The Colorado Violent Death Reporting System (COVDRS): Validity and Utility of the Veteran Status Variable

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ABSTRACT

Objective. Using the Veterans Affairs Beneficiary Identification Record Locator Subsystem (BIRLS) as the criterion database, we evaluated the sensitivity and specificity of the death certificate information in the Colorado Violent Death Reporting System (COVDRS) to determine Veteran status for those who died by suicide.

Methods. The study sample consisted of 3,820 individuals aged 18 years and older who died by suicide in Colorado from January 1, 2004, through December 31, 2008. To determine agreement on Veteran status, COVDRS data were submitted to the Veterans Benefits Administration for linkage to the BIRLS using Social Security numbers.

Results. Sensitivity and specificity of the Veteran status information on the death certificate were 93.1% (95% confidence interval [CI] 90.7, 95.2) and 91.7% (95% CI 90.5, 92.8), respectively. The overall agreement between the death certificate and the BIRLS on Veteran status was very good (kappa = 0.76; 95% CI 0.74, 0.79).

Conclusions. This study of 3,820 suicide deaths in Colorado demonstrated a high level of agreement between the COVDRS Veteran status variable and the BIRLS. Such findings offer support for using the COVDRS in studying factors associated with suicide in the Veteran population.

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Studies have shown that, compared with the general population, U.S. Veterans may have a greater risk of suicide. However, the majority of these studies have focused on samples of Veterans using services in the Veterans Health Administration (VHA).¹⁻³ Given that only 25% of Veterans seek care at Veterans Affairs (VA) facilities, studies based solely on VHA samples may over- or underestimate the risk of Veteran suicide.⁴ Such sampling issues provide a limited understanding of suicide rates and risk factors among Veterans in the general population.⁵

To supplement the information from studies based on a VHA sample, a more comprehensive suicide surveillance system might provide additional information to characterize the populations at risk and to identify opportunities for interventions to reduce suicide. With the development of the National Violent Death Reporting System (NVDRS) by the Centers for Disease Control and Prevention (CDC) in 2002, there is the potential to comprehensively track suicide-related deaths among Veterans in the general population. The NVDRS is a population-based surveillance system designed to provide an ongoing census of violent deaths in the United States.⁶ Violent deaths include suicides, homicides, deaths from unintentional firearm injuries, deaths resulting from legal intervention, and deaths of undetermined intent. Compared with other public health surveillance systems, the NVDRS has a number of advantages. First, as a passive surveillance system, it requires no primary data collection. Instead, the NVDRS obtains and merges existing data from several sources, such as death certificates, police reports, medical examiner and coroner reports, and crime laboratories, into a single, centralized database.⁷ When viewed separately, these individual data sources rarely offer sufficient information to drive violence-prevention policies and programs. However, when linked in the NVDRS, the comprehensive, detailed information on decedents and circumstances can be used to identify and target areas for prevention and intervention.

Since the inception of the NVDRS in 2002, CDC has provided funding to 18 states, including Colorado, to participate in the system. State systems typically operate under the authority of the state health department. A subset of the data captured at the state level is downloaded to CDC to create the national database. Among the variables included in the NVDRS is the decedent's Veteran status, which is determined from information on the death certificate. For data from the NVDRS to be used to examine factors associated with Veteran suicides, researchers, state health officials, and policy makers must first understand the utility of this infor-

mation in accurately determining Veteran status. If the Veteran status variable is not sufficiently accurate, then information about Veterans who die by suicide may be obscured, and a distorted picture of this group of decedents will emerge.

Previous research examining the validity of demographic variables (e.g., Veteran status) on death certificates is scarce. Findings from Sorlie et al.⁸ revealed that Veteran status concurred 95% when death certificates were compared with information obtained from personal interviews with heads of households; however, Veteran status was missing or unknown on death certificates for 20% of the cases examined. Such methods rely on subjective information from an informant. In cases where an informant is unavailable, this information may not be captured. Furthermore, the recording of demographic information on death certificates is not standardized, and studies have shown notable variability in the methods used to collect demographic information.⁹ For example, data recorded on the death certificate may be obtained from several sources, including physicians, funeral directors, hospital records, other health records, and informants. Information on the death certificate regarding Veteran status is frequently captured by funeral directors based on information from the decedent's family or friends.

While there is no centralized database for identifying Veteran status, the U.S. Department of Veterans Affairs has several databases that provide extensive information on Veterans who use VHA services, as well as those who have enrolled in the VA system for other benefits. These databases are valuable resources for investigators who conduct epidemiologic, clinical, and health services research.¹⁰ One such database is the VA Beneficiary Identification Record Locator Subsystem (BIRLS). The BIRLS is a Veterans Benefits Administration (VBA) database containing records of all VA beneficiaries, including Veterans discharged from military service since March 1973, Medal of Honor recipients, Veterans who received education benefits from the VA, and Veterans whose survivors applied for burial benefits. A study by the National Academy of Sciences' Medical Follow-Up Agency revealed that deceased Veterans identified first through the National Personnel Records Center, a repository of military personnel records of discharged and deceased Veterans from all services during the 20th century, were subsequently found in BIRLS records 82% to 93% of the time.¹¹ The BIRLS offers several advantages when linking large amounts of data in that it is readily available to researchers affiliated with the VA and provides a cost-effective way of gathering information on Veteran status and other vital statistics.¹⁰ In addition, unlike

other VA patient care databases, the BIRLS includes all Veterans discharged either after 1973 or prior to 1973 if any benefits, including burial, were sought. As such, it is a source of information regarding a larger population than just those who sought VHA services.

If the death certificate is a sufficiently valid and reliable source in determining Veteran status, data from the NVDRS could be used to track the number of Veterans who die by suicide following military service. However, it must first be determined that this variable is indeed valid. With validity established, examination of the NVDRS data could deepen our understanding of factors and circumstances that are unique to Veterans who die by suicide. In turn, this information may help identify Veterans who are at greater risk for suicide and inform interventions designed to reduce suicide in both VA service-seeking and non-VA service-seeking Veterans.

Using the BIRLS as the criterion database, we evaluated the sensitivity and specificity of the death certificate information in the Colorado Violent Death Reporting System (COVDRS) to determine Veteran status for those who died by suicide. The results of these analyses will help determine if suicide prevention policy and clinical intervention decisions for Veterans can be informed by COVDRS data and whether it is worth attempting similar data linkages in other NVDRS participating states.

METHODS

The study population comprised all decedents aged 18 years and older in the COVDRS database who died by suicide from January 1, 2004, through December 31, 2008.

Materials

The two data sources used in this analysis were the COVDRS and the BIRLS. The COVDRS is a subset of the larger NVDRS and contains information on violent deaths in Colorado. The Health Statistics Section at the Colorado Department of Public Health and Environment is responsible for the maintenance and use of the data in the COVDRS. Data are collected from a number of sources, including death certificates, coroner/medical examiner reports, and law enforcement reports. Trained abstractors code and enter the data based on definitions and procedures established by CDC. To ensure the accuracy of information entered into the database, abstractors routinely review and check data. The comprehensive database consists of more than 700 variables, including the demographic characteristics of the decedent, drug and alcohol use by the decedent at

the time of death, the mechanism of injury resulting in death, and the circumstances associated with each violent death. Among the COVDRS variables is Veteran status. Information on Veteran status is abstracted from item eight on the Colorado death certificate, which notes whether the decedent “was ever in the U.S. Armed Forces.” For the purpose of this study, we only examined data on Veteran status for individuals aged 18 years and older who died by suicide.

The BIRLS is a VBA database containing records of all VA beneficiaries, including Veterans discharged from military service since March 1973, Medal of Honor recipients, Veterans who received education benefits from the VA, and Veterans whose survivors applied for burial benefits. The BIRLS death file is a subset of the larger BIRLS file and contains current vital status information on Veterans who receive VA benefits.¹⁰ The file is updated monthly and contains information from multiple sources, including reports from family members applying for death benefits, VHA hospitals, and the VA National Cemetery Administration. This file can be linked to other VA files using the Veteran’s real or scrambled Social Security number (SSN). For this study, data were linked to the entire BIRLS file, including the death file.

Linkages

The study sample consisted of 3,820 individuals aged 18 years and older who died by suicide in Colorado from January 1, 2004, to December 31, 2008. To determine agreement on Veteran status, COVDRS data were submitted to the VBA for linkage to BIRLS. Linkage was conducted using SSNs. Because full SSNs of decedents were included in the data transfer, additional precautions were employed to enhance data security. Specifically, SSNs were scrambled using a proprietary algorithm. Given that transposition of SSNs can produce erroneous matches, we further assessed the validity of matches by comparing first and last name. As such, criteria used to establish true matches included SSN, first name, and last name.

Statistical methods

For each source, a decedent case was assigned to one of four categories based on whether there was agreement between the decedent’s Veteran status from the death certificate and the BIRLS database (Figure).¹² For example, false positives (Group Two) included decedents who were identified as Veterans on the death certificate but were not found in the BIRLS database.

Using the information from the BIRLS as the gold standard, we computed four comparison statistics for the accuracy of Veteran status from the death

Figure. Identification methods for assessing the accuracy of Veteran status for all adult decedents of suicide in the COVDRS, 2004–2008^a

Group	Definition
1. True positives	All deceased individuals who were identified as Veterans on both the death certificate and in the BIRLS database
2. False positives	All deceased individuals who were identified as Veterans on the death certificate but were not linked to a case in the BIRLS database
3. False negatives	All deceased individuals who were not identified as Veterans on the death certificate but were identified as Veterans in the BIRLS database
4. True negatives	All deceased individuals who were not identified as Veterans on either the death certificate or in the BIRLS database

^aSohn M, Arnold N, Maynard C, Hynes DM. Accuracy and completeness of mortality data in the Department of Veterans Affairs. *Population Health Metrics* 2006;4:2. Also available from: URL: <http://www.pophealthmetrics.com/content/4/1/2> [cited 2011 Jan 11].

COVDRS = Colorado Violent Death Reporting System

BIRLS = Beneficiary Identification Record Locator Subsystem

certificate. Sensitivity, defined as the percentage of decedents who were correctly identified as a Veteran on the death certificate, was calculated as the ratio of true positives to true positives plus false negatives. Specificity, defined as the percentage of individuals who were correctly identified as not a Veteran on the death certificate and not found in the BIRLS database, was calculated as the ratio of true negatives to true negatives plus false positives. Positive predictive value (PPV) referred to the likelihood that an individual who was identified as a Veteran on the death certificate was actually a Veteran according to the BIRLS. Negative predictive value (NPV) referred to the probability that an individual who was not identified as a Veteran on the death certificate was actually not a Veteran according to the BIRLS.¹²

RESULTS

The Table shows comparisons between death certificate data and BIRLS data on Veteran status. Sensitivity and specificity of the Veteran status information on the death certificate were 93.1% (95% confidence interval [CI] 90.7, 95.2) and 91.7% (95% CI 90.5, 92.8), respectively, which resulted in a PPV of 72.2% (95% CI 68.7, 75.5) and an NPV of 98.3% (95% CI 97.6, 98.9). The overall agreement between the death certificate and the BIRLS on Veteran status was very good (kappa = 0.76, 95% CI 0.74, 0.79).

Given the number of false positives, cases were further analyzed to determine if there were significant differences between the false positives and true positives on available demographic data. Differences in date of birth were seen between individuals identified as Veterans on both the death certificate and the BIRLS (true positives) and those identified as Veterans on the

death certificate only (false positives). Compared with individuals identified as Veterans in both databases, those identified as Veterans on the death certificate only were born an average of 7.1 years earlier (95% CI 4.8, 9.5, $p < 0.0001$). Specifically, the median year of birth for the false positives was 1943, while the median year of birth for the true positives was 1952 (data not shown).

DISCUSSION

Results indicate that, for Colorado decedents who died by suicide between 2004 and 2008, the agreement between death certificate information and the BIRLS on Veteran status was very good. Despite this high level of agreement, the death certificate was found to over-identify Veteran status in 257 cases. This over-identification resulted in a PPV of 72.2%, thereby raising a number of questions regarding the validity and potential utility of the Veteran status variable within COVDRS, which is extracted from the death certificate. While erroneous matches from the data linkage might be possible, the use of SSNs as well as other identifiers (e.g., first and last name) further corroborated and increased the accuracy of the matches.

There are several other plausible explanations for the number of false positives on the death certificate. Although the BIRLS is a rather comprehensive source of data for both service- and non-service-connected Veterans, the likelihood that individuals are captured in the database is greater for certain groups of Veterans, namely those who were discharged after 1973 and recipients of any type of VA benefits (e.g., health-care, pension, education, or burial benefits). This likelihood is in part supported by the fact that the individuals who were identified as Veterans on both the death certificate and the BIRLS were born an average of 7.1

years later than those identified as Veterans in COVDRS only. Because the BIRLS provides data for all Veterans discharged after 1973, those with a later birth date and, therefore, later military discharge date are more likely than those with an earlier birth date to be included in the BIRLS database.

Another potential explanation for the number of false positives may be related to differences in how Veteran status is defined by those providing demographic information. For example, a recent examination of NVDRS data suggested that about 20% of the suicides identified in 2005 occurred among former and current military personnel.¹³ Although the present study presents data on suicide among both active-duty personnel and Veterans, it does not differentiate between these two distinct groups. The VA defines a Veteran as a “person who served in the active military, naval, or air service, and who was discharged or released from there under conditions other than dishonorable.”¹⁴ This definition includes National Guard and Reserve members who have served on extended active duty, but not those whose service was active duty for training. The VA largely bases its determination of Veteran status upon military department service records,¹⁵ yet the operationalization of Veteran according to COVDRS is whether or not the individual “was ever in the U.S. Armed Forces.” As such, this broader definition of Veteran may contribute to overreporting of Veteran status on death certificates (i.e., includes some percentage of current military personnel) and may increase the number of individuals in COVDRS identified as Veterans. Researchers should be aware of this limitation when using the COVDRS or the larger NVDRS to examine factors associated with Veteran suicide.

The number of false positives on the death certificate may also reflect issues related to how information on the death certificate is recorded and captured. Specifically, the lack of standardization with respect

to how and by whom data are collected on the death certificate contributes to greater variability and errors. Oftentimes, information on the deceased individual (other than the time, date, and place of death) is provided by an informant or someone who knew the deceased—usually a friend or family member—rather than an official record. Therefore, a death certificate is considered a secondary source for certain information, such as ethnicity, education, and Veteran status. Regarding Veteran status, the official document used by the Department of Veterans Affairs to verify military service is the DD Form 214, “Certificate of Release or Discharge from Active Duty.” The DD Form 214 is issued upon a military service member’s retirement, separation, or discharge from active-duty military, and represents the complete, verified record of a service member’s time in the military. Although the DD Form 214 is generally required by funeral directors to prove eligibility for interment in a VA cemetery and/or to provide military honors to a deceased Veteran, in most cases, this official document is not used to complete information regarding Veteran status on the death certificate.

Limitations

This study was subject to several limitations. One potential limitation was that findings are reported for Colorado only. As the current study only examined data from one state, it is not possible to evaluate the ease of creating such linkages in another state, nor the validity of the resulting merged data. However, it is believed that use of the methods employed in the current study can be applied in other states to determine if the level of agreement demonstrated in this study is generalizable across all states participating in the NVDRS. Limitations of the BIRLS database are also important to consider. Specifically, the BIRLS does not provide a complete listing of all Veterans who

Table. Comparison of death certificate with BIRLS data on Veteran status for all adult decedents of suicide in the COVDRS, 2004–2008 (n=3,820)^a

Death certificate Veteran status	BIRLS Veteran status			Sensitivity Percent (95% CI)	Specificity Percent (95% CI)	Positive predictive value Percent (95% CI)	Negative predictive value Percent (95% CI)
	No N	Yes N	Total N				
No	2,848	49	2,897	93.1	91.7	72.2	98.3
Yes	257	666	923	(90.7, 95.2)	(90.5, 92.8)	(68.7, 75.5)	(97.6, 98.9)

^aBased on matching social security number, first name, and last name

BIRLS = Beneficiary Identification Record Locator Subsystem

COVDRS = Colorado Violent Death Reporting System

CI = confidence interval

have served in the U.S. Armed Forces. The likelihood that individuals are captured in the BIRLS database is greater for certain groups of Veterans, namely those who were discharged after 1973 and recipients of any type of VA benefits. On the other hand, Veterans who were discharged prior to 1973 and did not receive any type of VA benefits would not be included in the BIRLS. In this vein, the BIRLS should not be mistaken for a national registry of all U.S. Veterans.

CONCLUSIONS

A range of very useful research questions can now be posed regarding characteristics of Veterans dying by suicide who have and have not sought care in VA. Answers to these questions may guide policy on outreach to specific subgroups of Veterans to connect them to available services. The capacity already exists among those suicide decedents who were seen in VA to determine in which clinics (e.g., mental health or primary care) they were seen prior to death and for what conditions. That information can be used to help strengthen VA's already substantial suicide prevention efforts. For example, it might be that a significant percentage of decedents were seen by dental services within three months of death, suggesting that more training in suicide screening and referral could be conducted in that specialty area. Being able to examine health variables for Veteran decedents who did not seek care in VA can help determine areas in the community where more outreach could be targeted along similar lines. These issues are being addressed by the current research team using COVDRS data combined with electronic medical records from the Eastern Colorado Health Care System. The methods and procedures used in the current study and follow-up analyses can be employed in any of the other 17 states participating in NVDRS.

This study of 3,820 suicide deaths in Colorado demonstrates a high level of agreement between the COVDRS Veteran status variable, which comes from the death certificate, and the BIRLS. Such findings offer support for using the COVDRS to study factors associated with suicide in the Veteran population. Keeping in mind some of the limitations of the death certificate information, as well as the possible incomplete case ascertainment of surveillance data, researchers can begin to explore ways in which state-level as well as aggregate NVDRS data can be used to test hypotheses regarding Veteran suicide among the entire population of Veterans who have died by suicide, not just those who sought VHA services. The approach used in the current study demonstrates that it may be possible to

acquire valid datasets by linking a single VA to a single CDC (or state) dataset. In this vein, creating datasets by merging only data from a single state database (e.g., COVDRS) and VHA records to be used for analyses is much more efficient, and potentially less expensive, than combining datasets from multiple sources (e.g., coroner's records, VA medical records, non-VA medical records, and police reports).

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