

Suicide and Suicidal Attempts in the United States: Costs and Policy Implications

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The national cost of suicides and suicide attempts in the United States in 2013 was \$58.4 billion based on reported numbers alone. Lost productivity (termed indirect costs) represents most (97.1%) of this cost. Adjustment for under-reporting increased the total cost to \$93.5 billion or \$298 per capita, 2.1–2.8 times that of previous studies. Previous research suggests that improved continuity of care would likely reduce the number of subsequent suicidal attempts following a previous nonfatal attempt. We estimate a highly favorable benefit–cost ratio of 6 to 1 for investments in additional medical, counseling, and linkage services for such patients.

In the United States, suicides and intentional self-inflicted injuries are officially tabulated through the Web-based Injury Statistics Query and Reporting System (WISQARS) maintained by the Centers for Disease Control and Prevention (CDC), largely based on facility-based reporting. According to WISQARS, 41,149 persons died by suicide in the United States in 2013 (the latest official data), continuing the series of annual increases (CDC, 2015a). Based

on reported deaths, suicide is the second leading cause of death for ages 25–34 years and for ages 15–24, and the tenth leading cause across all ages (National Institutes of Mental Health, 2013).

In addition to completed suicides, there were 395,000 intentional self-inflicted injuries in 2013 (CDC, 2015a). By contrast, SAMHSA's National Survey on Drug Use and Health estimated that in 2012, 2.7 million adults aged 18 or older (1.1% of adults)

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made a suicide plan, and 1.3 million (0.6% of adults) made a suicide attempt (Substance Abuse and Mental Health Services Administration [SAMHSA], 2013). The comparison between the SAMHSA survey data (Substance Abuse and Mental Health Services Administration [SAMHSA], 2013) and official reporting (CDC, 2015a) suggests that even the increasing official statistics underestimate the full magnitude of this problem.

While the emotional costs of suicide and suicidal behaviors are difficult to estimate, improved estimates of the economic loss and burden on society should inform the country's national call to action as outlined in the National Strategy for Suicide Prevention (US Department of Health and Human Services, 2012).

Three previous studies, using different approaches, have addressed the economic costs of suicide in the United States: one for 2000 (Corso, Mercy, Simon, Finkelstein, & Miller, 2007), one for 2005 (Yang & Lester, 2007), and one for 2010 (CDC, 2015a). This study seeks to improve on the previous estimates by addressing the increase in the number of suicides since those publications, incorporating adjustments for underreporting of suicides and additional data refinements, and exploring approaches for reducing this economic cost based on literature and key informant interviews.

METHODS

Approach to Cost Estimation

Suicidal acts result in either a fatal injury (suicide), or a nonfatal injury (suicide attempt). This cost analysis presents the costs of estimated fatal and nonfatal injuries for the year 2013, the latest reported national data, in 2013 U.S. dollars. Each type of injury incurred both direct costs, which are directly related to injury treatment, and indirect economic costs, which are mainly productivity losses from premature death or lost time from injuries. More specifically, the costs for medical care (especially emergency departments

and inpatient hospitalization), ambulance transport, investigations by medical examiners or coroners, nursing home care, general and specialty physicians' care, and follow-up care comprise the direct costs. Indirect economic costs consist of the net present value of future salaries and wages, fringe benefits, and the value of household productivity lost or reduced by the suicide or suicide attempt. We calculated aggregate direct and indirect costs by age category, gender, state of residence, and outcome (fatal or nonfatal). We derived the national cost by multiplying the unit cost per injury times the number of acts within each combination of age, gender, and state and summed the products.

Numbers of Suicides and Suicide Attempts

To incorporate the variation in costs among states into our analysis, we began with publicly available age- and gender-specific numbers of fatal and nonfatal suicide-related injuries by state for 2007 (CDC, 2015a). This is the latest year for which state-level counts of deaths by suicide by age and sex are reported without restriction. We then updated our results to 2013 by multiplying these data by the national ratio of suicides and intentional self-inflicted injuries in 2013 to the number in 2007 from WISQARS (CDC, 2015a).

Sources and Analyses of Cost Data

Unit costs are the economic cost per suicide and per attempt by type of cost (i.e., direct or indirect). We began with the latest peer-reviewed, comprehensive analysis of costs of medical and indirect costs by age category and gender (Corso et al., 2007) and then applied a series of updates and refinements. We first updated medical costs per death and per attempt to national estimates for 2007 based on the increase in per capita health expenditures from 2000 to 2007 (Centers for Medicare & Medicaid Services, 2015). More comprehensive than an inflation adjustment, this process also adjusted for the

change in patterns of medical care, such as new technologies and more intensive use of existing technology, which also contributed to higher medical costs. Second, we updated indirect costs per death to 2007 based on the change in per capita gross domestic product (GDP) (World Bank, 2015a). This adjustment incorporated not only inflation, but also increases in earnings due to higher productivity. Third, we incorporated variability among states in per capita health care expenditures and income to reflect state-to-state differences in economic loss from a suicide. To adjust medical costs, we used per capita health expenditures, relative to the national average (Kaiser Family Foundation, 2015). To adjust indirect costs, we used average per capita GDP relative to the national average based on aggregate data (US Department of Commerce Bureau of Economic Analysis, 2015) and population by state (Kaiser Family Foundation, 2015). We then computed each state's cost based on its number of suicides by age times the adjusted medical and adjusted age-specific indirect costs and combined the results to national averages of medical and indirect costs per suicide. Fourth, we adjusted the resulting 2007 medical and indirect costs per suicide to 2013 based on national trends in the previously used indicators—GDP per capita (World Bank, 2015a) and health expenditures per capita (Centers for Medicare & Medicaid Services, 2015). Fifth, we computed aggregate 2013 costs of reported suicides by multiplying the numbers of suicides by age and gender times the respective adjusted unit costs.

Comparison with Most Recent Previous Report

To clarify our calculations, we compared our estimates of the age-specific indirect costs with the latest previous report. Published on the web by Centers for Disease Control and Prevention (CDC), it used officially reported numbers of suicides and costs for 2010 (CDC, 2015a). To compare our findings (which apply to 2013) to those from the CDC, we adjusted the CDC's

findings to 2013 approximating the same procedure as our study. As 97% of the costs of suicidal deaths were indirect, we focused our comparison on indirect costs, adjusting by the growth in GDP per capita (World Bank, 2015a). Furthermore, as both our study and the CDCs use the same counts in reported suicidal deaths, the comparison of indirect costs simplified to a comparison of indirect costs per suicidal death.

Adjustment for Under-Reporting

Our final step adjusted for under-reporting of deaths by suicide. Several studies have shown that coroners in the United States may misclassify some suicides due to incomplete data or stigma, particularly in teens and minorities (Mohler & Earls, 2001; Pescosolido & Mendelsohn, 1986; Phillips, Robin, Nugent, & Idler, 2010; Rocketta, Samora, & Cobena, 2006). A similar study from the United Kingdom allowed this phenomenon to be quantified (Cooper & Milroy, 1995). The share of probable suicides that were reported as suicides (termed % reported) varied by gender and age, ranging from 46.6% to 64.5%. As we were not aware of quantitative estimate for the overall U.S. population and the United States and United Kingdom share many cultural and economic characteristics, we applied the rates of under-reporting from Cooper & Milroy (1995) to both fatal and nonfatal suicide-related acts.

Key Informant Interviews

As part of this study, we conducted key informant interviews to explore the health care delivery system for factors that appear to hinder and facilitate effective services and treatment for this at-risk population. Suicide attempts and self-injury make up an increasing proportion of emergency department visits and hospitalizations for self-harm (Larkin, Smith, & Beautrais, 2008). As many as one in 10 deaths by suicide are by people who had been seen in the emergency department within 2 months of their death (Knesper et al., 2011). Given this

strong association (Larkin & Beautrais, 2010), we focused the key informant interviews on a tertiary care emergency department and the care continuum that ideally flows from this initial site of care. We selected a university-based teaching hospital and interviewed representatives of each of the following service functions: emergency department, inpatient psychiatric unit, psychiatric emergency services, inpatient consult psychiatric team, and community mental health provider ($N = 5$). To guide the interviews, we developed a semistructured interview guide. Key domains of inquiry included: existing care process, barriers to effective care delivery, and interventions for improving care delivery. Our goal for this phase was to explore possible health system improvements for patients with self-inflicted injury. The study was approved by the Institutional Review Board at Brandeis University.

RESULTS

Overall Economic Costs

The number of reported suicides in 2013 was 32,055 males, 9,094 females, and 41,149 total. The crude rates per 100,000

population were 20.59, 5.67, and 13.02, respectively (CDC, 2015a). We calculated that the national cost of reported fatal and nonfatal suicide-related injuries in 2013 was about \$58.4 billion (see Table 1). The economic cost of male suicides and suicidal attempts (\$48.1 billion) was substantially higher than that in females (\$10.4 billion), representing 82.2% and 17.8% of the total, respectively. Also, overall indirect costs (\$56.8 billion) represented the overwhelming portion (97.1%) of total economic costs.

Comparison with WISQARS

Table 2 compares costs per death in 2013 in our study with adjusted costs from WISQARS by age category. Overall, our study is 55% higher. Our study exceeds WISQARS by the highest percentage (69%) for the age category 45–64. On the other hand, our study gives lower values for suicides in persons aged 75 and above.

Adjustment for Under-reporting

Table 3 shows the adjustment for under-reporting. This adjustment increased the total cost for suicides and nonfatal

TABLE 1
National Cost of Reported Suicide-Related Acts, 2013 (in Millions of 2013 Dollars)^a

Components	Males	Females	Total	%
Medical cost				
Suicides	\$121	\$26	\$146	0.3
Nonfatal suicidal attempts	\$1,149	\$388	\$1,537	2.6
Total (all self-inflicted injuries)	\$1,270	\$413	\$1,684	2.9
Indirect economic cost				
Suicides	\$43,589	\$9,458	\$53,047	90.8
Nonfatal suicidal attempts	\$3,196	\$518	\$3,714	6.4
Total (all self-inflicted injuries)	\$46,785	\$9,976	\$56,761	97.1
Total economic cost				
Suicides	\$43,710	\$9,483	\$53,193	91.0
Nonfatal suicidal attempts	\$4,346	\$906	\$5,251	9.0
Total (all self-inflicted injuries)	\$48,056	\$10,392	\$58,445	100.0

Source: Authors' calculation.

^aItems may not sum to totals due to rounding.

TABLE 2

Suicides (Fatal Self-Inflicted Injury) in 2013: Number and Economic Cost Per Suicide Comparison Between This Study and WISQARS by Age Category

Age category (years)	Number of suicides	Average cost per suicide		Ratio: this study/ WISQARS
		This study	WISQARS	
0–4	0	n.a.	n.a.	n.a.
5–14	395	\$1,795,378	\$1,264,705	1.42
15–24	4,878	\$2,012,476	\$1,410,138	1.43
25–44	12,899	\$1,837,842	\$1,225,050	1.50
45–64	15,756	\$1,058,304	\$625,188	1.69
65–74	3,794	\$243,883	\$175,739	1.39
75+	3,421	\$66,218	\$78,673	0.84
Unknown	6	\$1,329,553	\$1,033,346	1.29
All ages	41,149	\$1,329,553	\$858,981	1.55

Note. Cost estimates both for this study, which were based on Corso, et al. 2007, and for WISQARS from national cost of injury reports, 2010 (CDC, 2015a) are expressed in 2013 dollars. For deaths with age unknown, the average of all ages was used.

attempts by 55.0% for males (i.e., [\$74,518–\$48,064]/\$48,064), 81.8% for females (i.e., [\$18,937–\$10,414]/\$10,414), and 59.8% (i.e., [\$93,454–\$58,478]/\$58,478) overall compared with unadjusted numbers, raising the 2013 cost of suicidal acts to \$93.5 billion.

Findings from Key Informant Interviews

Analysis of the interviews with hospital representatives working for the five service components in the care continuum identified three broad areas (or opportunities) for improving care delivery for people seen in emergency departments with self-inflicted injury. The first area relates to the capacity of hospitals in general, and emergency departments in particular, to screen for suicidal behavior. While our site (a tertiary care hospital and adjoining psychiatric hospital) was able to assess patient risk for self-inflicted injury, the informants' consensus was that most emergency departments across the country lack adequate expertise and staffing for such assessments.

The second theme relates to difficulties in securing community-based and inpatient behavioral health services. A by-product of this challenge can be extended lengths of stay in the hospital and, by

extension, delays in a patient's receipt of needed mental health services. For example, respondents described an inadequate supply of outpatient community resources, such as therapists willing to treat suicidal patients and availability of substance abuse treatment facilities. This causes delays in securing services for this population segment under the risk of injury. Other delays related to patients (typically those with chronic health conditions) who met medical clearance requirements for discharge from an acute care hospital, but did not meet medical clearance requirements for admission to a psychiatric hospital. Such patients are considered to have an underlying medical illness which renders admission to a psychiatric facility unsafe or inappropriate. Furthermore, respondents felt that psychiatric hospitals require a threshold level of profound psychiatric illness for admission, with delayed treatment for many patients' mental health conditions as a consequence.

The third and final theme relates to improving the continuity of care across care settings. All respondents reported challenges in this area and opportunities for improvement, including requiring hospital emergency departments to contact a patient's therapist (when possible) and

TABLE 3
Aggregate Costs of Suicides and Attempts, Adjusted for Under-Reporting (in Millions of 2013 Dollars)^a

Age range (years)	Males			Females			Total		
	% Re-reported	Unadjusted costs	Adjusted costs	% Re-reported	Unadjusted costs	Adjusted costs	% Re-reported	Unadjusted costs	Adjusted costs
Suicides									
0-4	n.a.	0	0	n.a.	0	0	n.a.	0	0
5-14	64.5	\$291	\$451	61.7	\$102	\$166	63.8	\$393	\$616
15-24	64.5	\$8,609	\$13,347	61.7	\$1,329	\$2,154	64.1	\$9,938	\$15,501
25-44	64.5	\$21,359	\$33,114	61.7	\$4,499	\$7,291	64.0	\$25,857	\$40,406
45-64	64.5	\$12,629	\$19,579	46.6	\$3,361	\$7,213	59.9	\$15,990	\$26,793
65-74	64.5	\$605	\$939	46.6	\$153	\$329	60.0	\$759	\$1,268
75+	64.5	\$218	\$338	46.6	\$64	\$137	59.9	\$282	\$475
Unk ^b	64.5	\$12	\$19	61.7	\$0	\$0	64.2	\$12	\$19
ALL	64.5	\$43,722	\$67,786	55.0	\$9,509	\$17,291	62.7	\$53,231	\$85,077
Nonfatal attempts									
ALL	64.5	\$4,342	\$6,732	55.0	\$905	\$1,646	62.6	\$5,247	\$8,377
Suicides and nonfatal attempts									
ALL	64.5	\$48,064	\$74,518	55.0	\$10,414	\$18,937	62.6	\$58,478	\$93,454

Unk, unknown.

^a% reported is the percentage of authors' estimate of actual numbers of suicides that are reported as suicides. Unadjusted costs are the costs based on reported numbers of suicides (as summarized in Table 1). Adjusted costs are costs based on estimated actual suicides.

requesting therapists make themselves better known and available to hospitals (in the case of therapists who treat high-risk patients). Respondents suggested that care continuity could and should also be strengthened by establishing better systems to track a patient after he/she has been discharged from the emergency department or an inpatient stay. Discharge planning in these cases typically involves a referral to another service setting for further care, but there are few systems and resources in place to track patient follow through (Knesper et al., 2011).

DISCUSSION

Key Findings

Our estimates incorporate several methodological refinements over previous studies (CDC, 2015b; Corso et al., 2007; Yang & Lester, 2007). We updated findings, adjusted for under-reporting of suicides in official reports due to stigma and other factors, and incorporated state-to-state variation in medical and indirect costs. Our \$93.5 billion estimate of 2013 national cost of suicide and suicide attempts, adjusted for underreporting, is 2.1 times the latest previous study—the CDC's estimate for 2010 of \$44.7 billion (CDC, 2014, 2015b). Our 2013 estimate is 2.8 times the latest comprehensive peer-reviewed publication of \$33.3 billion for 2000 (Corso et al., 2007).

Our estimate is higher than previous reports for several reasons. First, our adjustment for underreporting substantially increased the estimated numbers of suicides, thereby raising the economic cost by 59.8% compared with the estimate based only on officially reported suicides. Second, our estimates are more recent. Population, health expenditures per capita, GDP per capita, and numbers of suicides have increased (Adams, 2011). For example, from 2000 to 2013, the numbers of deaths by suicide increased from 29,416 to 41,149. The

rise outstripped population growth, with a rise in the suicide rate from 11 to 13 per 100,000 population (CDC, 2015a; Corso et al., 2007). Third, our data sources have generated higher average values of earnings due to a difference in data sources. As noted, our estimates of earnings were based on Corso et al. (2007), which used as the average monetary earnings of the entire U.S. population by decade of age as reported in tables PINC-01, PINC-04, and PINC-05 of Current Population Survey (U.S. Census Bureau, 2015). On the other hand, based on the background document (Lawrence et al., 2014), the CDC apparently used weekly income by category (US Census Bureau, 2015). Therefore, the CDC Cost of Injury Reports (CDC, 2015b) could not generate an objective estimate of the mean of the top category and the imputed mean appears to have been truncated (T. Miller, personal communication, Oct. 14, 2011). This effect was partially offset, however, by separate imputed values for household production such as cooking, cleaning, and child care, in the CDC estimates (CDC, 2015b), contributing to its higher values for persons aged 65 and above.

International Comparisons

To interpret our findings, we compared our results with costs from other countries. We found such cost estimates for four other industrialized countries (Centre for Suicide Prevention, 2010; Yang & Lester, 2007). While methodological differences remain, the results were reasonably comparable to this study after converting each cost to per capita amounts in 2013 U.S. dollars. This was done by converting the foreign currency to U.S. dollars in the study year (XE Currency Converter), dividing by the population in the study year of Scotland (Wikipedia, 2015) Canada, Ireland, New Zealand, and United States (World Bank, 2015b), respectively, and adjusting the amount for inflation, productivity growth, and technological change to 2013 using the growth in GDP per capita in the

United States (World Bank, 2015a). Resulting per capita amounts and original sources were \$84 for Canada (Smartrisk, 2009), \$293 for Ireland (Health Services Executive, 2005), \$299 for New Zealand (O'Dea & Tucker, 2005), and \$489 for Scotland (Platt et al., 2006). The amount in the United States was \$186 based on officially reported suicides and \$298 with adjustment for underreporting. In addition to the aforementioned UK study (Cooper & Milroy, 1995), imprecise coding of cause of death affects other countries as well (Lozano et al., 2012).

Strengths and Limitations

Our study has several notable strengths. First is the recent year (2013), an important factor with growth in population and age-adjusted rates of suicide. Second is our inclusion of all types of costs (direct and indirect costs for both suicides and nonfatal attempted suicides). Third is our adjustment for possible under-reporting of completed suicides, a process that parallels adjustments made for causes of death internationally in the 2010 Global Burden of Disease study (Lozano et al., 2012). The result is comprehensive and up-to-date consistent estimates across gender and age categories.

The main limitation with our study is that while our average costs have been adjusted for trends in health care expenditures and productivity, they originated with 2000 data, the most recent comprehensive data available. A second limitation is that our key informant interviews were conducted at only one tertiary medical center, precluding generalizability; nevertheless, our findings reinforce previous recommendations (Larkin & Beautrais, 2010). A third limitation is under-estimating household production in the original Corso study (Corso et al., 2007) and thus in our updated estimates. On the other hand, only 17.5% of suicides in 2013 were in persons aged 65 and above, so that effect is not too large.

Policy Recommendations

Our updated estimates of the increased cost of suicide reinforce the importance of additional preventive measures. Addressing suicide requires a multifactorial approach involving communities, workplaces, schools, and the health sector (Research Prioritization Task Force [RPTF], 2014; US Department of Health and Human Services, 2012). This study helps us quantify the benefits of one component of that approach: the health sector. Currently, 10%–15% of patients who engage in medically serious suicide attempts will die by suicide within 10 years (Suominen et al., 2004). Approximately 14% of individuals who make medically serious suicide attempts will be re-admitted to the hospital for a suicide attempt within 1 year, and their cumulative risk of readmission for a suicide attempt after an index suicide attempt is 28.1% over 10 years (Gibb, Beautrais, & Fergusson, 2005). Controlled studies have identified a number of successful approaches for reducing the risk of suicide attempts; a stronger continuum of care across services within hospitals as well as between hospitals and the community could help institutionalize these initiatives (Brown et al., 2005; Carter, Clover, Whyte, Dawson, & D'Este, 2005; Fleischman et al., 2008; Knesper et al., 2011; Linehan et al., 2006; Motto & Bostrom, 2001; Rotheram-Borus, Piacentini, Cantwell, Belin, & Song, 2000; Spirito, Boergers, Donaldson, Bishop, & Lewander, 2002; Welu, 1977). WISQARS statistics for 2013 show 9.6 intentional self-injuries for every suicide (CDC, 2015a). Thus, the health care system has multiple opportunities to build these linkages.

Based on our structured interviews and the literature, we suggest that improved care linkages could substantially reduce the future burden of suicide. First, we recommend that every patient seen in an ED or trauma unit for attempted suicide should receive a comprehensive suicide risk assessment to determine the need for psychiatric hospitalization, and, if hospitalization is not warranted, then the individual should receive brief treatment or an intervention (brief education, development of

a safety plan, lethal means counseling) before being discharged as well as receiving a rapid referral to a community-based behavioral health provider. Second, inpatient psychiatric units should ensure that upon discharge, all suicidal patients are formally linked to broader behavioral and other social services in the community to ensure ongoing treatment for the underlying problems that precipitated the suicidal behaviors. Third, emergency departments, inpatient services, and communities should develop a comprehensive list of care providers and facilities for immediate preventive action and recruit on-call suicide experts, which could include telepsychiatric support, to provide evaluation and treatment services to urgent cases. Sound coordination of networks, strong linkages, and referral mechanisms need to be explored to develop, implement, and evaluate specific comprehensive supportive services. Finally, it is essential that EDs and hospitals develop mechanisms to follow up with patients to ensure that they attend these outpatient appointments, such as establishing relationships with crisis centers or others who can do so.

As medical costs were only 2.9% of the total economic cost of reported suicides and suicidal attempts in 2013, the cost of strengthening these linkages would be relatively modest. From our key informant interviews, we project that implementing best practices around these linkages for every suicidal attempt might double the cost of medical care. With adjustment for under-re-

porting, this would add up to \$2.7 billion in additional medical costs in 2013 dollars. Based on past research, The Research Prioritization Task Force (RPTF) estimated that the number of suicides could be reduced by 20% through full successful implementation of five policies: providing brief psychotherapy treatments in emergency care, parity coverage for mental health care, adding a car safety feature, improving firearm safety, and implementing a school-based prevention program (Research Prioritization Task Force [RPTF], 2014, p. 7). The RPTF estimated that the first policy alone would reduce suicides among persons aged 18–64 by 8%. (RPTF, 2014, p. 32). We projected that psychotherapeutic and other linkage interventions across the age spectrum would lower overall suicides by 10%. The resulting impact would represent a savings of \$9.4 billion to the American economy, with a net benefit-cost ratio of 2.5 to 1 (i.e., [9.4–2.7]/2.7). Thus, even a modestly effective program would generate a very favorable return in both economic and human terms.

Our review of literature found important differences in approaches and data sources. An international review noted similar variability (Centre for Suicide Prevention, 2010). We recommend that future research on the economic cost of suicide consistently include all the components with both direct and indirect costs, seek to adjust for under-reporting, and adjust costs to a recent year as we have attempted to do here.

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