-1.004; $P < .001$), or currently receiving treatment for mental illness (OR, 1.32; 95% CI, 1.09-1.61; $P = .005$). Nonsurgeon physicians who died by suicide were less likely than the general population to have problems with intimate partners (OR, 0.71; 95% CI, 0.56-0.89; $P = .003$) or alcohol use (OR, 0.63; 95% CI, 0.47-0.84; $P = .002$) or to be women (OR, 0.61; 95% CI, 0.48-0.79; $P < .001$) or unmarried (OR, 0.44; 95% CI, 0.35-0.52; $P < .001$) (Table 3).

Compared with the general population, surgeons who died by suicide were more likely to have Asian or Pacific Islander ancestry (OR, 5.41; 95% CI, 2.60-11.25; $P < .001$) and job problems (OR, 2.19; 95% CI, 1.37-3.49; $P = .001$) and to be older (OR,

Table 4. Multiple Logistic Regression Analysis of Surgeons vs Nonsurgeon Physicians

Variable	Surgeons vs nonsurgeon physicians	
	OR (95% CI)	P value ^a
Age ^b	1.03 (1.01-1.05)	.002
Sex		
Male	1 [Reference]	NA
Female	0.31 (0.10-0.85)	.03
Race		
White	1 [Reference]	NA
Black	0.63 (0.13-3.05)	.60
Asian or Pacific Islander	2.03 (0.83-4.98)	.10
Other ^c	2.01 (0.60-6.80)	.30
Marital status		
Married	1 [Reference]	NA
Unmarried	0.49 (0.29-0.83)	.008
Type of problem		
Mental illness		
No	1 [Reference]	NA
Yes	1.68 (1.03-2.74)	.04
Depressed mood		
No	1 [Reference]	NA
Yes	1.33 (0.82-2.17)	.20
Physical health		
No	1 [Reference]	NA
Yes	0.65 (0.39-1.13)	.12
Job		
No	1 [Reference]	NA
Yes	1.76 (0.99-3.15)	.05
Civil legal		
No	1 [Reference]	NA
Yes	0.78 (0.27-2.23)	.64
Alcohol use		
No	1 [Reference]	NA
Yes	0.51 (0.20-1.30)	.16
Intimate partner		
No	1 [Reference]	NA
Yes	1.12 (0.63-1.99)	.70

Abbreviations: NA, not applicable; OR, odds ratio.

^a Significance threshold, $P < .05$.

^b Odds ratio for age is expressed per year.

^c Other race includes individuals with American Indian, native Alaskan, unknown, and mixed (≥ 2 races) ancestry.

1.004 per year; 95% CI, 1.002-1.006; $P < .001$) and currently receiving treatment for mental illness (OR, 2.12; 95% CI, 1.41-3.18; $P < .001$). Surgeons were less likely to have alcohol use problems (OR, 0.31; 95% CI, 0.13-0.71; $P = .006$), unmarried status (OR, 0.16; 95% CI, 0.10-0.26; $P < .001$), or female sex (OR, 0.12; 95% CI, 0.04-0.33; $P < .001$) (Table 3).

Compared with nonphysician surgeons, surgeons were more likely to be currently receiving treatment for mental illness (OR, 1.68; 95% CI, 1.03-2.74; $P = .04$) and to be older (mean [SD] age, 59.7 [15.6] years vs 64.2 [15.5] years, respectively; OR, 1.03 per year; 95% CI, 1.01-1.05; $P = .002$) (Table 4). Unmarried surgeons had a lower risk of suicide than unmarried nonsurgeon physicians (OR, 0.49; 95% CI, 0.29-0.83; $P = .008$).

A total of 15 surgeons (14.6%) had data available from the results of toxicologic tests performed at the time of suicide death. Substances present included morphine, opioid, tramadol, fentanyl, methadone, and buprenorphine ($n = 14$); temaz-

epam, oxazepam, nordiazepam, clonazepam, alprazolam, and other benzodiazepines ($n = 11$); alcohol ($n = 8$); citalopram ($n = 4$); sertraline ($n = 4$); mirtazapine ($n = 4$); diphenhydramine antihistamine ($n = 3$); propofol ($n = 2$); acetone ($n = 2$); carbon monoxide ($n = 2$); fluoxetine ($n = 1$); zolpidem ($n = 2$); cocaine ($n = 1$); digoxin ($n = 2$); bupropion ($n = 1$); phencyclidine ($n = 1$); benzoylecgonine ($n = 1$); barbiturate ($n = 1$); amphetamine ($n = 1$); and unknown substance ($n = 6$).

Discussion

This retrospective study of suicide decedents identified through the NVDRS database reveals factors associated with the likelihood of suicide in health care professionals compared with the general US population. To our knowledge, this database study is the first to compare suicide risk between

subgroups of health care professionals (surgeons, nonsurgeon physicians, and dentists) and the general population and to describe suicide by surgical subspecialty.

Risk factors for suicide among health care professionals involved both nonmodifiable and modifiable characteristics. Health care professionals who died by suicide were substantially older (mean age, 59.6 years) at the time of suicide than compared with the general population (mean age, 46.8 years). The prevailing belief is that medical residents have a greater risk of suicide owing to difficulty associated with the high number of training hours required. Our results suggest that, in addition to reports describing trainee burnout, another population comprising older surgeons and nonsurgeon physicians may also be at risk of suicide.¹¹

Results of our study suggest that health care professionals are at higher risk of suicide when nearing the end of their careers. One hypothesis is that the transition into a senior career position or retirement introduces new challenges regarding sense of purpose, finances, changes in routine, and restructuring of family dynamics. Medical professionals may be especially vulnerable given that the career path in the field of medicine is prescriptive throughout the training process. This vulnerability is compounded by the factors of sex and gender, as suicide risk factors for men include stoicism-associated reluctance to acknowledge personal challenges or seek mental health care, especially when feeling vulnerable or depressed.¹² A clinical trial in Canada is working with men who are experiencing difficulty with the transition into retirement to enhance their psychological resilience and prevent the onset or worsening of suicidal ideation.¹³ Our data highlight the need for mental health screening and conversations surrounding suicide to continue long after a health care professional finishes medical training. Other at-risk demographic characteristics among health care professionals included Asian and Pacific Islander ancestry compared with white ancestry. The cultural stigma of experiencing mental health challenges among this population may contribute to low rates of diagnosis and treatment of mental illness.^{14,15} Thus, screening for self-harm risks in health care professionals may be improved by age-informed and culturally sensitive assessments and interventions.

With regard to risk factors and other stressors associated with health, health care professionals who died by suicide were more likely to have been experiencing job stressors, physical health problems, and civil legal problems compared with suicide decedents in the general population. This pattern of job stressors as a risk factor was observed across the 3 health care professional subgroups, while physical health problems and civil legal problems were not. Given the time and economic investment expended in training to become a health care professional, the inability to practice may carry a larger burden of emotional distress. Notably, the presence of physical health problems did not increase the likelihood of suicide in surgeons or dentists, who practice in fields in which technical skills depend on good physical health. Civil legal problems were a significant risk factor for suicide among health care professionals compared with the general population.

In the subgroup analysis, the association of civil legal problems with suicide death was only significant in the nonsurgeon physician cohort. This association suggests the risk of malpractice litigation may be different in surgical specialties compared with other medical specialties. We know that the fields of neurosurgery, obstetrics and gynecology, and colorectal surgery have the highest rates of medical malpractice claims,¹⁶ whereas cardiology and internal medicine have relatively low rates.¹⁶ Physicians who practice in specialties that have a high risk of incurring malpractice claims may be more accustomed to handling such claims. In contrast, physicians who practice in specialties in which malpractice litigation is less common may experience more emotional distress when malpractice claims occur. In addition, even though most malpractice cases are resolved in favor of the physician, malpractice cases require, on average, 19 months to resolve.¹⁷ The duration, stress, and uncertainty of each case may result in further distress. It may therefore be beneficial for hospitals to offer additional psychological support to physicians during this time.

Married health care professionals were at higher risk of suicide compared with those who were unmarried. We hypothesize that marital stressors may be factors in suicide risk, although the literature on the associations with marriage are conflicting. A study in China reported an association between suicide attempts and marital affairs and fights with a partner within the month before an attempt.¹⁸ Results from the National Longitudinal Mortality Study from 1979 to 1989 indicated that the risk of suicide among divorced men in the United States was nearly double that of married men, but this risk was not observed in women.¹⁹ It is possible that marital status has different consequences for health care professionals compared with the general population. Studies conducted by Danish and Brazilian physicians reported that single or divorced marital status was associated with a higher risk of suicide, which was not observed in our study.^{20,21} Our results are consistent with those of Gold et al,¹¹ who also found that married physicians had a higher risk of suicide than unmarried physicians. The conflicting data suggest that marital status is a dynamic risk factor that can be protective or detrimental, depending on state of the marriage.

Overall, the risk factors identified in this study may inform opportunities for early interventions to mitigate burnout and decrease suicide rates within the field of medicine. Although it is difficult to directly associate burnout with suicide, the risk factors captured in the NVDRS database, such as depressed mood, current receipt of treatment for mental illness, and job problems, are also factors assessed in questionnaires measuring burnout, which include items such as occupation-related depression and emotional exhaustion.¹ Our study also adds to the findings of Gold et al,¹¹ who assessed an earlier version of the NVDRS data set that included only 17 states and approximately 30 000 suicide decedents. Our study used updated NVDRS data that encompassed 32 states with more than 170 000 individuals who died by suicide, and it included dentists and health care professionals stratified by occupation, including medical and surgical specialists. Gold et al¹¹ reported that the likelihood of having a mental health disorder or job problem was higher in physicians who died by

suicide and that physicians were more likely to have ingested substances (antipsychotic, barbiturate, and benzodiazepine medications) based on postmortem toxicologic test results. Our regression models indicated that job problems were more prevalent in physicians who died by suicide, but results from the analyses differed with those of previous studies regarding the association of substance use with physician suicide. This difference may be owing to our large sample compared with the smaller samples used in previous studies.

Opportunities for the improvement of suicide prevention interventions exist within the health care system. Our data suggest a need for increased screening of health care professionals, particularly among the high-risk groups comprising racial minorities and those in the late stages of their careers. Furthermore, although health care professionals are comfortable with advising patients regarding when to seek help, physicians are often reluctant to seek help themselves.²² Thus, a more active screening process would be beneficial. For example, the University of California, San Diego, launched an educational campaign that focused on destigmatizing suicide and promoting help-seeking behavior and mental health screening and treatment, including an anonymous interactive online screening program for all medical students and faculty.²³ Over an 11-year period, 230 individuals from the program received medical referrals for treatment, and only 1 faculty suicide death occurred.²³ In addition, because job problems and civil legal problems were associated with a significantly higher likelihood of suicide among health care professionals, institutions can aim to ensure sufficient human resource and legal support for professionals experiencing litigation. Surgeons, nonsurgeon physicians, and dentists can also recognize the signs of mental health difficulties in their colleagues, and in themselves, and take action.

Limitations

This study had several limitations. First, the nature of the data set precludes comparing the risk factors of suicide

decedents with nonsuicide decedents, so only lateral comparisons between occupations can be made. The NVDRS data collection expansion, from 6 states in 2003 to 50 states in 2018 through 2019, prevented temporal analyses of suicide rates over time. Additionally, a subset of data variables was reported as free text and subject to coding error, which was minimized in our study by using 1 coder (Y.D.J.) to assess all of the data. The free-text documentation for the search term *occupation* may not be precise, as surgeons may also be listed as physicians. This issue may have resulted in underestimation of the true proportion of suicide death among surgeons. Toxicologic testing was not routinely performed on all suicide decedents, which prevented further analysis. Despite these limitations, the NVDRS database is a valuable tool for the analysis of suicide-associated factors at the population level.

Conclusions

This study indicates that, among health care professionals in the United States, those who are older, have Asian or Pacific Islander ancestry, are currently receiving treatment for mental illness, and have physical health, job, or civil legal problems have an increased risk of suicide compared with the general population. Furthermore, surgeons have a higher risk of suicide compared with nonsurgeon physicians if they are older, male, married, or currently receiving treatment for mental illness. The identification of nonmodifiable risk factors, such as age and race, can inform targeted interventions for specific health care professional subgroups. The presence of modifiable risk factors, such as the current receipt of treatment for mental illness, physical health problems, job problems, or civil legal problems, among health care professionals who die by suicide suggests a need for supportive resources for employees who are coping with mental illness or legal issues.

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Invited Commentary

Physician Suicide—Reflections on Relevance and Resilience

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Physician burnout and suicide are a grim reality in health care, with the physician suicide rate 2-fold that of the general public and the highest among any US profession.¹ In fact, a 2019 survey of more than 15 000 physicians revealed that, among physicians with depression, more than 20% thought about suicide and nearly 40% did not seek help.²

In their retrospective study, Ji et al³ found that, compared with those in the general population who died by suicide, surgeons who died by suicide were more likely to be Asian, older, male, and married and to have more mental health, job, and alcohol use issues. It is important to take a

close look at the conclusions. Overall, the number of suicide deaths among health care professionals in



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the cohort was small (n = 767 [0.5%]), and surgeons represented only 0.06% (n = 100) of those who died by suicide. In addition, the analysis assumed that the sex and racial/ethnic makeup of individuals included in the National Violent Death Reporting System database mirrored that of the physician workforce, but this may not be the case. Although Asian individuals constitute approximately 6% of the US population, they account for 17.7% of surgical faculty, with the highest prevalence of Asian male physicians found in the medical specialty of surgery.^{4,5} Conclusions drawn by

the authors regarding the need for targeted interventions could therefore be misinterpreted by individuals in a racial group that may not be at increased risk.

The association between older age and higher suicide risk is worrisome. Research has indicated that surgeons report high levels of career satisfaction and feel highly respected in the community, which may be associated with working longer before retirement.⁶ Loss of connection with colleagues during retirement and a perceived loss of relevance after a satisfying career could be factors in surgeons' high levels of distress. To alleviate this issue, older surgeons should be actively engaged with meaningful ways in which they can continue to contribute to the field.

Strategies to mitigate burnout and depression should be targeted to all physicians. The time has come to cultivate well-being and resilience, and building such a culture requires intentionality, empathy, and support in the midst of professional and personal stressors. Interventions can include confidential peer support, availability of referrals to mental health professionals who understand the issues physicians face, flexible services, and on-site mental health services.

Programs to increase individual self-care (stress management and resilience skills), systemic changes that reduce burnout (building greater efficiency into the electronic health