Estimating the rates of deaths by suicide among adults who attempt suicide in the United States

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ABSTRACT

Background: In 2012, over 1.3 million U.S. adults reported that they attempted suicide in the past year, and 39,426 adults died by suicide. This study estimated national suicide case fatality rates among adult suicide attempters (fatal and nonfatal cases) and examined how they varied by sociodemographic characteristics.

Methods: We pooled data on deaths by suicide (n = 147,427, fatal cases in the U.S.) from the 2008–2011 U S. mortality files and data on suicide attempters who survived (n = 2000 nonfatal cases) from the 2008–2012 National Surveys on Drug Use and Health. Descriptive analyses and multivariable logistic regression models were applied.

Results: Among adult suicide attempters in the U.S., the overall 12-month suicide case fatality rate was 3.2% (95% confidence interval (CI) = 2.9%–3.5%). It varied significantly by sociodemographic factors. For those aged 45 or older, the adjusted suicide case fatality rate was higher among men (7.6%) than among women (2.6%) (suicide case fatality rate ratio (SCFRR) = 3.0, 95% CI = 1.83–4.79), was higher among non-Hispanic whites (7.9%) than among non-white minorities (0.8–2.5%) (SCFRRs = 3.2–9.9), and was higher among those with less than high school education (16.0%) than among college graduates (1.8%) (SCFRR = 8.8, 95% CI = 3.83–20.16). Across male and female attempters, being aged 45 or older and non-Hispanic white and having less than secondary school were at a higher risk for death by suicide.

Conclusions: Focusing on these demographic characteristics can help identify suicide attempters at higher risk for death by suicide, inform clinical assessments, and improve suicide prevention and intervention efforts by increasing high-risk suicide attempters' access to mental health treatment.

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1. Introduction

Over 1.3 million adults aged 18 or older in the U.S. reported in 2012 that they attempted suicide in the past 12 months (Substance Abuse and Mental Health Services Administration (SAMHSA), 2013). Also, it was reported that 39,426 adults aged 18 or older died by suicide in the U.S. in 2012 (CDC, 2014), making suicide the tenth leading cause of death in the U.S (CDC, 2014; HHS, 2012) and documenting a stubborn lack of progress in the fight against this preventable cause of premature death (CDC, 2014; HHS, 2012; Suominen et al., 2004). Although suicide attempt history is the strongest known clinical predictor for death by suicide (HHS, 2012; Suominen et al., 2004) most suicide attempters do not die by suicide (Action Alliance for Suicide Prevention, 2014; Caine, 2013, 2015). Identifying subgroups of the adult suicide attempter population with increased suicide case fatality rates may help clinicians identify high-risk patients and help develop more targeted preventive interventions. We define a suicide case fatality rate as the proportion of fatal cases (deaths by suicide) among adult fatal and nonfatal suicide attempters (including those who die by suicide, i.e., fatal cases, *plus* those who survive, i.e., nonfatal cases) in the past 12 months.

Previous U.S. studies reported suicide case fatality rates based on geographically localized samples from emergency department and hospital data (Claassen et al., 2008; Miller et al., 2004; Spicer and Miller, 2000). While relevant for understanding cases that

directly come to clinical attention, these studies are constrained by their geographic boundaries and exclusion of individuals who did not receive medical attention following their attempts. In the U.S., only about half of the adult suicide attempters received medical attention (Center for Behavioral Health Statistics and Quality, 2013). Although these studies provided much needed information about specific subgroups, they cannot provide valid population estimates on the number of suicide attempters in the U.S. and cannot statistically compare the suicide case fatality rates of different population segments. Furthermore, existing studies (Claassen et al., 2008; Miller et al., 2004, 2012; Spicer and Miller, 2000) have used the number of fatal and nonfatal suicide attempts (not attempters) as the denominator when calculating suicide case fatality rates. None of these U.S. studies calculated the 12-month suicide case fatality rate as the proportion of fatal cases among fatal and nonfatal cases in the past year.

Based on the data from the five-site Epidemiologic Catchment Area (ECA) Study conducted by the U.S. National Institute of Mental Health, an earlier study found 300 nonfatal cases per 100,000 adult persons annually, compared with only 12 fatal cases per 100,000 adult population (Moscicki et al., 1989). The authors concluded that there were 25 attempted suicides for each death by suicide (Moscicki et al., 1989). Based on the data from the 1991–1992 National Comorbidity Survey (NCS) and the 2001–2003 National Comorbidity Survey Replication (NCS-R), another earlier study found 500 nonfatal cases aged 18–54 per 100,000 population in the U.S. each year compared with 14 fatal cases per 100,000 population (Kessler et al., 2005). Both studies (Kessler et al., 2005; Moscicki et al., 1989) relied on a very small number of nonfatal cases, yielding the preliminary estimates above. Moreover, neither of the two studies examined fatal cases, reported suicide case fatality rates, estimated variances, standard errors, or 95% confidence intervals (CIs) of suicide case fatality rates, or conducted statistical analyses examining how suicide case fatality rates significantly varied by sociodemographic characteristics at the population level.

Cross-national data reveal major differences in suicide case fatality rates and characteristics because of differences in suicide methods used in different places, variation in availability and quality of emergency care, and differences in data sources and data collection periods. In particular, methodological data collection differences may help explain the wide variation in rates across countries. For example, suicide case fatality rates were 56.0% for men and were 30.0% for women in Italy in 2007 since only the most severe attempts were analyzed using Italian police statistics (Preti, 2012). In contrast, the overall suicide case fatality rate was 10% in Australia in 2002–2003 based on Australia's National Hospital Morbidity Database and national mortality files (Elnour and Harrison, 2008). Based on suicide death and hospitalization records, the overall suicide case fatality rates were 49% in a predominantly rural population in Shandong, China in 2009–2011 (Sun et al., 2015) and 8% in Taiwan in 2006–2008 (Chen et al., 2015). Thus, it is inappropriate to estimate suicide case fatality rates in the U.S. based on rates from other countries.

This study aimed to use nationally representative data on nonfatal cases and national data on fatal cases to estimate, for the first time, national 12-month suicide case fatality rates and related 95% CIs by population subgroups. We also examined how 12-month suicide case fatality rates significantly varied by sociodemographic factors at bivariable and multivariable levels and assessed potential interaction effects on suicide case fatality. Since the prevalence of nonfatal cases is high among young adults (Kessler et al., 2005) and among women (Moscicki et al., 1989) and because the prevalence of fatal cases is relatively low among the two populations (Action Alliance for Suicide Prevention, 2014; CDC, 2014; HHS, 2012), we tested the following hypotheses:

1. The 12-month suicide case fatality rate was higher among adults aged 45 or older than among adults aged 18–25 even after adjusting for other sociodemographic characteristics.
2. The 12-month suicide case fatality rate was higher among men than among women even after controlling for other sociodemographic characteristics.

2. Materials and methods

2.1. Data sources

2.1.1. Fatal cases

Data on fatal cases were drawn from the restricted-use data, containing all collected death certificate variables, from the 2008–2011 U S. mortality files from the National Vital Statistics System (National Center for Health Statistics, 2015), which include information on the manner of death. Suicide is one of its seven mutually exclusive categories. During the 2008–2011 period, 147,427 adults aged 18 or older died by suicide in the U.S. and constituted the fatal cases in this study.

2.1.2. Nonfatal cases

Data were drawn from the restricted-use data on the 229,600 individuals aged 18 or older who participated in the 2008–2012 National Surveys on Drug Use and Health (NSDUH). NSDUH is an annual survey conducted by the SAMHSA, providing nationally representative data on suicide attempters among the civilian, noninstitutionalized population aged 18 or older in the U.S. since 2008 (SAMHSA, 2012; 2013; 2015).

As detailed elsewhere (SAMHSA, 2012; 2013; 2015) the 2008–2012 NSDUH employed a design with an independent, multistage area probability sample. Data were collected annually, from January to December, by interviewers during in-person visits to households and noninstitutional group quarters. Audio computer-assisted self-administered interviewing was used, providing respondents with a private, confidential way to record answers to sensitive questions (SAMHSA, 2013). Each individual NSDUH respondent represented a number of adults in the U.S. and was weighted accordingly (Chen et al., 2012).

The 2008–2012 NSDUH questionnaires asked all adult respondents if at any time during the 12 months preceding the survey interview they had thought seriously about trying to kill themselves. Those who reported that they had suicidal ideation were asked if they made any plans to kill themselves and if they tried to kill themselves in the past 12 months prior to survey interview. Because of the structure of the interview, a suicide attempt could occur either in the interview year or in the previous year. Thus, we imputed the specific year when a respondent attempted suicide and survived based on the month of his/her survey interview. For example, if a survey interview occurred in November 2009, a suicide attempter was given an 11/12th probability of attempting suicide in 2009 and an 1/12th chance of attempting suicide in 2008. This meant that 11/12th of the respondent's weight was assigned to 2009 and the rest to 2008. Similarly, if a survey interview occurred in May 2012, a suicide attempter was given a 7/12th probability of attempting suicide in 2011 and a 5/12th chance of attempting suicide in 2012. Since the data on suicide attempters who died by suicide examined in the restricted-use mortality files occurred in 2008–2011 and because the timing for the corresponding suicide attempters who survived examined in this study also needed to be in 2008–2011, adults whose imputed year of suicide attempt from NSDUH data was in 2007 or 2012 were excluded from all the analyses.