# Chapter 2
# Epidemiology

**Denise M. Oleske**

**Abstract** Suicide is a complex global health problem with consequences extending far beyond the estimated annual 800,000 fatalities. According to World Mental Health Surveys, the lifetime prevalences of suicidal ideation, plans, or attempts are 9.2, 3.1, and 2.7 %, respectively. There are somewhat different patterns among nations regarding who are at risk and factors contributing to this risk. An understanding of the epidemiology of suicide and suicidal thoughts and other suicidal behaviors, namely the pattern of their distribution in populations and the factors which could be attributed to their occurrence, provide an insight into those at risk for whom preventive efforts may be targeted. Concepts, sources of epidemiological data, and key findings are presented in this chapter.

## 2.1 Introduction

Self-directed violence encompasses a range of violent behaviors, including acts of fatal and nonfatal suicidal behavior, and nonsuicidal intentional self-harm (i.e., behaviors where the intention is not to kill oneself, as in self-mutilation). Suicidal behavior is a complex health problem with fatal and nonfatal components. Suicide, the fatal behavior, is according to the proverbial epidemiological paradigm is only the "tip of the iceberg" of self-directed violence. Suicide, nonfatal suicidal behaviors and suicidal ideations lead to considerable utilization of health care resources, specifically emergency department visits and hospitalizations, with variable outcomes from these encounters (Fig. 2.1). An understanding of the epidemiology of suicide and suicidal thoughts and behaviors, namely the pattern of their distribution in populations and the factors which could be attributed to their occurrence, provide an insight into those at risk for whom preventive efforts may be targeted. Concepts, sources of epidemiological data, and key findings are presented in this chapter.

D.M. Oleske (✉)
Global Surveillance and Pharmacoepidemiology, AbbVie, North Chicago, IL 60064, USA
e-mail: denise.oleske@abbvie.com



K.E. Cannon and T.J. Hudzik (eds.), *Suicide: Phenomenology and Neurobiology*,
DOI 10.1007/978-3-319-09964-4_2


**Fig. 2.1** Public health burden of suicidal behavior among adults aged ≥18 years—United States, 2008 (*Source* Crosby et al. 2011). **Source* CDC's National Vital Statistics System. All rates per 100,000 population. § Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project–Nationwide Inpatient Sample. ¶ CDC's National Electronic Injury Surveillance System–All Injury Program

## 2.2 Suicide

Suicide is defined as the fatal event of self-directed violence. The death certificate is the source document for the identification of cases of suicide in epidemiologic studies and in vital statistics. Suicide, including accidental poisonings, on the death certificate in the "cause of death" field can be identified through the ICD-10 codes displayed in Table 2.1. In the UK, the definition of suicide includes deaths given an underlying cause of intentional self-harm or an injury/poisoning of undetermined intent. However, it cannot be applied to children due to the possibility that these deaths could have been attributed to neglect, abuse, or unverifiable accidents. The risk suicide is defined as the number of events of death from suicide in a defined population occurring at the same time the population was enumerated and multiplied by a factor of 10. Risk of suicide is represented as a rate measure when referring to the frequency of its occurrence in a general population, where:

Rate = Number of events in a specified time interval/Average population during the same time interval $\times 10^k$

In 2010, the population of the U.S. was 308,746,000 and there were 38,364 deaths from suicide. Using the above formula and applying a power of 10 multiplier ($10^k$) to convert the fraction into a rate (usually 100,000 for vital statistics), the suicide rate was 12.4 per 100,000 population. This means that for every 100,000 persons, there were about 12–13 suicides in this one year in the U.S.

**Table 2.1** International classification of disease codes (ICD-10) for suicide—including accidental poisonings

| General code groupings | |
|---|---|
| X60–X84 | Intentional self-harm |
| Y10–Y34 | Injury/poisoning of undetermined intent |
| Y87.0–Y87.2 | Sequelae of intentional self-harm /injury/poisoning of undetermined intent |
| Y87.0–Y87.2 | Sequelae of intentional self-harm /injury /poisoning of undetermined intent |
| Specific intent codes | |
| Accidental poisoning: ICD-9 codes E850-E854, E858, E862, E868; ICD-10 codes X40-X42, X46, X47 | |
| Poisoning with undetermined intent: ICD-10 codes Y10-Y12, Y16, Y17 | |
| Self-inflicted poisoning: ICD-9 codes E950-E952, ICD-10 codes X60-X69 | |
| Self-inflicted injury by hanging, strangulation, and suffocation: ICD-9 code E953, ICD-10 code X70 | |
| Self-inflicted injury by drowning: ICD-9 code E954, ICD-10 code X71 | |
| Self-inflicted injury by firearms and explosives: ICD-9 code E955, ICD-10 codes X72-X75 | |
| Self-inflicted injury by smoke, fire, flames, steam, hot vapors, and hot objects: ICD-9 codes E958.1, E958.2; ICD-10 codes X76, X77 | |
| Self-inflicted injury by cutting and piecing instruments: ICD-9 code E956; ICD-10 codes X78, X79 | |
| Self-inflicted injury by jumping from high places: ICD-9 code E957, ICD-10 code X80 | |
| Self-inflicted injury by jumping or lying before a moving object: ICD-9 code E958.0, ICD-10 code X81 | |
| Self-inflicted injury by crashing of motor vehicle: ICD-9 code E958.5, ICD-10-CA code X82 | |
| Self-inflicted injury by other and unspecified means: ICD-9 codes E958.3, E958.4, E958.6-E958.9; ICD-10 codes X83, X84 | |
| Late effects of self-inflicted injury: ICD-9 code E959 | |

### *2.2.1 Data Sources for Suicide Statistics*

National vital statistics systems are the primary sources of country-specific suicide mortality statistics. These statistics are derived from a death certificate, the format and procedures for completing differ by regional laws and practices. The listing of a cause of death on a death certificate is influenced by many factors, including cultural factors, availability of an informant, provisions regarding confidentiality of the cause of death, and local laws governing forensic investigation. Death rates may also be affected by the age structure of a population and any temporal trends within age subgroups. In general, any suicide rate may be underestimated. For example, suicide rates generally exclude those aged <10 years (aged <15 years in the UK) because intent for self-harm is typically not attributed to young children. Thus, when interpreting suicide rates, it is important to keep in mind how these factors could influence the rate and use caution in interpreting rates across countries.

The World Health Organization (WHO) compiles suicide statistics by country. Data, search tools, and reports can be obtained through the Global Health

Observation (GHO) at http://ww.who.int/GHO/. Data from the WHO reveal that suicide is a worldwide health problem with more than 800,000 people worldwide dying every year from suicide.

In the U.S., **WISQARS™** (Web-based Injury Statistics Query and Reporting System) is an interactive database system that provides customized reports of suicide and other injury-related data. Suicide was the 10th leading cause of death among all ages and the leading cause of injury death in 2012. In Canada, CANSIM is a data base updated daily which provides the latest statistics for Canada, including health conditions. Suicide mortality data by age, gender, and year are available as downloadable tables.

In addition to recording death information in a vital records system, some countries and organizations have specialized surveillance systems or registries for obtaining more detailed information about a suicide event and its causes. In the U.S., surveillance data is obtained through the National Violent Death Reporting System (NVDRS). This system links information from death certificates, medical examiners, law enforcement, and forensic laboratories. Circumstances surrounding the suicide by age group, such as depressed mood, declining health, and disclosure of suicidal intent are compiled. The U.S. Department of Defense has a similar system and employs a more standardized and detailed collection of medical, military, and personal history information as a potential model for other organizations (Gahm et al. 2012). The National Suicide Registry in Malaysia also engages psychiatrics and staff members of psychiatric and mental health departments for the collection of the information on the demographics of the decedent, characteristics of the suicidal act, and risk factors (Hayati et al. 2008). The National Poison Data System is a near real-time surveillance database tracking poisonings and their sources in the U.S. Information is collected from calls by the public and health professionals to poison centers nationwide, consolidated, and evaluated. Suspected suicides, fatal (and non-fatal) cases are among the human exposure cases analyzed. The system is maintained by the American Association of Poison Control Centers (www.aapcc.org) with annual reports published in the journal Clinical Toxicology.

### *2.2.2 Age, Sex, Race/Ethnicity, Geographical Region, and Other Population Subgroups*

There is marked variation in suicide rates by age, sex, race/ethnicity, and geographic region.

By age group, among the highest suicide rates are noted to occur in midlife in Canada, the U.K., and the U.S. Suicide rates by age reveal a peak in adolescence in the U.S. (ONS 2014; Navaneelan 2012) (Fig. 2.2). In the U.S., the rates of suicide exceed homicide rates for all age groups except for the age groups of 18–24, where the homicide rate exceeds the suicide rate and for under age 10, where suicide rates are not reported (Fig. 2.2). In contrast, the highest suicides rates across European nations, the highest suicide rates are reported among people aged 65+ (21.9 per

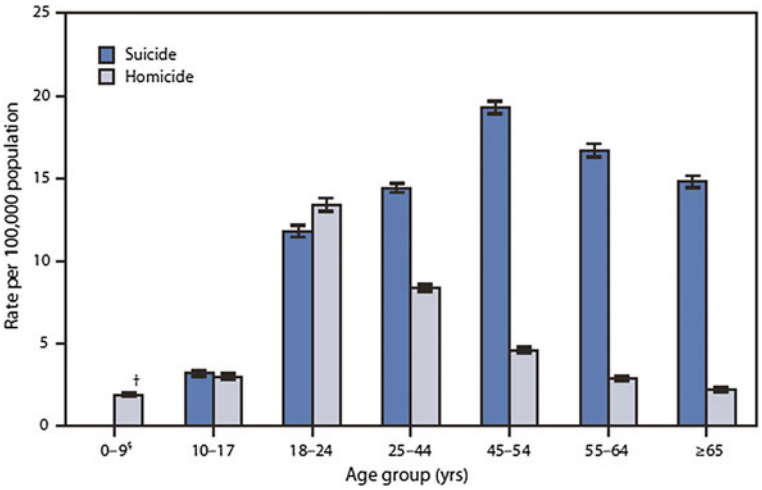


**Fig. 2.2** Suicide and Homicide Rates,* by Age Group—United States, 2009. MMWR:July 20, 2012:61(28);543. * Per 100,000 population in age group. Suicides are coded as *U03, X60–X84, and Y87.0, and homicides are coded as *U01–*U02, X85–Y09, and Y87.1 according to the *International Classification of Diseases, 10th Revision*. † 95 % confidence interval. § Suicide data for persons aged 0–9 years are suppressed based on a child's inability to form and understand suicidal intent and consequences

100,000 population and those aged 45–59 (21.5 per 100,000 population) (WHO 2014). Higher rates have been reported among those aged 85 years and older in China ranging from 68.41 per 100,000 in large cities to 191.74 per 100,000 in rural areas (Simon et al. 2013).

The male predominance of suicide (as much as three times higher than females) is noted for all age groups across all nations with the exception in China, where overall it is higher among females (Table 2.2).

Suicide rates are two-times higher among whites than nonwhites. Between 1999 and 2010, the suicide rates among whites increased 20.4 % from 11.3 deaths per 100,000 population to 13.6 per 100,000 (Fig. 2.3) (CDC 2013, April 5, 2013/62 (13);257**).** Ethnicity contributes to suicide risk when those groups are immigrants. Suicide occurs at a disproportionately higher rate among persons in higher income countries than among those in low- and middle-income countries with the exception of low- and middle-income countries of Europe and Southeast Asia (Table 2.2) (Norton and Kobusingye 2013).

Other population subgroups at risk for suicide include military personnel and veterans, young parents, and those with various chronic medical conditions (e.g., schizophrenia, certain dementias, bipolar disorder, chronic pain, post traumatic stressdisorder, and traumatic brain injury) (Trofimovich et al. 2012; Fawcett 2014; Fazel et al. 2014; Hooley et al. 2014; Niederkrotenthaler et al. 2012).

**Table 2.2** Suicide rates per 100,000 by country, year and sex, for most recent year available as of 2011

| Country | Year | Males | Females |
|---|---|---|---|
| Albania | 03 | 4.7 | 3.3 |
| Antigua and Barbuda | 95 | 0 | 0 |
| Argentina | 08 | 12.6 | 3 |
| Armenia | 08 | 2.8 | 1.1 |
| Australia | 06 | 12.8 | 3.6 |
| Austria | 09 | 23.8 | 7.1 |
| Azerbaijan | 07 | 1 | 0.3 |
| Bahamas | 05 | 1.9 | 0.6 |
| Bahrain | 06 | 4 | 3.5 |
| Barbados | 06 | 7.3 | 0 |
| Belarus | 07 | 48.7 | 8.8 |
| Belgium | 05 | 28.8 | 10.3 |
| Belize | 08 | 6.6 | 0.7 |
| Bosnia and Herzegovina | 91 | 20.3 | 3.3 |
| Brazil | 08 | 7.7 | 2 |
| Bulgaria | 08 | 18.8 | 6.2 |
| Canada | 04 | 17.3 | 5.4 |
| Chile | 07 | 18.2 | 4.2 |
| China (selected rural and urban areas) | 99 | 13 | 14.8 |
| China (Hong Kong Sar) | 09 | 19 | 10.7 |
| Colombia | 07 | 7.9 | 2 |
| Costa rica | 09 | 10.2 | 1.9 |
| Croatia | 09 | 28.9 | 7.5 |
| Cuba | 08 | 19 | 5.5 |
| Cyprus | 08 | 7.4 | 1.7 |
| Czech Republic | 09 | 23.9 | 4.4 |
| Denmark | 06 | 17.5 | 6.4 |
| Dominican Republic | 05 | 3.9 | 0.7 |
| Ecuador | 09 | 10.5 | 3.6 |
| Egypt | 09 | 0.1 | 0 |
| El salvador | 08 | 12.9 | 3.6 |
| Estonia | 08 | 30.6 | 7.3 |
| Finland | 09 | 29 | 10 |
| France | 07 | 24.7 | 8.5 |
| Georgia | 09 | 7.1 | 1.7 |
| Germany | 06 | 17.9 | 6 |
| Greece | 09 | 6 | 1 |
| Grenada | 08 | 0 | 0 |
| Guatemala | 08 | 5.6 | 1.7 |
| Guyana | 06 | 39 | 13.4 |

(continued)

**Table 2.2** (continued)

| Country | Year | Males | Females |
|---|---|---|---|
| Haiti | 03 | 0 | 0 |
| Honduras | 78 | 0 | 0 |
| Hungary | 09 | 40 | 10.6 |
| Iceland | 08 | 16.5 | 7 |
| India | 09 | 13 | 7.8 |
| Iran | 91 | 0.3 | 0.1 |
| Ireland | 09 | 19 | 4.7 |
| Israel | 07 | 7 | 1.5 |
| Italy | 07 | 10 | 2.8 |
| Jamaica | 90 | 0.3 | 0 |
| Japan | 09 | 36.2 | 13.2 |
| Jordan | 08 | 0.2 | 0 |
| Kazakhstan | 08 | 43 | 9.4 |
| Kuwait | 09 | 1.9 | 1.7 |
| Kyrgyzstan | 09 | 14.1 | 3.6 |
| Latvia | 09 | 40 | 8.2 |
| Lithuania | 09 | 61.3 | 10.4 |
| Luxembourg | 08 | 16.1 | 3.2 |
| Maldives | 05 | 0.7 | 0 |
| Malta | 08 | 5.9 | 1 |
| Mauritius | 08 | 11.8 | 1.9 |
| Mexico | 08 | 7 | 1.5 |
| Netherlands | 09 | 13.1 | 5.5 |
| New Zealand | 07 | 18.1 | 5.5 |
| Nicaragua | 06 | 9 | 2.6 |
| Norway | 09 | 17.3 | 6.5 |
| Panama | 08 | 9 | 1.9 |
| Paraguay | 08 | 5.1 | 2 |
| Peru | 07 | 1.9 | 1 |
| Philippines | 93 | 2.5 | 1.7 |
| Poland | 08 | 26.4 | 4.1 |
| Portugal | 09 | 15.6 | 4 |
| Puerto Rico | 05 | 13.2 | 2 |
| Republic of Korea | 09 | 39.9 | 22.1 |
| Republic of Moldova | 08 | 30.1 | 5.6 |
| Romania | 09 | 21 | 3.5 |
| Russian Federation | 06 | 53.9 | 9.5 |
| Saint Kitts and Nevis | 95 | 0 | 0 |
| Saint Lucia | 05 | 4.9 | 0 |
| Saint vincent and the Grenadines | 08 | 5.4 | 1.9 |
| Sao Tome and principe | 87 | 0 | 1.8 |

(continued)

**Table 2.2** (continued)

| Country | Year | Males | Females |
|---|---|---|---|
| Serbia | 09 | 28.1 | 10 |
| Seychelles | 08 | 8.9 | 0 |
| Singapore | 06 | 12.9 | 7.7 |
| Slovakia | 05 | 22.3 | 3.4 |
| Slovenia | 09 | 34.6 | 9.4 |
| South Africa | 07 | 1.4 | 0.4 |
| Spain | 08 | 11.9 | 3.4 |
| Sri lanka | 91 | 44.6 | 16.8 |
| Suriname | 05 | 23.9 | 4.8 |
| Sweden | 08 | 18.7 | 6.8 |
| Switzerland | 07 | 24.8 | 11.4 |
| Syrian Arab Republic | 85 | 0.2 | 0 |
| Tajikistan | 01 | 2.9 | 2.3 |
| Thailand | 02 | 12 | 3.8 |
| Tfyr Macedonia | 03 | 9.5 | 4 |
| Trinidad and Tobago | 06 | 17.9 | 3.8 |
| Turkmenistan | 98 | 13.8 | 3.5 |
| Ukraine | 09 | 37.8 | 7 |
| United Kingdom | 09 | 10.9 | 3 |
| United States of America | 05 | 17.7 | 4.5 |
| Uruguay | 04 | 26 | 6.3 |
| Uzbekistan | 05 | 7 | 2.3 |
| Venezuela | 07 | 5.3 | 1.2 |
| Zimbabwe | 90 | 10.6 | 5.2 |

### *2.2.3 Agents of Suicide*

Agents of suicide exhibit variation by characteristics of the population and their environmental circumstances. In the U.S., firearm suicides comprised 51 % (6.3 per 100,000 population) of the 38,364 suicide deaths in 2010. Of the drug-induced deaths, 13.1 % were suicidal drug poisoning. Although access to lethal agents are thought to be major risk factors, in nations where firearms are greatly restricted, elevated structures, substances, or other means may prevail. For example, suffocation has become the predominant method for committing suicide among adolescents in Canada, hanging, strangulation and suffocation among men in the U.K., and access to toxic substances, such as pesticides in rural China (Li et al. 2012; ONS 2014; Skinner and McFaull 2012).

Globally, European nations have among the highest suicide rates. The average suicide rate in Europe is 13.9 per 100,000, with the highest rates in the Commonwealth of Independent States (CIS) (21.4 per 100,000), followed by the new

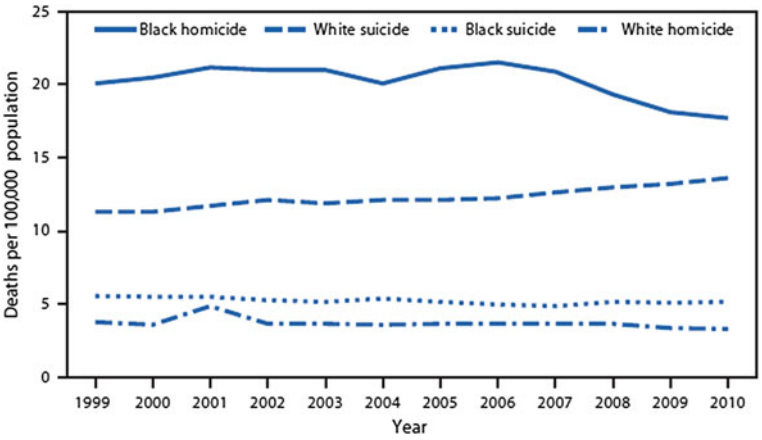


**Fig. 2.3** Annual Age-Adjusted Death Rates*† for Suicide and Homicide, by Black or White Race —United States,§ 1999–2010. April 5, 2013/62(13);257. * Deaths are coded as *U03, X60–X84, and Y87.0 for suicide, and *U01–*U02, X85–Y09, and Y87.1 for homicide, as underlying causes of death, according to the *International Classification of Diseases 10th Revision*. Rates include deaths related to the events of September 11, 2001. † Rates have been revised by using populations enumerated as of April 1, for 2000 and 2010, and intercensal estimates as of July 1 for all other years. Therefore, the rates might differ from those published previously. § U.S. residents only

EU countries (13.8 per 100,000). Even within the European Union, where the overall average rate is 10.1 per 100,000 population, it rises as high as 30.7 per 100,000 population in Lithuania, 21.5 per 100,000 in Hungary, and 18.5 per 100,000 in Finland, and 18.4 per 100,000 in Slovenia (WHO 2014).

### *2.2.4 Risk Factors for Suicide*

There are a number of risk factors identified for suicide. The most common ones cited in the literature are displayed in Table 2.3. There is no single risk factor on its own known to be causative, although depression is the most commonly identified from forensic autopsies and other studies of those who have committed suicide. Suicide typically results from a combination and interaction of a number of personal factors, including mental illness, marital difficulties, specifically divorce, financial hardship, deteriorating physical health, fearlessness about death, a major loss, as well as environmental factors such as lack of social support, economic downturns (Europe, Americas) and residence in rural areas (China) (Chang et al. 2013; Fassberg et al. 2012; Hooley et al. 2014; Hor and Taylor 2010; Li et al. 2012; Tang and Crane 2006). More recently, the social environment such as bullying and social internet media providing advice on aspects of suicide methods are playing a more prominent role as potential risk factors.

**Table 2.3** Risk factors for completed suicide

| Risk factor |
|---|
| Schizophrenia |
| Downward economic cycle/unemployment |
| Easy access to lethal methods (e.g., access to firearms) |
| Family history of suicide |
| Family history of violence, including physical or sexual abuse |
| Previous suicide attempt(s) |
| History of or current mental disorders, particularly clinical depression |
| History of or current alcohol and substance abuse |
| Feelings of hopelessness |
| Impulsive or aggressive tendencies |
| Cultural and religious beliefs (e.g., belief that suicide is noble resolution of a personal dilemma) |
| Exposure to suicidal behavior of others, including from media |
| Isolation, a feeling of being cut off from other people |
| Barriers to accessing mental health treatment |
| Loss (relational, social, work, or financial) |
| Chronic medical conditions (e.g., chronic pain) |
| Unwillingness to seek help because of the stigma attached to mental health and substance abuse disorders or to suicidal thoughts |

## 2.3 Suicidal Thoughts and Nonfatal Suicidal Behaviors

When obtaining information about suicidal thoughts, plans, or attempts, it is important to take note of the time interval in which the event occurred. Common time periods ascertained are lifetime, recent history (<6 months), baseline (within 30 days), or some prospective measurement (since baseline, since last visit, within one year). Historical measures are subject to recall bias. This means that respondents tend to recall events in the recent past better than those occurring more distantly. This could reflect why certain groups would have a lower prevalence of these behaviors if their event was 12 months or more prior to the survey compared with others, whose event was only one month prior to the survey. Persons in the former group might not report their event because of recall bias, and so the finding might not mean that their rates were actually lower. Prospective measurements are subject to survivorship bias meaning individuals who died from suicide or other means may not have lived and thus might be different from persons available for subsequent interviews.

### 2.3.1 Data Sources for Nonfatal Suicidal Events

Population based data on nonfatal suicidal events provide important background context for evaluating the impact of any programmatic or therapeutic intervention or change in public policy.

The World Mental Health (WMH) Survey Initiative is a source of information about suicidal behavior and various mental disorders, risk factors, and their treatment in the general. The WMH surveys were conducted 17 countries in Africa, the Americas, Asia, and the Pacific, Europe, and the Middle East (Nock et al. 2008).

The National Comorbidity Survey Replication (NCS-R) is a probability sample of the United States carried out a decade after the original 1992 NCS (NCS-1) was conducted. The NCS-R repeats many of the questions from the NCS-1 and also expands the questioning to include assessments based on the diagnostic criteria of the American Psychiatric Association as reported in the Diagnostic and Statistical Manual-IV (DSM-IV), 1994. The two major aims of the NCS-R were first, to investigate time trends and their correlates over the decade of the 1990s, and second, to expand the assessment in the baseline NCS-1 in order to address a number of important substantive and methodological issues that were raised by the NCS-1. The NCS-R is part of the Collaborative Psychiatric Epidemiology Surveys (CPES) data collection. Data and documentation for NCS-R can be accessed through the CPES Web site. The NCSR conducted the first national survey of US adolescents (NCS-Adolescent Suppl3ment) assessing a wide range of DSM-IV suicidal behaviors using structured diagnostic interviews (Nock et al. 2013).

The National Survey on Drug Use and Health (NSDUH) is an annual nationwide survey of a representative sample of the civilian, noninstitutionalized U.S. population aged ≥12 years. NSDUH collects data on adverse health consequences related to the use of illicit drugs, alcohol, and tobacco; initiation of substance use; substance use disorders and treatment; health care; and mental health. The suicide-related questions from NSDUH may be correlated with population demographics and the presence of a risk factor (e.g., major depressive episode), its duration and severity.

### 2.3.2 Age, Sex, Race, and Geographical Region Variations in Suicidal Thoughts and Nonfatal Suicidal Behaviors

There is marked variation in the prevalence of suicidal thoughts, plans, and attempts by age, sex, gender, and other demographic characteristics across nations and within nations (Casey et al. 2006; Crosby et al. 2011; Nock et al. 2008; Simon et al. 2013). Demographic, social, and access to health care could explain most of the cross-country variation, although there are some similarities in patterns. Results from the World Mental Health Surveys display the prevalences of these behaviors for individuals 18+ years are displayed in Table 2.4. Across all countries studied,

the lifetime prevalence (standard error) of suicidal ideation, plans, and attempts is 9.2 % (0.1), 3.1 % (0.1), and 2.7 % (0.1). The prevalence of each of these varied widely by country. Although these prevalences appear small, when translated on a population basis, the extent of the impact becomes profound. For example, in the U.S., during 2008–2009, 0.5 % of the adult population reported having made a suicide attempt or an estimated 1 million (annual average) persons. Sixty percent of transitions from ideation to plan and attempt were estimated to occur within the first year after ideation onset in both adults and children (Nock et al. 2008, 2013). Further details on the prevalences of these according to more detailed population characteristics for the U.S. adults are listed in Table 2.5. By comparison, among adolescents in the U.S., the lifetime prevalences of suicide ideation, plans, and attempts were 12.1, 4.0, and 4.1 %, respectively, rates higher than in the overall adult population (Nock et al. 2013). Noteworthy in these statistics combined are that suicidal thoughts (or ideas) are not uncommon in the population ranging from 15.9 % in New Zealand to 3.0 % in Italy. Accordingly, plans are less frequently reported, ranging from 5.6 % in New Zealand to 0.9 % in China. The prevalence of attempts is of similar magnitude to prevalence of those making suicidal plans, ranging from 0.5 % in Italy to 5.0 % in the U.S. (Table 2.4).

### *2.3.3 Risk and Protective Factors for Suicidal Thoughts and Behavior*

There are a number of risk factors for nonfatal suicidal thoughts and behavior many of which are also associated with a fatal suicide (Table 2.6). Similarly, these also vary by age, gender, race, and ethnic group. Consistently among countries, the strongest association with suicidal thoughts and behaviors is depression, particularly severe depression, despite variability in the prevalence of this factor across nations (Casey et al. 2006; Nock et al.2008). Other populations at risk for self-harm include those with dementia or psychiatric disorders, particularly schizophrenia. In these populations, the risk is further increased with the presence of comorbidites such as depression (Haw et al. 2009; Radomsky et al. 1999). An increased risk of suicide attempts after benzodiazepine and/or antidepressant use has been reported (Neutel and Patten 1997). Caution should be used in attributing prescription drug use and suicidal thoughts and behavior among persons with psychiatric behaviors as the association may be from a confounding by indication. Protective factors should also be considered as these are associated with a lower risk of suicidal behaviors. Both are listed in Table 2.6.

**Table 2.4** Lifetime prevalence of suicide-related outcomes in the world mental health surveys (Knock et al. 2008)

| | Total sample | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ideation | | | | Plan | | | | Attempt | | | |
| | (%) | (se) | (sd) | (n) | (%) | (se) | (sd) | (n) | % | (se) | (sd) | (n) |
| *The Americas* | | | | | | | | | | | | |
| Colombia | 12.4[b] | (0.7) | (46.6) | (587) | 4.1[b] | (0.4) | (26.6) | (204) | 4.7[b] | (0.4) | (26.6) | (224) |
| Mexico | 8.1[a] | (0.5) | (38) | (488) | 3.2 | (0.3) | (22.8) | (192) | 2.7 | (0.3) | (22.8) | (166) |
| USA | 15.6[b] | (0.5) | (48.2) | (1462) | 5.4[b] | (0.3) | (28.9) | (507) | 5.0[b] | (0.2) | (19.3) | (469) |
| *Europe* | | | | | | | | | | | | |
| Belgium | 8.4 | (0.9) | (44.3) | (209) | 2.7 | (0.4) | (19.7) | (77) | 2.5 | (0.4) | (19.7) | (66) |
| France | 12.4[b] | (0.7) | (37.7) | (391) | 4.4[b] | (0.4) | (21.5) | (143) | 3.4 | (0.4) | (21.5) | (115) |
| Germany | 9.7 | (0.7) | (41.7) | (347) | 2.2[a] | (0.3) | (17.9) | (78) | 1.7[a] | (0.3) | (17.9) | (64) |
| Italy | 3.0[a] | (0.3) | (20.6) | (144) | 0.7[a] | (0.1) | (6.9) | (33) | 0.5[a] | (0.1) | (6.9) | (26) |
| Netherlands | 8.2 | (0.6) | (29.2) | (223) | 2.7 | (0.5) | (24.4) | (78) | 2.3 | (0.3) | (14.6) | (64) |
| Spain | 4.4[a] | (0.3) | (22.2) | (272) | 1.4[a] | (0.2) | (14.8) | (84) | 1.5[a] | (0.2) | (14.8) | (80) |
| Ukraine | 8.2[a] | (0.5) | (34.4) | (389) | 2.7 | (0.3) | (20.6) | (126) | 1.8[a] | (0.2) | (13.7) | (80) |
| *Africa and the Middle East* | | | | | | | | | | | | |
| Israel | 5.5[a] | (0.3) | (20.9) | (268) | 1.9[a] | (0.2) | (13.9) | (93) | 1.4[a] | (0.2) | (13.9) | (66) |
| Lebanon | 4.3[a] | (0.6) | (32.1) | (117) | 1.7[a] | (0.4) | (21.4) | (39) | 2.0[a] | (0.3) | (16) | (54) |
| Nigeria | 3.2[a] | (0.2) | (16.4) | (237) | 1.0[a] | (0.1) | (8.2) | (70) | 0.7[a] | (0.1) | (8.2) | (46) |
| South Africa | 9.1 | (0.7) | (46) | (394) | 3.8 | (0.4) | (26.3) | (171) | 2.9 | (0.3) | 19.7) | (140) |

(continued)

**Table 2.4** (continued)

| | Total sample | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ideation | | | | Plan | | | | Attempt | | | |
| | (%) | (se) | (sd) | (n) | (%) | (se) | (sd) | (n) | % | (se) | (sd) | (n) |
| *Asia and the Pacific* | | | | | | | | | | | | |
| China | 3.1[a] | (0.2) | (14.4) | (160) | 0.9[a] | (0.2) | (14.4) | (42) | 1.0[a] | (0.2) | (14.4) | (49) |
| Japan | 10.9[b] | (0.5) | (24.7) | (264) | 2.1[a] | (0.3) | (14.8) | 50) | 1.9[a] | (0.3) | (14.8) | (48) |
| New Zealand | 15.9[b] | (0.5) | (56.5) | (2212) | 5.6[b] | (0.3) | (33.9) | (814) | 4.6[b] | (0.3) | (33.9) | (688) |
| *Total* | 9.2 | (0.1) | (29.1) | (8164) | 3.1 | (0.1) | (29.1) | (2801) | 2.7 | (0.1) | (29.1) | (2445) |

[1] n = 84,850

[a] The upper end of the 95 % confidence interval of the estimate is below the prevalence estimate for the total sample

[b] The lower end of the 95 % confidence interval of the estimate is above the prevalence estimate for the total sample

*Source* (Nock et al. 2008)

**Table 2.5** Annual average estimated number* and percentage of adults aged ≥18 years who had suicidal thoughts or engaged in suicidal behaviors during the previous year, by selected demographic characteristics—National Survey on Drug Use and Health, United States, 2008–2009†

| Characteristic | Thought | | | Plan | | | Attempt | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. | (%) | (95 % CI) | No. | (%) | (95 % CI) | No. | (%) | (95 % CI) |
| *Sex* | | | | | | | | | |
| Male | 3,789 | 3.5 | (3.2–3.8) | 1,045 | 1.0 | (0.8–1.1) | 442 | 0.4 | (0.3–0.5) |
| Female | 4,571 | 3.9 | (3.7–4.2) | 1,218 | 1.0 | (0.9–1.2) | 616 | 0.5 | (0.4–0.6) |
| *Age group (yrs)* | | | | | | | | | |
| 18–29 | 2,865 | 5.7 | (5.4–6.0) | 821 | 1.6 | (1.5–1.8) | 477 | 1.0 | (0.8–1.1) |
| ≥30 | 5,494 | 3.1 | (2.9–3.4) | 1,442 | 0.8 | (0.7–0.9) | 581 | 0.3 | (0.3–0.4) |
| *Race/ethnicity* | | | | | | | | | |
| White, nonhispanic | 6,044 | 3.9 | (3.7–4.1) | 1,616 | 1.0 | (0.9–1.2) | 663 | 0.4 | (0.4–0.5) |
| Black, nonhispanic | 911 | 3.5 | (3.1–4.0) | 262 | 1.0 | (0.8–1.3) | 182 | 0.7 | (0.5–0.9) |
| Hispanic§ | 933 | 3.0 | (2.6–3.6) | 267 | 0.9 | (0.6–1.2) | 144 | 0.5 | (0.3–0.6) |
| Asian, nonhispanic | 208 | 2.1 | (1.6–2.8) | 37 | 0.4 | (0.2–0.6) | 23 | 0.2 | (0.1–0.6) |
| *Education* | | | | | | | | | |
| Less than high school | 1,373 | 4.0 | (3.5–4.4) | 429 | 1.2 | (1.0-1.5) | 247 | 0.7 | (0.6–0.9) |
| High school graduate¶ | 2,823 | 4.0 | (3.7–4.4) | 730 | 1.0 | (0.9–1.2) | 393 | 0.6 | (0.5–0.7) |
| Some college | 2,359 | 4.1 | (3.8–4.5) | 672 | 1.2 | (1.0–1.4) | 304 | 0.5 | (0.4–0.7) |
| College graduate or higher | 1,805 | 2.8 | (2.5–3.2) | 433 | 0.7 | (0.5–0.9) | 113 | 0.2 | (0.1–0.3) |
| *Current employment* | | | | | | | | | |
| Full-time | 3,679 | 3.1 | (2.9–3.3) | 844 | 0.7 | (0.6–0.8) | 351 | 0.3 | (0.2–0.4) |
| Part-time | 1,380 | 4.5 | (4.0–5.0) | 405 | 1.3 | (1.1–1.6) | 200 | 0.6 | (0.5–0.9) |
| Unemployed | 768 | 6.5 | (5.6–7.5) | 244 | 2.1 | (1.6–2.7) | 118 | 1.0 | (0.8–1.3) |
| Other** | 2,532 | 3.9 | (3.6–4.3) | 770 | 1.2 | (1.0–1.4) | 389 | 0.6 | (0.5–0.8) |

(continued)

**Table 2.5** (continued)

| Characteristic | Thought | | | Plan | | | Attempt | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. | (%) | (95 % CI) | No. | (%) | (95 % CI) | No. | (%) | (95 % CI) |
| *County type* | | | | | | | | | |
| Large metropolitan area†† | 4,353 | 3.6 | (3.4–3.9) | 1,148 | 1.0 | (0.8-1.1) | 559 | 0.5 | (0.4–0.6) |
| Small metropolitan area§§ | 2,692 | 3.9 | (3.6–4.3) | 777 | 1.1 | (1.0–1.3) | 351 | 0.5 | (0.4–0.6) |
| Nonmetropolitan area¶¶ | 1,315 | 3.5 | (3.2–4.0) | 338 | 0.9 | (0.8–1.1) | 148 | 0.4 | (0.3–0.5) |
| *Total*** | 8,359 | 3.7 | (3.5–3.9) | 2,263 | 1.0 | (0.9–1.1) | 1,058 | 0.5 | (0.4–0.5) |

*Abbreviations* CI = confidence interval; thought = had serious thoughts of suicide; plan = made any suicide plan; attempt = attempted suicide

* In thousands

† Estimates are based only on responses to suicide items in the Mental Health module. Respondents with unknown suicide information were excluded

§ Persons of hispanic origin can be of any race

¶ Includes persons with a general education diploma

** Includes retired persons, disabled persons, homemakers, students, or other persons not in the labor force

†† Area with a population of ≥1 million persons

§§ Area with a population of <1 million persons

¶¶ Area that is outside of a metropolitan statistical area; includes urbanized counties with a population of ≥20,000 persons in urbanized areas, less urbanized counties with a population of ≥2,500 persons but <20,000 persons in urbanized areas, and completely rural counties with a population of <2,500 persons in urbanized areas

** Totals exclude persons with missing or unknown race and ethnicity. Totals might vary due to rounding

*Source* (Crosby et al. 2011)

**Table 2.6** Risk and protective factors for suicidal thoughts and nonfatal suicidal behaviors

| *Risk factor* (See also Risk Factors in Table 2.3) |
|---|
| Low birth weight |
| Young maternal age at birth |
| Young paternal age at birth |
| Life events without help (women) |
| Severity of depressed mood (Beck's depression inventory score ≥13) |
| Schizophrenia |
| Post traumatic stress disorder |
| Major depressive disorder |
| Disruptive behavior disorders |
| Certain forms of dementia |
| *Protective factors* |
| Effective clinical care for mental, physical, and substance abuse disorders |
| Easy access to a variety of clinical interventions and support for help seeking |
| Family and community support (connectedness) |
| Support from ongoing medical and mental health care relationships |
| Skills in problem solving, conflict resolution, and nonviolent ways of handling disputes |
| Cultural and religious beliefs that discourage suicide and support instincts for self-preservation |

## 2.4 Conclusion

There are a number of challenges in assessing suicide risk and suicidal behavior in populations. Among these are changing environmental factors and their differential distribution among population subgroups. But uniform in concern is that suicide rates are trending upwards in many countries and population subgroups despite a recognition that suicide data may be under reported due to the difficult nature of classifying suicide and the time lag in determining this as a cause of death. The epidemiological concepts underlying suicide and suicidal behavior illustrate a complex pathway to either fatal or nonfatal self-harm and present a challenge in developing preventive strategies. The factors that give rise to these events are highly subject to personal and environmental characteristics, whose influences are changed over time because of social, cultural, and economic conditions. Thus, the interpretations of any measures of such must consider to what degree biases enter into how their measurement and reporting could affect the underlying true rates.

## References

Bossarte RM, Knox KL, Piegari R, Altieri J, Kemp J, Katz IR (2012) Prevalence and characteristics of suicide ideation and attempts among active military and veteran participants in a national health survey. Am J Pub Health 102:S38–S40

Casey PR, Dunn G, Kelly BD, Birkbeck G, Dalgard OS, Lehtinen V, Britta S, Ayuso-Mateos JL, Dowrick C (2006) Factors associated with suicidal ideation in the general population: five-centre analysis from the ODIN study. Br J Psychiatry 189:410–415

Chang S-S, Stuckler D, Yip P, Gunnell D (2013) Impact of 2008 global economic crisis on suicide: time trend study in 54 countries. BMJ 17(347):f5239

Crosby AE, Han B, Ortega LAG, Parks SE, Gfroerer J (2011) Suicidal thoughts and behaviors among adults aged ≥18 years—United States, 2008–2009. MMWR 60(SS-13):1–22

Fassberg MM, van Orden KA, Duberstein P, Erlangsen A, Lapierre S, Bodner E, Canetto SS, DeLeo D, Szanto K, Waern M (2012) A systematic review of social factors and suicidal behavior in older adulthood. Int J Environ Res Pub Health 9:722–745

Fazel S, Wolf A, Pillas D, Lichtenstein P, Langstrom N (2014) Suicide, fatal injuries, and other causes of premature mortality in patients with traumatic brain injury: a 41-year Swedish population study. JAMA Psychiatry 71:326–333

Gahm GA, Reger MA, Kinn JT, Luxton DD, Skopp NA, Bush NE (2012) Addressing the surveillance goal in the national strategy for suicide prevention: the Department of Defense suicide event report. Am J Pub Health 102:S24–S28

Haw C, Harwood D, Hawton K (2009) Dementia and suicidal behavior: a review of the literature. Int Psychogeriatr 21:440–453

Hayati AN, Abdullah AA, Shah MM (eds) (2008) National suicide registry Malaysia: preliminary report July–Dec 2007. Kuala Lumpur

Hooley JM, Franklin JC, Nock MK (2014) Chronic pain and suicide: understanding the association. Curr Pain Headache Rep 18:435

Hor K, Taylor M (2010) Suicide and schizophrenia: a systematic review of rates and risk factors. J Psychopharmacology 24(Suppl 4):81–90

Knock MK et al (2008) Cross-national prevalence and risk factors for suicidal ideation, plans, and attempts. Br J Psychiatry 192:98−105

Li Y, Li Y, Cao J (2012) Factors associated with suicidal behaviors in mainland China: a meta-analysis. BMC Publ Health 12:524

Navaneelan T (2012) Suicide rates: an overview. Statistics Canada Catalogue no. 82-624-X

Neutel CI, Patten SB (1997) Risk of suicide attempts after benzodiazepine and/or antidepressant use. Ann Epidemiol 7:568–574

Niederkrotenthaler T, Rasmussen F, Mittendorfer-Rutz E (2012) Perinatal conditions and parental age at birth as risk markers for subsequent suicide attempt and suicide: a population based case-control study. Eur J Epidemiol 27:729–738

Nock MK, Borges G, Bromet EJ, Alonso J, Angermeyer M, Beautrais A, Bruffaerts R, Chiu WT, de Girolamo G, Gluzman S, de Graaf R, Gureje O, Haro JM, Huang Y, Karam E, Ronald C (2008) Cross-national prevalence and risk factors for suicidal ideation, plans, and attempts. Br J Psychiatry 192:98–105

Nock MK, Green JG, Hwang I, McLaughlin KA, Sampson NA, Zaslavsky AM, Kessler RC (2013) Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents. JAMA Psychiatry 70:300–310

Norton R, Kobusingye O (2013) Injuries. New Engl J Med 368:1723–1730

Office for National Statistics (ONS) (2014) Suicides in the United Kingdom, 2012 Registrations. ONS: United Kingdom

Radomsky ED, Haas GL, Mann JJ, Sweeney JA (1999) Suicidal behavior in patients with schizophrenia and other psychotic disorders. Am J Psychiatry 156:1590–1595

Simon M, Chang E-S, Zeng P, Dong X (2013) Prevalence of suicidal ideation, attempts, and completed suicide rate in Chinese aging populations: a systematic review. Arch Gerontol Geriatr 57:250–256

Skinner R, McFaull S (2012) Suicide among children and adolescents in Canada: trends and sex differences, 1980-2008. CMAJ 184:1029–1034

Tang NKY, Crane C (2006) Suicidality in chronic pain: a review of the prevalence, risk factors and psychological links. Psychol Med 36:575–586

Trofimovich L, Skopp NA, Luxton DD, Reger MA (2012) Health care experiences prior to suicide and self-inflicted injury, active component, U.S. Armed Forces, 2001–2010. MSMR 19:2–6

WHO (2014) Data and statistics: fact sheet mental health. http://www.euro.who.int/en/health-topics/noncommunicable-diseases/mental-health/data-and-statistics/fact-sheet-mental-health. Accessed 20 May 2014