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Title: Testing a Strategy to Identify Incidence of Nurse Suicide in the United States

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Abstract

Objective: To test a strategy for quantifying incidence of nurse suicide using San Diego county data as a pilot for national investigation.

Background: Worldwide, 1 person dies by suicide every 40 seconds; over 1,000,000 suicides occur yearly. Suicide rates for nurses in the U.S. have not been evaluated. This methodological paper tested a strategy to identify incidence of nurse suicide compared to physicians and the general public.

Method: De-identified San Diego County medical examiner data from 2005 to 2015 were analyzed with a descriptive epidemiologic approach.

Results: Overall registered nurse (RN) (18.51) and physician (40.72) incidence of suicide per 100,000 person years were higher than the San Diego general population excluding nurses (15.81) normalized to 100,000 person years.

Conclusions: Establishing incidence of nurse suicide is confounded by variation in reporting mechanisms plus incomplete availability of nurse gender data. Relatively small outcome numbers compared to the general population may underestimate results. Research using a larger sample is indicated. Nurse executives may decrease risk by proactively addressing workplace stressors.

Over 1,000,000 people worldwide die each year by suicide (1). The World Health Organization reports that globally 1 person dies by suicide every 40 seconds (2). In the U.S. alone, over 44,000 people complete suicide in 2016 alone making it the 10th leading cause of death (3). While the other 10 leading causes of death are decreasing, suicide rates are on the rise (4). There are compelling data that physicians are at a greater risk to die by suicide compared to the general population or other professionals (5), with emerging data demonstrating that the same holds true for other healthcare practitioners, including nurses (6).

Information about U.S. nurse suicides is conflicting and outdated. Between 1937 and 1956 nurses had an odds ratio of 6 times the general female population suicide rate (7). These results conflict with those generated from the Nurses' Health Study which reported the annual nurse suicide rate between 1982 and 1996 to be 6.8 per 100,000 lives (n=8,505), essentially no different than women in the general population at that time (8). The proportional mortality ratio of nurse suicides between 1963 and 1977 was higher (ratio =151) than the general female worker population (ratio =147). Authors postulated that given the female worker suicide rate, proportionally it would be expected that there would only have been 27 nurse suicides, where in fact 41 were identified (9). An outdated 2001 occupational risk study using 1990 data reported that the gender adjusted odds ratio for nurse suicide was 1.58 times the working-age population (10). The most recent systematic review of nursing and suicide included only 9 papers, 2 of which were from the U.S. with the most recent being this same paper from 2001 (6). This review highlights both the troubling high prevalence of nurse suicide as well as the persistent lack of recent studies examining this issue.

After experiencing nurse suicides within the San Diego California nursing workforce, we attempted to find the current incidence of nurse suicide in the U.S. without success. Nurse suicide in the U.S. is not systematically evaluated or reported at a local or national level through public or professional agencies. The American Nurses Association, American Foundation for Suicide Prevention, and California State Board of Registered Nursing (BRN) were contacted via phone (Personal Communication November, 2014). Representatives from each of these organizations confirmed that no recent efforts had been made

to address nurse suicide in a targeted way. The purpose of this study was to extract the nurse suicide incidence rate from the medical examiner's data as a pilot in 1 large U.S. market to establish a strategy for confirming the incidence. This particular methodology will also be used to subsequently identify national nurse suicide rates using the Center for Disease Control's restricted access National Violent Death Reporting System (NVRDS) occupation-coded mortality dataset.

Research Questions

- 1) What is the incidence of nurse suicide in San Diego County?
- 2) How does the incidence of nurse suicide compare to physician suicide?
- 3) What is the difference between general population, female suicide and nurse suicide?
- 4) Which methods of suicide are used most by nurses?
- 5) Does the method of suicide among nurses differ from the general population?

Methods

This study used an epidemiologic descriptive design. De-identified San Diego County Medical Examiner data were analyzed for 11 years (2005-2015). The California State BRN provided the number of registered nurses (RNs) in San Diego County for each year of that timeframe. The same process was used with the San Diego County Medical Association to determine the number of practicing physicians. The San Diego County population information was obtained from the Public Data service offered through Google where annual population counts were provided based on the U.S. Census Bureau data (11, 12). The intent was to trace back the denominator of female nurses per year from the published California Health Care Foundation data. However, it was not possible to extract San Diego specific data from the published reports (13). San Diego female gender nursing data was only available for 2014 through a secondary source evaluating the California BRN Report (Personal Communication, Joanne Spetz May 23, 2017)

Ethics

The University of California San Diego institutional review board (IRB) declared this project non-human subjects research (filing #160092) excused from IRB oversight because it was a review of deceased humans using de-identified medical examiner data.

Sample

The sample included adults (≥ 20 years old) deceased individuals coded for suicide by the San Diego County Medical Examiner's office between 2005-2015.

Data Analysis

Data were cleaned for duplication and de-identified by a designee of the Medical Examiner before receipt by the research team. Since occupation was hand-entered by the medical examiner into the database, a list of searched keywords to assign a physician and nurse occupation code was developed for this study (Table 1). 'Nurse' was limited to 'licensed registered nurses'. Method of suicide was determined using the following categories:

- Drug overdose (this included all methods of ingestion of medications, with or without other substance such as alcohol or illicit drugs)
- Firearms
- Hanging
- Jumping
- Poisoning (ingesting something other than a drug)
- Cutting or stabbing
- Suffocation by plastic bag
- Carbon Monoxide inhalation
- Others (this included injury by motor vehicle, drowning, electrocution, gas inhalation other than carbon monoxide, suffocation by other than plastic bag, fire, alcohol overdose, and unknown method)

For reporting consistency, incidence data were normalized per 100,000 person years (14). Descriptive statistics, and incidence rate ratios (IRR) were calculated. Nurse comparisons of IRR were made to the population age 20 and over; physicians were compared to the population age 25 years and over.

Comparison of nurse to the general population without nurses as well as the general population without nurses and physicians was performed. Advisement for these strategies was received from the California

BRN and the Chief Medical Office of the American Foundation for Suicide Prevention. All calculations were performed using R (V3.4.0) (15).

Results

Overall, 2005-2016 San Diego County incidence per 100,000 person years was: RN (18.51), physician (40.72), general population over 20 years excluding nurses (15.81), general population minus physicians and nurses over the age of 20 (15.91).

The 2005-2015 incident rate ratio (IRR) was significant for physicians (IRR 2.293, 95% CI 1.663-3.084, $P < .001$) (general population minus physicians over the age of 25) but not for nurses (IRR 1.171, 95% CI 0.8885-1.520), $P = .237$) (general population minus nurses over the age of 20). Because physicians are a high risk group, an attempt was made to compare IRR between nurses and the population that was neither nurse nor physicians. (Denominator: suicides over the age of 20); and although the IRR per 100,000 is consistently higher than the general population, the IRR was not statistically significant (IRR 1.194, 95% CI 0.902-1.55, $p = 0.184$).

Gender of nurses in San Diego County was only available for 2014. Female nurses incident rate: 10.41 per 100,000 person years. Other females incident rate: 7.41 per 100,000 person years. IRR for female nurses vs. other females: 1.404, 95% CI: 0.284 to 4.234, $p = 0.562$

The method of suicide varied greatly between groups. (Table 2) Whereas physicians and the general population both completed suicide most often by the use of firearms, nurses completed suicide most commonly by the use of drugs. The top 5 most commonly used methods of suicide for nurses were (in decreasing order): drugs, firearm, alcohol-drug combinations, hanging, and plastic bag suffocation. The distribution of type of medication used during suicide is depicted in Table 3.

Discussion

Incidence

The incidence of nurse suicide in San Diego California (18.51) is higher than the overall published figure for the American public (13.26) normalized to 100,000 person years (3). The incidence is also consistent with global studies generally reporting elevated suicide rates for nurses compared to other, non-healthcare providers. For instance, in Denmark, when compared to educators, healthcare suicides were found to be higher; nurses (RR 1.90, 95% CI 1.63-2.21), physicians (RR 1.87, 95% CI 1.55-2.26) and pharmacists (RR 1.91 95% CI 1.26-2.87) (16). In British Columbia nurses completed suicide at a rate significantly higher than homemakers (75 suicides, proportional mortality ratio 159, 95% CI 126-200, $p < 0.001$) (17). Male medical doctors in Australia had lower incidence of suicide than educators (RR 1.23 95%CI 0.72-2.10), though female doctors had a higher incidence than the educator comparator group (RR 3.88 95% CI 2.54-9.34). Nurses of either gender had significantly higher suicide rates than educators (female RR 2.24 95% CI 1.34-3.74, male RR 2.30 95% CI 1.31-4.00) (18). Canadian researchers conducted a critical review of nurse suicides identifying 9 quantitative studies published since 1999. Authors concluded that nurses are at a higher risk of suicide compared to the educator reference group or the general population (16). In Norway, both nurses and physicians had a higher reported risk of suicide than college educated persons in other fields (19, 20). Similarly, a review of Icelandic nurses' mortality demonstrated that, when compared to other women, overall life expectancy was longer for nurses; however, while the mortality rate for many diagnoses was lower in Icelandic nurses than the general female population, nurses had higher rates of suicide (21). In Australia, results from a large, retrospective study again confirmed the higher suicide rates for female health professionals, including nurses, than for women in other professionals (incidence rate ratio [IRR] for nurses and midwives = 2.65; 95% CI, 2.22-3.25; $P < 0.001$) (14).

Risk

Our data demonstrates that nurses complete suicide mainly with the use of medications, as has been shown elsewhere. Though it has been previously suggested (22), there is not enough evidence to declare access to medications as a primary or sole risk factor. Even though nurses in Denmark were 4.52 times more likely to complete suicide by the use of medications than the general population, it was not known if

the drugs were personal or obtained in the workplace (16). Another study lends further credence to questioning the assumption of access to medications being a suicide risk, although medications were the most frequently used method of suicide, only 4 of 72 suicides involved evidence of actual workplace medication utilization (23). The NVDRS contains police report and investigation data. If all states submitted suicide data to the registry the question regarding whether or not access (i.e., opioid diversion) contributes to the higher rate of suicide in healthcare professionals could be addressed because data from police investigations would disclose whether or not the medications were taken from the workplace. We plan to analyze data from the 18 participating states for future work.

The knowledge of how to use medications in a lethal manner may also factor into why nurses have a higher risk of suicide (22). In our own study, although the names of the medications were available, it was not possible to determine whether they were obtained from the workplace. However, the top 2 frequently used medications were diphenhydramine and acetaminophen, readily available over the counter medications, suggesting these deaths may not be access related.

In past decades, it was commonly reported that men completed suicide at a rate of 4 times that of women (24). Over time, female suicides have increased proportionally. Currently, the suicide rate among men is 3 times that of women (2, 4). We found female nurse suicide in this region is higher than other females within the population as has been demonstrated in the international literature (16, 18-21, 23, 25). A larger sample is needed to demonstrate statistical significance and to examine whether or not the closing of the gender gap in suicide is observed among nurses. Better access to gender demographics in nursing is needed to conduct further research.

Data on workplace stress also would be useful. It has been suggested that the psychological demands of nursing and the perceived lack of autonomy in the role are sources of stress (26). While Major Depressive Disorder (MDD) clearly is a risk for suicide, regardless of profession or occupation, burnout, a related phenomenon in the healthcare professions, may also be a factor (27). Both MDD and burnout have been well documented to occur frequently among nurses (11). Burnout, a psychological syndrome that

emerges as a prolonged response to chronic interpersonal stressors on the job, is characterized by 3 key dimensions: overwhelming exhaustion; feelings of cynicism and detachment from the job; and a sense of ineffectiveness and lack of accomplishment. Burnout occurs frequently in occupations, like nursing, where work demands, stresses and stakes are high while autonomy and resources can be low (28). Burnout is increasingly recognized as an occupational risk in nursing (29). Further, burnout may be a precursor for MDD (30). Both burnout and MDD have been linked to suicidal ideation (31), and depression is a well-known risk for suicide (32). We have previously reported that when offered suicide risk screening at-risk nurses can be identified and referred for treatment (33). Future studies collecting data documenting MDD, burnout and related workplace stressors, such as whether or not suicide was preceded by a workplace stress-associated leave of absence or medical error, would also be helpful to better understand suicide risk in nurses. Furthermore, the relationship between drug and alcohol use and nurse suicide has not been studied and warrants attention. As previously stated, these issues could be analyzed and addressed through the NVDRS dataset.

Methodology

Variation of data year to year without pattern supports the future use of a longitudinal approach to analyze the data (Figure 1). It is especially intriguing that the pattern of seemingly normal random variation in nurses is the same as in physicians, yet completely different than that of the general population. The reason for this cannot be explained without matching to events associated with suicide.

The discrepancy between higher incidence per 100,000 person years and lack of statistical significance in IRR can be partially explained by the relative low incidence of suicide compared to the population.

Because nurse incidence per 100,000 person years is higher than the general population, further study of nurse suicide is warranted with a larger population sample. Age-matched control comparison between disciplines is difficult due to the varying ages that each discipline enters the workforce.

As described above, methods of reporting incidence of suicide vary greatly making it difficult to make comparisons between reported studies. We chose incidence response rates per 100,000 person years

because it is the most widely reported metric. Also, IRR better accounts statistically for overlap in year-to-year population samples (humans from 2013 may also exist in 2014). Further, the recent Australian longitudinal study used a nearly identical methodology, which will make future comparisons possible (14).

Additional Limitations

To date, U.S. suicide data are not collected in a standardized fashion making comparisons among professions and populations difficult. We were unable to directly calculate female nurse suicide incidence compared to the female population longitudinally because the denominator for female nurses in our region was not obtainable. Instead we calculated the suicide rate of female nurses only for 2014 using data retrieved through personal communication and not published reports. Moreover, we had hoped to study the incidence of nurse suicide to the common comparator of educator suicide, but the denominator of educators in the county was not available. It is important to note that this pilot study is specific to San Diego County, yet can serve to develop a method for future large-scale studies. Given that the findings of this pilot are congruent with the findings of other international studies, in that there is a trend of higher incidence of suicide than the general population (14, 34), we have guarded confidence in generalizability.

We intend to extend this project nationally using the occupation and gender-coded NVDRS dataset which will allow us to access to some of these missing data pieces. However, the next phase may include challenges because not all 50 states enter data into the system. Given that the coding in this database is standardized, the data may be more robust in states that participate in the database than those that remain to have county-by-county variation. Further, whereas pharmacy and medicine have consistent methods to determine number of licensed professionals each year, nursing data are inconsistently reported. For instance, of the 18 states currently reporting into the NVDRS, the number of licensed RNs from Oklahoma were not reported to the National Councils of BRN and those values were obtained instead from the Oklahoma BRN which may have imposed variation in operational definition.

Conclusion/Implications for Nurse Executives

The suggestion that nurses may complete suicide at a rate higher than the general population supports the need for nurse executives to proactively develop workplace systems to identify those with burnout, depression and suicide risk who would benefit from treatment. Identifying and preventing modifiable work-related stress is also indicated and should be a priority for nurse executives. The higher rates of suicide among female physicians and nurses compared to other women necessitate further exploration. Although no causality can be made, and root causes of suicide cannot be inferred from the available data, it is clear that suicide is a concern within the nursing profession and needs to be addressed. With the movement towards optimizing the healthy work environment, we suggest that death by suicide be considered in healthcare occupational health statistics so that timely internal evaluation of workplace stressors can be evaluated and remediated where indicated. Standardization of reporting through nationwide participation in the NVDRS is needed to provide a more reliable dataset to explore the phenomena of suicide among nurses. With standardization, accurate reporting and evaluation of the data, efforts can be taken to proactively address the precipitating factors and incidence among nurses and other healthcare providers.

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Table 1: Nurse and physician occupation search terms

Nurses	Physicians
Nurse Nurse Practitioner Nursing Administrator Registered Nurse Registered Nurse Practitioner RN Surgical Nurse	Anesthesiologist Cardiologist Doctor Doctor of Anesthesiology Internal Medicine Physician Internist Medical Doctor Medical Doctor (retired) Pathologist Physician Psychiatrist Psychotherapist Radiologist Retired Psychiatrist Surgeon

Table 2: Top 5 Methods of Suicide

Top 5	Nurse (n)	Nurse %	Top 5	MD (n)	MD%	Top 5	Other (n)	Other%
Drug	26	44.83	Firearm	15	34.09	Firearm	605	14.98
Firearm	11	18.97	Drug	14	31.82	Hanging	848	21
Alcohol- Drug	6	10.34	Hanging	4	9.09	Drug	605	14.98
Hanging	4	6.90	Alcohol- Drug	3	6.82	Jumping	292	7.23
Plastic	3	5.17	Cutting	2	4.55	Cutting	116	2.87

Table 3: Top 20 Medications used in San Diego Nurse Suicide

Medication	RN	MD	Total
diphenhydramine	10	2	12
acetaminophen	9	1	10
alcohol	7	2	9
hydrocodone	7	2	9
quetiapine	5	1	6
zolpidem	5	2	7
citalopram	4		4
oxycodone	4	3	7
alprazolam	3	1	4
bupropion	3		3
clonazepam	3	1	4
venlafaxine	3		3
amitriptyline	2		2
benzodiazepines	2		2
diltiazem	2		2
lorazepam	2	1	3
propoxyphene	2		2
temazepam	2	2	4
amlodipine	1		1
aspirin	1	1	2

Legend: Sorted from highest to lowest. RN = nurse, MD = physician. Numbers reflect the number of individuals completing suicide with that particular medication.

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Figure 1: San Diego County Incidence of Suicide Per 100,000 Person Years

