

Evaluation of a Novel Medicolegal Death Investigator–Based Suicide Surveillance System to the National Violent Death Reporting System

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Abstract: The abundance of actionable information available in a medicolegal suicide investigation is often inaccessible and underutilized in public health to the detriment of prevention efforts. Epidemiologists obtained the Washington County subset of the Oregon Violent Death Reporting System (OR-VDRS). To determine if additional information beyond the OR-VDRS was available through a standard death investigation, an epidemiologist shadowed medicolegal death investigators (MDIs) for nearly 2 years. The MDIs and epidemiologist developed a novel, real-time, MDI-entered surveillance system, the Suicide Risk Factor Surveillance System (SRFSS), to capture suicide risk factor data with greater timeliness and accuracy than available through the OR-VDRS. To evaluate the performance of each surveillance system, differences in the prevalence of suicide risk factor data from SRFSS were compared with the county OR-VDRS subset for the same 133 suicides occurring in 2014–2015. Across 27 suicide risk factors and circumstances, the median difference in prevalence was 10.5 percentage points between the OR-VDRS and the SRFSS, with the higher prevalence in SRFSS. The prevalence was significantly different between the 2 surveillance systems for 21 (78%) of 27 variables. This study demonstrates the truly exceptional data quality and timeliness of MDI information over traditional sources.

Key Words: death investigation, epidemiology, suicide, surveillance

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In 2016, there were twice as many suicides as there were homicides¹ in the United States, making the majority of violent death suicides.^{1,2} The US suicide rate has increased yearly from 2000 through 2014,^{2–4} with nearly 45,000 suicides in 2016.¹ In Washington County, Oregon, suicide was identified as a top health issue in 2 rigorous Community Health Needs Assessments.^{3,4}

Vital statistics and death certificate information, although invaluable for demographics and manner/cause of death, lack the detailed upstream risk factor information to independently guide suicide prevention efforts. Naturally, medical examiner records contain considerably more information about the death than death certificates.⁵

Although 40 states are now funded, Oregon is 1 of the 6 founding states of the National Violent Death Reporting System (NVDRS) with Oregon data available from 2003 to present. The NVDRS is the first multistate system to provide detailed

information on circumstances precipitating violent deaths.⁶ Examples of some suicide-specific risk factors and circumstances harvested from the medical examiner narrative for the NVDRS include history of mental health diagnosis, previous suicide attempt, abuse as a child, and intimate partner problem.² The NVDRS is generally restricted to state-level surveillance.⁷ The availability, completeness, and timeliness of NVDRS data are dependent on the multitude of partnerships required for the system.² In contrast to the medicolegal death investigator (MDI) performing the investigation, the Oregon Violent Death Reporting System (OR-VDRS) abstractor must request reports individually from each agency involved in the investigation, such as law enforcement, emergency medical services, and fire, and provision of those reports is voluntary. Notably, an NVDRS abstractor is limited to the data included in the reports they receive, and variations in coding may occur depending on the abstractor's level of experience.²

In 2010, all available county-level suicide data were evaluated and validated by Washington County epidemiologists for their completeness and ability to inform suicide prevention efforts. In 2014, a new MDI-based surveillance system, the Suicide Risk Factor Surveillance System (SRFSS), was created. Four significant issues contributed to the development of a new suicide surveillance system in Washington County: (1) In Oregon, there is usually at least a 2-year delay from the date of death to the release of a state-level VDRS suicide summary report.^{8,9} (2) Oregon has limited funding and capacity in its OR-VDRS program, and reports are not able to be produced at the county level. In addition to county data not being easily accessible, Washington County has a unique demographic profile that is not well represented by state or national data summaries, necessitating the use of more granular data. Washington County consistently has had the highest birth rates, lowest death rates, and overrepresentation of younger veterans than the rest of Oregon. (3) By design, the MDI who performed the death investigation has the most extensive access to all information regarding the death, including information often not included in the final narrative statement. (4) Each step removed from the MDI performing the death scene investigation is a data loss, as each step away has less and less access to the totality of information. This article describes the development and evaluation of the MDI-based SRFSS compared with the OR-VDRS for the same 133 suicides across 2 years (2014–2015). This article quantifies, for the first time, the significant difference in prevalence reporting of suicide risk factors and circumstances between the MDI performing the investigation and the abstraction of the medical examiner narrative in the NVDRS.

MATERIALS AND METHODS

Assessment of Available Data

In 2010, after early assessment data in the Community Health Needs Assessments indicated suicide would likely be a

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top health priority, Washington County epidemiologists in the Research, Analytics, Informatics and Data program gathered all county population suicide-related data through accessing standard databases and requesting access to any restricted datasets. Summary vital statistics were obtained through the Oregon Public Health Assessment Tool.¹⁰ Line-level death certificate data for all Washington County suicides were requested through the Oregon Health Authority Vital Statistics Registrar for years 2014–2015.¹¹ The Washington County OR-VDRS restricted suicide data set was sought from the Oregon Health Authority Office of Injury and Violence Prevention for years 2012–2015.

Validation of Washington County Subset of the OR-VDRS

It is standard practice in the epidemiology program at Washington County to vet any new data source to a criterion standard before the data are used to guide policy and funding allocation. A random selection of 10% of Washington County suicides from 2011 to 2012 was chosen ($n = 15$). The MDI responsible for each suicide investigation was asked to retrospectively abstract his/her cases falling within this random selection. The MDIs were trained to assign the presence or absence of a risk factor using the definitions provided in the NVDRS Coding Manual¹² and were given a printed reference copy during their abstraction process. The MDIs were blinded to the OR-VDRS abstraction of their cases. For the OR-VDRS validation process, only the coroner/medical examiner (CME) data source variables in the OR-VDRS subset were used. Prevalence of risk factor and circumstance data were compared between the OR-VDRS and the MDI abstraction.

Fieldwork

To assess what information was available during a standard death investigation, an epidemiologist in the Research, Analytics, Informatics and Data program shadowed the MDIs to nearly every death in the Washington County jurisdiction for over 18 months. The purpose of this was to determine what information was available at the scene that (1) was not included in the OR-VDRS, (2) was not in the MDI narrative statement in the death record, and (3) could be valuable for intervention and prevention efforts in public health. Staff attended forensic death investigations with each of the full-time MDIs in the county to observe intrarelated and interrelated reliability.

Development of the Data Collection Instrument

After shadowing fieldwork and assessing the validity of Washington County subset of the OR-VDRS, a draft data collection instrument was created by the epidemiologists and MDIs to collect more timely and accurate data. The original form contained 47 of the NVDRS suicide risk factors/circumstances as well as additional risk factors requested by the county MDIs and agreed upon by the MDIs and epidemiologists as relevant to the Washington County population. Epidemiologists built a single-page fillable PDF, which the MDIs named the Consolidated Risk Assessment Profile (CRAP) form. The MDIs used the NVDRS Coding Manual definitions to complete their forms within 24 hours of each suicide or after toxicology results were received and the death was ruled as a suicide by a board-certified forensic pathologist. Completed questionnaires were sent by secure email to the epidemiology staff to enter into a Stata/IC 15 (College Station, Tex)¹³ database. The CRAP form was pilot tested for 9 months with the MDI staff for feedback on usability. After several years of data collection with the final instrument, the CRAP form was built into an online Health Insurance Portability and Accountability

Act-compliant database in Qualtrics (Provo, Utah)¹⁴ to further enhance efficiency and MDI user experience.

In 2014, CRAP form data were linked to vital statistics using a modified version of the unique identifier variable combination developed by the North Carolina Violent Death Reporting System¹⁵ program consisting of the last 4 numbers of the death certificate, the initial letter of the decedent's last name, numeric birth month, and full date of death. The CRAP form data and demographic information from vital statistics combine to embody the SRFSS.

Evaluation of the SRFSS to the OR-VDRS

There were 53 suicide-related variables collected in the SRFSS and 99 variables in the NVDRS. To allow for comparison, demographic variables, NVDRS calculated variables, and any variables not represented in both systems by the same definition were dropped. Variables with zero count cells in either surveillance system were excluded. This left 27 core variables shared between the 2 systems. The prevalence of “yes” responses were evaluated for these 27 variables for the same 133 suicides across 2 years of data (2014–2015) (Table 1). Statistical testing was performed using Stata version 14,¹³ and statistical significance was assessed using χ^2 with $P \leq 0.05$ as significant.

RESULTS

Concordance of the OR-VDRS Abstraction to an MDI Abstraction

The Washington County subset of the OR-VDRS CME abstraction and the county MDI abstraction were compared for concordance at 2 levels: the case level and the risk factor level.

To be considered a concordant case between the 2 data sources, all individual risk factors listed in the MDI abstraction and the OR-VDRS CME abstraction had to agree for that decedent. From the 15 suicides examined, only 4 cases ($4/15 = 27\%$) achieved full case-level concordance, 73% discordance by case.

In contrast to case concordance, which includes evaluating multiple risk factors to represent overall concordance, risk-factor-level concordance was assessed singularly. A total of 93 risk factors were noted in either the MDI abstraction or the OR-VDRS CME abstraction for the 15 suicides. There was approximately 81% concordance by individual risk factor ($75/93 = 80.6\%$), 19% discordance by individual risk factor.

Fieldwork

Independent of the concordance assessment between the OR-VDRS CME and the MDI abstractions, through fieldwork with MDIs, epidemiologists observed that all information needed for accurate completion of the NVDRS variables was already being obtained through the MDI interviews completed at the scene as part of a routine death investigation.

Data Collection Instrument

Extensive weekly feedback was solicited from the MDIs during the pilot testing period, requiring multiple revisions. Form improvements were made based on MDI feedback for ease of use, technical form errors, the organization of variables to parallel their occurrence in the investigation, and missing fields necessary for linking to vital statistics. The CRAP form was not considered final until all MDIs had used the form for 2 months without a single suggestion for revision. The current online and mobile version of the CRAP form with linked NVDRS definitions for each

TABLE 1. The 27 Variables Collected in the CRAP Form With Definitions Developed and Defined in the NVDRS Coding 5.1 Manual^{1,2}**Definitions of General Suicide Circumstances Defined and Used by the NVDRS and Used in the SRFSS**

History of abuse or neglect as a child: The victim had a history of abuse (physical, sexual, or psychological) or neglect (physical, including medical/dental, emotional, or educational neglect, or exposure to violent environments or inadequate supervision) as a child

Alcohol problem: The person has alcohol dependence or alcohol problem

Depressed mood: Victim was perceived by self or others to be depressed at the time of injury

Eviction or loss of housing: A recent eviction or other loss of the victim's housing, or the threat of it, appears to have contributed to the death

Family relationship problem: Victim had relationship problems with a family member other than an intimate partner that appears to have contributed to the death

Financial problems appear to have contributed to the death

History of ever being treated for a mental health or substance abuse problem

The victim was a perpetrator of violence within the past month that was distinct and occurred before the violence that killed the victim

Intimate partner problem: Problems with a current or former intimate partner appear to have contributed to the suicide

Job problems appear to have contributed to the death

Civil (noncriminal) legal problems appear to have contributed to the death

Other addiction: Person has an addiction other than substance abuse, such as gambling, sexual, etc, that appears to have contributed to the death

Victim's physical health problem(s) appears to have contributed to the death

Criminal legal problems appear to have contributed to the death

The suicide of a friend or family member appears to have contributed to the death

Other relationship problem: Problems with a friend or associate (other than an intimate partner or family member) appear to have contributed to the death

Other substance abuse problem: Person has a non-alcohol-related substance abuse problem

History of suicide attempts before the fatal incident

The victim had a history of suicidal thoughts, plans or attempts

Crisis: A Current/Acute Event Within 2 wk of Death That Is Indicated to Have Contributed to the Death

Contributing criminal legal problem was a crisis

Eviction or loss of home was a crisis

Family relationship problem was a crisis

Intimate partner problem was a crisis

Job problem was a crisis

Contributing physical health problem was a crisis

Nonsuicide death of friend or family member

question can be viewed here at https://washingtonhhs.co1.qualtrics.com/jfe/form/SV_6ytmqBzqGqwUvz.

Evaluation of the SRFSS to the OR-VDRS

Figure 1 shows the prevalence of “yes” answers in the SRFSS and the Washington County subset of the OR-VDRS for the same 133 suicides. Across 27 variables, the median difference in prevalence was 10.5 percentage points. Overall, the prevalence of a suicide risk factor or circumstance was significantly different in 21 (78%) of 27 variables (McNemar exact) between the 2 surveillance systems. In all but 2 cases, the SRFSS data demonstrated a higher prevalence of the risk factor or circumstance surrounding the suicide. There were 2 variables where the OR-VDRS prevalence was higher: the nonsuicidal death of a friend or family member and history of mental illness treatment. The 6 variables where there was no significant difference between the OR-VDRS and the SRFSS included alcohol problem, previous suicide attempt, civil legal problem, history of mental illness treatment, other substance abuse problem, and abused as a child (Table 2).

DISCUSSION

The question families ask most when it comes to the suicide of their loved one is “why?” Few individuals leave a note, and many of the notes are directions of what to do with their property, not why they ended their lives. Through the use of the SRFSS,

multiple community-specific suicide risk factors were identified, supporting the NVDRS data indicating most suicides have many precipitating conditions.^{2,16} The SRFSS includes 2 risk factors not currently collected in the NVDRS but defined and requested by Washington County MDIs as specific risk factors to the community: social isolation and nonfatal self-directed violence. Although not the intent, MDIs reported a significant impact on their investigation from the development of the CRAP form. When conducting investigations, MDIs examined the risk factors on the CRAP form, and when interviewing next of kin, they asked questions about these risk factors. This, in turn, made the MDI investigations more thorough, leading to more data in SRFSS to help understand why people are taking their lives.

Through the SRFSS, epidemiologists in Washington County were able to track near-real-time trends to find the most at-risk community members for suicide. Perhaps most importantly, these data were used to make a direct impact in the community. Independently, MDIs noticed several pet owners surrendering their healthy pets to the county animal shelter just before they died by suicide. This information was collected on the CRAP form, synthesized by the epidemiologists, and reported to the Washington County Suicide Prevention Council. The council, within 2 months of receiving this information, trained all staff and volunteers at every animal shelter in the county in the suicide prevention tool: Question, Persuade, Refer (QPR).¹⁷ The QPR training taught shelter staff to ask the question “Are you thinking about killing

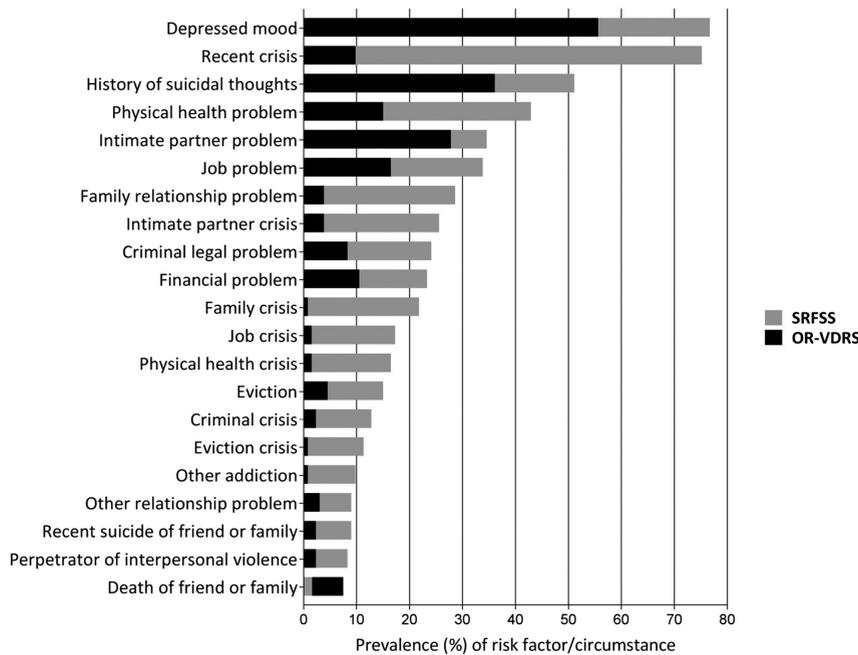


FIGURE 1. Prevalence of statistically significantly different “yes” answers in the SRFSS and the Washington County, Oregon, subset of the OR-VDRS for the same 133 suicides (2014–2015).

yourself?” and if yes, get the person on the phone with the national crisis line. Within 3 months of completion of the QPR training, shelter staff had already identified and intervened with 7 people surrendering their animals who stated they were going to kill themselves after being asked the question by staff.

Another example of public health impact through the use of the SRFSS occurred with a cluster of youth suicides. Three MDIs independently had multiple youth suicides within a 10-day period. Entering these data into the SRFSS allowed this information to be seen by the epidemiologists and facilitated postvention work at the schools at least a week earlier than through the standard channels.

The information gathered through the SRFSS has become a critical piece of information shared quarterly with both the Suicide Prevention Council and Suicide Fatality Review committee at Washington County to guide prevention efforts in a timely data-driven manner. Perhaps, above all, the data produced by the MDIs have created real and specific risk factor profiles, which are used to guide discussions when speaking with families at the scene and have eliminated the need to rely on historical anecdotes of typical suicides.

As shown in Figure 1, the most prevalent risk factors for suicide in Washington County were depressed mood and experiencing a crisis. When further evaluating the type of crises, an eviction crisis was common. These data led to local law enforcement's intervention of including the crisis line information when serving an eviction notice and making a member of the

mental health crisis response team available. In collaboration with public health, the coroner's office in Humboldt County, California, has adopted this data collection instrument and found a completely different set of suicide risk factors for their population, with eviction being one of the least frequent risk factors (Ron Largusa, MSPH, written communication, March 20, 2019). This data collection instrument is a tool to help capture the unique profile of suicide risk factors in a defined population, and risk factor results are not generalizable to other jurisdictions.

The SRFSS Versus the OR-VDRS

In all but 2 cases, the SRFSS data demonstrated a higher prevalence of the suicide risk factor or circumstance among the decedents. The 2 variables where the OR-VDRS was higher included the nonsuicidal death of a friend or family member and history of mental illness treatment. This discrepancy is likely to be an abstraction error when this information is not listed in the medical examiner narrative, or the MDI may have recorded these factors in the narrative but did not believe the factor influenced the death. The 6 variables where there was no significant difference between the OR-VDRS and the SRFSS included alcohol problem, previous suicide attempt, civil legal problem, history of mental illness treatment, other substance abuse problem, and abused as a child. This may indicate these risk factors are consistently interpreted and listed in the medical examiner narrative for suicides.

The differences in prevalence between the OR-VDRS and the SRFSS for the same risk factors for the same suicides are quite significant. After interviewing key stakeholders in the data trail and chart reviewing cases where there were discrepancies, 4 possibilities for these discrepancies emerged: (1) If the risk factor is not reported in the medical examiner narrative statement, it cannot possibly be abstracted. Medicolegal death investigators stated they did not put all the scene information in the narrative statement because the information was not forensically relevant to determining the manner and cause of death. (2) Depending on state law, death files can be requested and viewed by family members. The

TABLE 2. Risk Factor Concordance Between the OR-VDRS CME Abstraction and Washington County MDI Abstraction

	OR-VDRS CME	MDI	n = 93
Suicide risk factor or circumstance presence	Yes	Yes	75 (81%)
	Yes	No	3 (3%)
	No/unknown	Yes	15 (16%)

language in which the narrative statements are written is clinical and neutral, which could pose a problem for NVDRS abstractors trying to read between the lines. For example, at a Washington County death scene, there were more than 500 empty beer bottles and almost as many empty fifths of liquor in a trailer. The MDI asked the next of kin if the decedent had an alcohol problem, and he said, “No, he was just thirsty.” The on-scene phone conversations between the MDI and forensic pathologist went into great detail about the alcohol problem and other sensitive risk factors to inform the need for autopsy or toxicology. The MDI indicated a severe alcohol problem on the CRAP form, but the OR-VDRS abstractor said “no/unknown” based on the narrative statement. This neutral language barrier was most evident in the “recent crisis variable” where it was clear to the investigator and pathologist there was a crisis, but the language in the report was neutral such as “the decedent was upset.” (3) There is no standardization of information required in a medical examiner narrative, and even if from the same office, MDIs may write their reports very differently. (4) Upon auditing a random selection of 10% of suicides, the NVDRS abstraction error rate was found to be approximately 30%. An example of this is the abstractor selecting “no” for the suicide note, while having the actual suicide note in the MDI file, and the investigator indicating the presence of a suicide note in the narrative statement. All of these issues contribute to the considerable difference in prevalence measured by the death investigator versus an NVDRS abstractor using the MDI narrative.

The significant epidemiological advantage of the SRFSS, besides data timeliness and accuracy, is the granularity of 4 possible outcomes per risk factor/circumstance: yes, no, unknown, and missing. The NVDRS has a “yes” category, and all other responses are combined, diluting the measures of association and making proper regression analysis with a true “no” category impossible.

The limitations of the SRFSS include having the internal capacity of MDIs to complete the form, epidemiological ability to synthesize and report the data, close collaboration between epidemiology and MDIs, and an internalized suicide prevention structure to take action on the data. Without these in place, the SRFSS would not be useful. Additionally, without formal training on definitions, MDIs can interpret the risk factors differently; therefore, providing the NVDRS standardized definition is critical to consistent, repeatable data collection.

CONCLUSIONS

The Oregon State Medical Examiner agency resides in and is funded by the Oregon State Police¹⁸ with 6 full-time board-certified forensic pathologists in the state. Oregon has a hybrid state-based medical examiner system where the MDIs work as employees of the counties and not of the State Medical Examiner Office. The administrative structure of Washington County Public Health is uniquely situated with the MDIs residing in the Public Health Division alongside the epidemiologists. This proximity has facilitated the MDIs' leading projects and councils throughout the division, bringing substantial visibility and respect to a previously invisible program, and helping to eliminate barriers between the health department and the death investigation system.¹⁹ Medical examiner cases are relevant to public health, as the information gathered during death investigations reveals different outcomes for vulnerable populations, the crisis level of drug addiction, the need for mental health services, the safety of roads and child safety, and, ultimately, should inform where resources are invested for prevention.^{19,20} This unique collaboration has started conversations with medical examiners and coroners across the United States and internationally. However, independent of any public health involvement, this form has been adopted by offices

where the pathologists directly supervise the MDIs, offices where the pathologists do not supervise the MDIs, and coroner systems where the coroner oversees the deputy coroners. The key aspect for success for adopting the form was the approval and leadership of the medical examiner or coroner of the respective jurisdiction. Compared with the NVDRS abstraction, MDIs provide faster, more accurate, and cleaner data, allowing for active collaboration, and quick, targeted responses that can demonstrably save lives.

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