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## The National Violent Death Reporting System: Use of the Restricted Access Database and Recommendations for the System's Improvement

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### INTRODUCTION

The Centers for Disease Control Prevention (CDC) created the National Violent Death Reporting System (NVDRS) in 2002 to conduct surveillance for homicides, suicides, and unintentional deaths involving firearms. As of 2016, a total of 42 states are funded to contribute cases to the NVDRS using data from coroner and medical examiner (C/ME) reports, death certificates, law enforcement reports, and toxicology reports.<sup>1</sup> Since 2011, the authors' research team has worked with NVDRS Restricted Access Data (RAD) on two projects funded by the National Institute on Alcohol Abuse and Alcoholism focusing on acute alcohol use immediately prior to suicide. Not only is suicide a major public health problem, but also according to CDC, 8,179 deaths and 273,206 years of potential life lost resulted from alcohol-attributable suicides in 2006–2010 (the latest years available).<sup>2</sup> This paper provides a unique perspective on NVDRS strengths and limitations for researchers analyzing associations between alcohol variables and suicide and for investigators interested in other aspects of suicide.

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The first project, Acute Alcohol Use and Suicide, examined associations among alcohol consumption, blood alcohol concentration (BAC) levels, and suicide. Kaplan et al.<sup>3</sup> showed that nearly one third of suicide decedents nationwide were intoxicated at time of death. Caetano and colleagues<sup>4</sup> found that American Indians/Alaska Natives had the highest rate of suicide decedents with a positive BAC (47%) as well as the highest rate of intoxication (BAC  $\geq$  0.08 g/dL), particularly among those aged  $<$ 30 years. Among American Indian/Alaska Native decedents, about 48% of all suicide cases with a BAC  $\geq$  0.08 g/dL were aged  $<$ 30 years. The second-highest rate in this younger age group was among Hispanics (44%). Conner et al.<sup>5</sup> then showed that high drinking levels prior to suicide were associated with the use of the most violent suicide methods (i.e., firearms and hanging). Kaplan and colleagues<sup>6</sup> compared acute alcohol use prior to suicide with drinking patterns in a living population and found that suicide decedents were more likely to drink—and do so heavily—prior to the event than would be expected in a living sample. Using multilevel analyses, Giesbrecht et al.<sup>7</sup> found that the density of both on- and off-premises alcohol outlets in a county is positively associated with the alcohol-related suicide rate, especially among American Indian/Alaska Native populations. In summary, this work demonstrates that acute alcohol use is common prior to suicide and is a potent risk factor for suicide after accounting for other variables related to drinking, including alcohol use disorder, population-wide drinking patterns, and alcohol availability.

The second project, Economic Contraction and Alcohol-Related Suicides: A Multilevel Analysis, was designed to estimate the effect of the 2007–2009 economic downturn (the Great Recession) on rates of suicide involving acute alcohol intoxication using RAD. Although considerable evidence exists regarding the impact of contracting economies—especially levels of unemployment—on suicide mortality risk, less is known about the role of heavy alcohol consumption on the link between economic conditions and suicide. The project compared associations across time periods using multilevel approaches to model effects of state- and county-level variables on differences in the associations.

Kaplan and colleagues<sup>8</sup> showed that the fraction of all suicide decedents with alcohol intoxication increased by 7% after the onset of the recession (from 22.2% in 2005–2007 to 23.9% in 2008–2011). Compared with the prior years, male suicide decedents showed a 10% increased risk of alcohol intoxication within the first 2 years of the recession. Surprisingly, there was evidence of a lag effect among female suicide decedents, who had a 1.14-fold (95% CI=1.02, 1.27) increased risk of intoxication in 2010–2011 compared with 2005–2007. In a study involving a nonsuicide comparison sample, Kaplan et al.<sup>9</sup> showed that this increase in alcohol-related suicide among male decedents was greater than the change in heavy alcohol use among living men. More recently, Kerr and colleagues<sup>10</sup> examined associations between county-level rates of foreclosures, unemployment, and poverty and suicide rates and alcohol involvement in 16 NVDRS states from 2005 to 2011. Results suggest that suicide rates were most closely associated with poverty rates, with large positive coefficients in all gender and age groups. Alcohol involvement was positively associated with poverty rates for men in their middle years (age 45–64 years), whose suicide rates increased substantially over the period, but not in other subgroups. As discussed below, the authors' papers and conference presentations identified strengths and limitations of NVDRS

and informed recommendations for enhancing this system to facilitate future analyses and prevention initiatives.

## **STRENGTHS OF THE NATIONAL VIOLENT DEATH REPORTING SYSTEM RESTRICTED ACCESS DATA**

In contrast to standard suicide mortality data obtained exclusively from death certificates, NVDRS has much broader data elements and provides accurate, timely, and comprehensive surveillance data. Also, RAD is the only data set that identifies BACs among suicide decedents and homicide-followed-by-suicide cases and includes nearly complete toxicology data for suspected poisoning deaths. In addition, RAD provides geographic indicators (e.g., county and ZIP code) that can be used to link decedents to contextual neighborhood factors. Finally, NVDRS data have been useful for creation of prevention programs for several vulnerable populations.<sup>11,12</sup>

## **LIMITATIONS OF THE NATIONAL VIOLENT DEATH REPORTING SYSTEM RESTRICTED ACCESS DATA**

As with most existing databases, NVDRS has limitations. First, NVDRS is not national but recently increased funding allowed participation of 32 states. Second, collection of the circumstances preceding death is not standardized but varies across jurisdictions and among law enforcement personnel and C/MEs. As discussed in detail below, especially noteworthy limitations include lack of standardization for and possible selection bias in collecting mental health and substance use information.

Also, toxicology testing is not supported by CDC funding and thus depends greatly on local resources. Some states have limited toxicology data due to the price of testing. In these states (e.g., Oregon), toxicologic data are collected only from decedents for whom this information is important to the determination of the cause of death (for example, death by poisoning). Moreover, reporting of unintentional poisoning deaths to CDC is voluntary for participating NVDRS states,<sup>13</sup> which could be a major deficit given the opioid epidemic and questions concerning misclassification of intentional poisoning as unintentional.<sup>14–16</sup>

The CDC funding is also not directed toward improving medicolegal death investigation procedures. Consequently, NVDRS is limited by the assortment of medicolegal death investigation systems in the participating states, including extreme variations in expertise.

Indeed, although there are national standards for C/ME death certification,<sup>13</sup> this process is sometimes influenced by idiosyncratic assumptions of individual C/MEs. Variation in assigning the manner of death (natural, homicide, suicide, accident, or undetermined) is especially troubling. For example, under-resourced and ill-equipped C/ME agencies may assign ambiguous or inaccurate manner of death when definitive evidence of suicide is lacking.<sup>14–16</sup> These choices influence surveillance statistics (misclassification of manner of death) as well as research using mortality data.

Lack of standardized information regarding mental health and substance use history merits further comment. NVDRS includes items pertaining to depression and substance use. However, it is usually unclear who (if anyone) has provided the information. Indeed, it can often be difficult to determine if a negative response means that the decedent had, say, no history of substance use or that a lack of information exists regarding alcohol and drug consumption. Moreover, the primary NVDRS data are obtained by law enforcement personnel or C/MEs who are unlikely to ask standardized questions of informants. Thus, comparing information pertaining to decedents with survey data obtained from general population (living) respondents can be difficult.

## RECOMMENDATIONS FOR NATIONAL VIOLENT DEATH REPORTING SYSTEM RESTRICTED ACCESS DATA EXPANSION AND IMPROVEMENT

### 1. Quality Over Quantity

Should additional funding be earmarked for expanding NVDRS to nonparticipating states or for improving the quality of the data (e.g., toxicology data) currently collected in participating states? Ideally, all NVDRS decedents should receive a full panel of toxicology testing. Given funding constraints, researchers and state public health authorities can advise on sampling strategies so that representative decedents could receive comprehensive toxicology testing. The National Highway Traffic Safety Administration provides models for sampling in its Crash Investigation Sampling System<sup>17</sup> and Crash Report Sampling System,<sup>18</sup> which build on longstanding programs such as the Fatality Analysis Reporting System,<sup>19</sup> Generalized Estimates System,<sup>20</sup> Crashworthiness Data System, and National Automotive Sampling System.

### 2. Data Collection Standardization

Should a standard approach to collecting evidence be developed? Law enforcement and C/ME personnel collect data based on their assessment of the situation and death scene (but not for research). One suggestion is a standardized (perhaps electronic) collection instrument whereby law enforcement and C/ME investigators would gather information about all decedents. Such an application could be embedded in a larger standardized data management system that would allow C/MEs to manage cases efficiently and to provide uniform high-quality data to public health, public safety, and criminal justice agencies. Models for standardized data collection can be found in coding and data analysis manuals on the National Highway Traffic Safety Administration<sup>17,18</sup> websites.

Moreover, standardized data collection could benefit from literature on psychological autopsies.<sup>21,22</sup> Though challenging<sup>23</sup> and expensive to collect, psychological autopsy data could help adjudicate the small fraction of NVDRS cases currently labeled as *undetermined manner of death* and provide information essential to development of preventive interventions. Researchers could suggest targeted subsamples of suicide decedents for psychological autopsy and for review of medical records (especially electronic health records).

### 3. Standardization of the Death Investigation System

The medicolegal death investigation system is “at the bottom of the food chain,” with the lack of federal support resulting in statistics plagued by inaccuracy. Yet, prevention programs and policies are developed based on mortality data from this system. Moreover, the recent epidemic of fatal opioid overdoses has overwhelmed many C/ME agencies.<sup>24,25</sup> Similar to recommendations from the White House,<sup>26</sup> the authors suggest that incentive funding be provided to states to transform low-expertise coroner systems into high-expertise medical examiner systems. Funding should also be provided to enhance consolidation of small, fragmented, county-based medicolegal death investigation systems into regional and state-based centers to foster economy of scale in operations and uniformity in procedures. The medicolegal death investigation system should be the foundation for tracking national prevention efforts involving unnatural deaths, which should all be investigated, evaluated, and certified in the same way nationwide.

### 4. Enhanced General (Living) Population Survey Data

Ongoing surveys (such as the National Survey on Drug Use and Health, National Health Interview Survey, and Youth Risk Behavior Surveillance System) could be enhanced to facilitate comparison with NVDRS. For example, questions pertaining to alcohol consumption could include items such as: *How much did you drink yesterday [in standard drinks]?* and *Over how many hours did you drink yesterday?* These data would improve estimates of BAC in the general population. Ideally, survey data (especially the National Health and Nutrition Examination Survey) could include pertinent laboratory tests like BAC and marijuana toxicology.

## SUICIDE PREVENTION AND THE NATIONAL VIOLENT DEATH REPORTING SYSTEM

Information from NVDRS (especially from an expanded and improved NVDRS) can guide development of effective suicide prevention programs. In particular, NVDRS analyses can identify population subgroups at elevated suicide risk, elucidate modifiable risk factors, and find individual characteristics essential for tailoring preventive interventions. For example, recent NVDRS analyses examined connections between occupation and suicide.<sup>24</sup>

Prevention programs are often categorized as universal (primary), targeted (secondary), or indicated (tertiary) based on distributions of a risk factor across subgroups. Individuals with low levels of the risk factor might benefit from a universal prevention program. Conversely, immediate intervention is indicated for people with critically high risk factor levels. A unique and invaluable aspect of NVDRS is the possibility of delineating not just risk factors but also surrounding circumstances that can be used to generate “personalized prevention” programs. This work is needed to ameliorate the rapidly rising suicide rate.<sup>27–29</sup>

Last, NVDRS data confirm that firearms play a major role in suicides as well as homicides. CDC should focus surveillance, research, and prevention efforts on relationships among firearms, alcohol use, the opioid epidemic, mental health issues, and unnatural deaths. Not to do so is to ignore the proverbial “elephant in the room.”

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