Data for Building a National Suicide Prevention Strategy
What We Have and What We Need

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Suicide is a leading cause of death in the U.S. As both the rate and number of suicides continue to climb, the country struggles with how to reverse this alarming trend. Using population-based data from publically available sources including the Web-based Injury Statistics Query and Reporting System, National Survey on Drug Use and Health, the authors identified patterns of suicide that can be used to steer a public health–based suicide prevention strategy. That most suicide deaths occur upon the first attempt, for example, suggests that a greater investment in primary prevention is needed. The fact that definable subgroups receiving care through identifiable service systems, such as individuals in specialty substance use treatment, exhibit greater concentrations of suicide risk than the general public suggests that integrating suicide prevention strategies into those service system platforms is an efficient way to deliver care to those with heightened need. The data sets that reveal these patterns have both strengths (e.g., population-level) and weaknesses (e.g., lack of longitudinal data linking changing health status, intervention encounters, suicidal behavior, and death records). Some of the data needed for crafting a comprehensive, public health–based approach for dramatically reducing suicide are currently available or may be available in the near term. Other resources will have to be built, perhaps by enhancing existing federal surveillance systems or constructing new ones. The article concludes with suggestions for immediate and longer-term actions that can strengthen public data resources in the service of reducing suicide in the U.S.
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Introduction

In 2010, suicide was the tenth-leading cause of death in the U.S., claiming more than twice as many lives as homicide.[1] On average, between 2001 and 2010, more than 33,000 Americans died each year from suicide.[2] The burden of suicide in the U.S. goes beyond deaths, however: Suicide attempts confer morbidity and economic burden on individuals, their families and friends, their workplaces, and on healthcare settings as well. Emergency department (ED) records show that 487,770 ED visits by youth and adults in 2011 were linked to a suicide attempt.[3]

Annual surveys conducted since 2008 indicate that an estimated 1.1 million adults (0.5% of the adult population) attempted suicide each year,[4,5] and an additional almost 400,000 youth (2.4% of high school students) report having made a serious suicide attempt (i.e., resulting in treatment by a doctor or nurse).[6] The discrepancy between the numbers of self-reported suicide attempts and self-harm injuries seen in the ED suggests there is a range in the severity of suicide attempts and whether and where suicide attempters receive treatment.

Although the U.S. lacks rigorous and consistent longitudinal data that capture the natural history of suicidal behavior, information from various studies and reports can be pieced together to form a picture—and the picture is grim. Data from the National Violent Death Reporting System (NVDRS) indicate that among suicide decedents with known histories, 19.8% had made a previous suicide attempt.[7] This suggests that some deaths may have been avoided if effective interventions for preventing repeat suicide attempts had been in place.

Taken further, the NVDRS report indicates that 80% of people who die by suicide use highly lethal means, such as firearms or hanging, that are likely to cause death the first time they are used. Thus, a key point of intervention for 80% of suicide decedents each year is not when they reveal themselves to be at risk after a

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suicide attempt; rather, it is much earlier in the trajectory that leads up to that first suicide act.[8,9]

The vision of the National Action Alliance for Suicide Prevention (Action Alliance), an initiative launched by the USDHHS in 2010, is "a nation free from the tragic experience of suicide."[10] In pursuit of this vision, the Action Alliance's Research Prioritization Task Force (RPTF) has released a research agenda aimed at reducing suicide deaths and attempts by 20% in 5 years.[11]

To achieve this ambitious goal, a strategic approach to targeting intervention has been recommended.[11,12] One four-step approach involves prioritizing population subgroups with concentrated risk of suicide, identifying effective interventions ready for deployment and service platforms from which to launch them, estimating the potential impact of these interventions if deployed in real-world settings, and assessing the time horizons for taking implementation to scale.[12] This public health approach recognizes that suicide results from the complex interplay of many personal factors, such as poor mental health and substance abuse, and life experiences, such as abuse/trauma, physical illness, and financial distress, that affect a variety of people across the life span.[13]

A key to successful suicide prevention will be to expand the number and types of systems such as primary and mental health care clinics, schools, work places, hospitals, EDs, and criminal justice settings where at-risk populations can be identified and targeted early in the risk trajectory. These systems, in turn, can serve as platforms for the delivery of evidence-based prevention and intervention services and can monitor program effectiveness in reducing suicide. Decision makers with knowledge about evidence-based practices appropriate for their populations (e.g., universal, selective, or indicated) and reliable data for targeting interventions and assessing outcomes are better equipped to take strategic action to reduce suicide within and across the agencies and programs they lead.

What We Know

A Leading Cause of Death

Suicide statistics are generated from death certificate data collected by states and assembled into national record archives by the CDC.[1] Basic demographic data plus information about the method of death are recorded on each certificate of death. Suicide mortality statistics can be portrayed in multiple ways.

From a public health perspective, "leading causes of death" charts help to identify the most frequent types of illness, disease, or condition that lead to death along a developmental (age) spectrum. Suicide is within the top

four leading causes of death among individuals aged 10–54 years, who comprise almost two thirds of the U.S. population. It is only as other illnesses and diseases become prevalent in older adults that suicide falls to the eighth-leading cause for 55–64-year-olds and usually outside of the top ten causes of death among those who are ≥65 years old.[1]

A Growing Problem

The latest data available indicate that the U.S. suicide rate has risen from 10.5 per 100,000 in 1999 to more than 12 per 100,000 in 2010 (Table 1). This increase, in conjunction with population growth over the same time frame (279 million to almost 309 million), has raised the national total number of suicides per year by 31%, from 29,199 in 1999 to 38,364 in 2010.[2]

Differences by Gender, Race, and Ethnicity

Death certificates also yield demographic information about people who die by suicide, which can be used to target intervention strategies. Table 2 provides a breakdown of suicide numbers by gender and race, and then provides numbers for the top three methods used by men and women—firearms, poisoning, and suffocation. Firearms and poisoning together account for more than two thirds of suicides. Adding suffocation increases the percentage of suicides covered to 77% for women and a full 96% for men.

Table 1. Annual number of suicide deaths, U.S., 1999–2010

Year	Number of suicide deaths	Population	Rate per 100,000
1999	29,199	279,404,181	10.5
2000	29,350	287,803,914	10.4
2001	30,622	285,081,556	10.7
2002	31,655	287,803,914	11.0
2003	31,484	290,326,418	10.8
2004	32,439	293,045,739	11.1
2005	32,637	295,753,151	11.0
2006	33,300	298,593,212	11.2
2007	34,598	301,579,895	11.5
2008	36,035	304,374,846	11.8
2009	36,909	307,006,550	12.0
2010	38,364	308,745,538	12.4

Data source: Web-Based Injury Statistics Query and Reporting System (WISQARS); fatal injury reports, national and regional, 1999–2010

Table 2. Method of suicide death by gender and race/ethnicity, U.S., 2009

	Number of suicides	Top 3 methods of suicide death		Total accounted for by 3 methods
Male	29,089	Firearm	16,962	96%
		Poisoning	3,573	
		Suffocation	7,300	
Female	7,820	Firearm	2,428	77%
		Poisoning	1,901	
		Suffocation	1,700	
White	33,425	Firearm	17,332	90%
		Poisoning	5,036	
		Suffocation	7,805	
Black	2,084	Firearm	1,034	88%
		Poisoning	274	
		Suffocation	537	
American Indian/Alaska Native	429	Firearm	161	96%
		Poisoning	61	
		Suffocation	188	
Hispanic	2,573	Firearm	955	90%
		Poisoning	305	
		Suffocation	1,050	

Data source: Web-Based Injury Statistics Query and Reporting System (WISQARS), 2009

Distributions within the cause of death categories vary somewhat among different racial/ethnic groups. Firearms are the most frequently used suicide method among whites and blacks, whereas suffocation is the most commonly used method among American Indian/Alaska Native and Hispanic subgroups.[2]

Age and Suicide

Age at death, which is also listed on death certificates, offers a glimpse of the patterns and magnitude of suicide across the life span. Suicide is one of the highest-ranking causes of premature mortality in the industrialized world.[14] Expressed in "potential years of life lost," the burden of suicide mounts as decedents get younger. Using age 65 years as a cut point for premature death, data in Table 3 indicate that close to 85% of all suicides (those occurring between age 10 and 64 years) incur 1–55 potential years of life lost. Table 3 also shows that although numbers of suicides in the older age groups (≥65 years) appear to decrease, the suicide rates remain substantially higher than the 11.8 per 100,000 overall rate for the nation.

In sum, suicide rates and patterns by age, gender, and race can be identified in existing mortality data records, and they indicate a substantial public health problem in the U.S. The total number of suicides in the U.S. has increased gradually but consistently over the past decade, while downward trends have been noted in European and Scandinavian countries during the same time period.[15–17]

Suicide rates rise steadily with age, then peak in the 50–64-year age range. Firearms account for the highest numbers of suicides among men and women, white and black. The great majority (80%) of suicides occur upon the first attempt. This and other information may be used to target prevention efforts on the methods used in suicides or high-risk subgroups across the life span, as well as to monitor the effects of state and federal policy changes and safety practices in the past, present, and future.[18–20]

Suicide Attempts

Data on the Nation's rates and incidents of suicide attempts are available from multiple sources. The National Survey on Drug Use and Health (NSDUH) has collected data on self-reported suicidal behavior including ideation, plans, attempts, and attempts requiring medical attention in the general population, defined as adults aged ≥18 years,[4,5] since 2008. The Youth Risk Behavior Surveillance System (YRBSS) collects information about suicidal

Table 3. Number and rate of suicide deaths by age group, U.S., 2009

	Age range (years)						
	All ages	10–19	20–34	35–49	50–64	65–79	≥85
Number of suicide deaths	36,909	1,928	8,022	10,889	10,194	4,019	1,839
Rate per 100,000 (age adjusted)	11.8	4.4	12.9	16.8	17.9	14.1	16.6

Data source: Web-Based Injury Statistics Query and Reporting System (WISQARS), 2009

behavior from youth aged 13–18 years in Grades 9–12.[6] The Web-Based Injury Statistics Query and Reporting System (WISQARS) yields medical record data on intentional self-harm injuries treated in U.S. hospital EDs, collected under the aegis of the Consumer Protection Safety Commission's National Electronic Injury Surveillance System (NEISS).[3]

A relatively new and promising research platform, the Mental Health Research Network is a consortium of 11 healthcare systems that hold longitudinal electronic medical records and insurance claim data for 11 million enrolled members, yielding information about health events and contacts that occur prior to suicide attempts and deaths.[21] This is a unique, valuable resource currently unmatched by federal data systems.

The charge to reduce suicide deaths and attempts by 20% in 5 years requires a strategic approach to targeting suicide prevention and intervention programs.[12] Such an approach could begin with identification of existing service delivery systems, such as EDs, schools, jails/prisons, workplaces, and mental health and substance treatment facilities that contain "boundaried populations" and can therefore provide access to subgroups with higher concentrations of suicide risk and become platforms for delivering care.[12] Information available from the aforementioned federal data systems are useful for identifying potential service system platforms, determining concentrations of risk for boundaried populations within these systems, and statistical modeling of the potential impact of preventive interventions on suicide attempt rates in these populations.[22]

Population data on suicide attempts collected through the NSDUH can be reassembled to reflect specific boundaried populations (Table 4). The data indicate that some boundaried populations exhibit greater concentrations of suicide risk than others. It is commonly known that most suicide decedents have had some form of serious mental illness[23] and around a quarter of suicide decedents were in contact with mental health services in the month before death, offering the possibility of intervention.[21,24]

Less well known are other boundaried populations that represent ready, potentially fruitful opportunities for

Table 4. Number and percentage with suicidal ideation and attempt among specific boundaried populations

	Estimated number in population	People with past year suicidal ideation		People with past year suicide attempt	
		n	%	*n*	%
Total U.S. population (adults aged ≥ 18 years), 2012	226,065,000	9,031,000	3.9	1,290,000	0.6
Sorted by service delivery platform					
Full-time employee[a]	116,652,000	3,514,000	3.0	344,000	0.3
Seen in emergency department[a]	66,023,000	3,941,000	6.2	728,000	1.1
Military veteran[a]	24,141,000	800,000	3.4	96,000	0.4
On Medicaid[a]	20,903,000	1,440,000	6.9	311,000	1.5
Full-time college student[a]	15,748,000	888,000	5.6	119,000	0.8
On probation or parole[a]	5,493,000	543,000	9.9	130,000	2.4
Outpatient mental health clinic[b]	3,257,000	847,000	26.2	206,000	6.4
Specialty substance use treatment[a]	2,613,000	446,000	19.4	122,000	5.3

Data source: National Survey on Drug Use and Health, 2008–2012
[a]Annual averages based on 2008–2012
[b]Annual averages based on 2008–2010

intervention. For example, although the observed self-reported rate of suicide attempt in the general population is 0.6%, the rate of past-year suicide attempt among the specialty substance use treatment population is 5.3%—a concentration of risk more than eight times higher than that seen in the general population. Similarly, greater concentrations of suicide risk are seen among people on probation or parole, on Medicaid, and among those seen in an ED in the past year.

Proportionally lower concentrations of suicide risk are observed among people who are employed full-time (0.3%); however, the utility of an employer-based intervention platform should not be dismissed based on that information alone, because the 344,000 annual attempts among full-time workers represents almost one third of annual suicide attempts estimated for the nation. Further analysis of these data from this perspective could point to a set of boundaried populations for which suicide prevention interventions would yield the greatest public health benefit in terms of lives saved.[12]

Breakthroughs Needed

Federal data systems collect basic historic and demographic information on suicide decedents and attempters along with, in some cases, clues to where concentrations of suicide attempters may be identified and targeted for intervention. A strength of these surveillance systems is that they provide information on large numbers of individuals in the general population—data that may be examined and combined to inform the practices of those serving vulnerable populations, monitored to determine trends over time, and used to determine meaningful public health correlates of suicide such as mental illness, substance abuse, physical illness, financial distress.

In order to reduce suicide, however, these surveillance systems need to do more—they need to yield data that are timely, accurate, and much more useful for predicting risk, identifying needs, targeting care, and detecting intervention effects.[15] Delays of 3 or more years are common in the release of national mortality data, and the reliability of official suicide numbers and rates are subject to error because of variability in defining suicide and in determining and reporting manner of death.[25–27]

Furthermore, no federal data system follows general populations over time and links changing health status, intervention encounters, and information about suicidal behavior to mortality records. Recent advances in the use of electronic records (i.e., health, program participation, and research records) and the capacity for linkage to mortality records portend a brighter future for suicide research in the U.S. Some existing, self-contained data systems within specific care systems including the Mental

Health Research Networks, Department of Defense/military services, Veterans Affairs (VA) healthcare system, and possibly other health insurance/service delivery care systems, permit in-depth, longitudinal examination of key modifiable precursors to suicidal behavior that can serve as markers for suicide risk and targets for interventions.

These data systems cover only selected segments of the U.S. population; nevertheless, they could be melded into a coordinated data platform for identifying suicide risk factors by tracing the onset of suicidal behaviors longitudinally in large groups of participants who have not yet developed overt suicidal behavior. Consideration of such a coordinated approach underscores the would-be benefits of using common measures of suicidal behaviors and key correlates across studies to facilitate data pooling and interpretation across service systems. The use of common data elements, data banking, and data sharing are core methodologic research strategies recommended by the RPTF.

Deeper knowledge about the complex nature of suicidal behavior and how to prevent it will require a much more concentrated effort using epidemiologic data resources that permit retrospective and prospective analyses of precursors to suicidal events,[28] including detailed information about the treatment or interventions individuals receive along the way. Denmark and Sweden have developed national registries that can be used to explore a wide variety of epidemiologic questions regarding suicide risk and behavior at the population level.[29,30]

Data resources for the U.S. population will have to be built, perhaps by enhancing existing federal healthcare and surveillance data systems or creating new ones. Thus, although some pressing research objectives may be accomplished in the short term using existing data resources, other longer-term, complex research objectives may not be achieved until more comprehensive data resources become available.

Short-Term Research Objectives

Short-term research goals outlined by the RPTF—such as (1) developing risk algorithms from healthcare data for detecting suicide risk; (2) improving care efficiencies and decision-making tools by identifying valid screening approaches; or (3) identifying feasible and effective interventions[11]—may be tested within research platforms based in self-contained healthcare and administrative data systems such as those maintained by VA Health,[31] the Mental Health Research Network,[21] and the Army Study to Assess Risk and Resilience in Servicemembers.[32]

These data systems would permit retrospective examination of the pathways leading to suicide events and development of predictive algorithms and screeners that could be tested prospectively to determine their validity

and then disseminated for broad use. Healthcare data systems may also be used to monitor risk trajectories and outcomes for people who have been enrolled in suicide prevention interventions. Linking research data systems to mortality records will be critical for strengthening the ability to determine cause of death outcomes of interest to the care systems.

Long-Term Research Objectives

Longer-term research goals identified by the RPTF— such as (1) determining whether processes that reduce risk conditions (e.g., insomnia, addiction, pain) also mitigate suicide; (2) developing screening approaches for low-, moderate-, and high-risk individuals so that preventive interventions can be more finely calibrated based on risk level; or (3) identifying which interventions that are launched outside of healthcare settings reduce suicide risk[11]—will require the development of additional data resources. Multiple data networks that are linked by common data elements will be needed in order to test suicide prevention programs, pair immediate and longer-term interventions with specific risk groups, and evaluate the impact of programs and interventions on overall suicide death and attempt rates over time.

In conclusion, the rate and number of suicides in the U.S. continue to climb despite the many concerted efforts to halt the trend. The RPTF recommends a fresh, strategic, public health–based approach to suicide prevention. Such an approach will have the greatest chance of success if it is based on sophisticated analysis of complex, population-based data (i.e., longitudinal data linking health status, intervention encounters, suicidal behavior, and death records) from a wide variety of service delivery system platforms. Some of the data and platforms needed for crafting a comprehensive, public health–based approach to dramatically reduce suicide are currently available or may be available in the near term. Other data resources will have to be created, perhaps by enhancing existing federal surveillance systems or constructing new ones.

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