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# Trends of Suicide in the United States During the 20th Century

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### Summary

Suicide represents a global health concern that encompasses a myriad of biological, psychological, and social factors. Suicide, strictly speaking a manner of death, currently ranks epidemiologically as the 11th leading cause of death in the United States, accounting for approx 30,000 deaths annually. Although reports of suicide have existed since the Greek and Roman times, the trends of suicide specifically in the United States have drastically changed, especially within the past century. The most striking finding is the significant increase in suicide rate for both men and women in the second and third decade of life. The highest suicide rate throughout the 20th century was recorded for

From: Forensic Pathology Reviews, Vol. 3 Edited by: M. Tsokos © Humana Press Inc., Totowa, NJ Caucasian males and increased with advancing age. In the United States, the national suicide rate decreased by 14% during the last decade of the 20th century, dropping suicide from the 8th to the 11th leading contributory cause of death. Methods of suicide have changed over the century. In 1860, the most common cause of suicide was hanging, which was supplanted by poisoning in 1900. By 1910, and every decade thereafter, death by firearms has prevailed as the primary method of choice. Numerous risk factors have been associated with an increased risk for suicide, such as being divorced or unemployed or suffering from a physical or mental illness. Individuals with a disease of the central nervous system have the highest risk of suicide and may commit suicide within a short time period after diagnosis, or in the late stages of the disease, when the pain and burden have become debilitating. Three mental illnesses most frequently linked to an increased risk of suicide, namely major affective disorder, schizophrenia, and neuropsychological sequelae of chronic alcoholism, are highlighted. The forensic pathologist plays a pivotal role in classifying the manner of death as homicide, suicide, accident, or natural. Both an extensive scene investigation and a thorough postmortem examination with complete toxicological study are warranted in the determination of a suicide. Although "classic" findings at the scene and at autopsy characterize a suicidal death, investigators should be astute to features that may have been intentionally altered to conceal the accurate manner of death. The psychodynamics of the suicide autopsy, which must be realistically evaluated in each case, are discussed in this review. This chapter also addresses causes of suicidal death, including firearm injuries, hanging, stabbing, self-immolation, and overdose. Particular attention to findings at autopsy is addressed. Suicide in the United States is the primary focus of this review because of the wealth of literature and because it is the authors' country of residence. Nevertheless, an international perspective on suicide with specific consideration of gender differences, adolescent suicide, and self-inflicted death by firearms is presented that correlates well with United States findings. In summary, this review encompasses numerous aspects of suicide, including statistics and trends in the United States. psychosocial characteristics, risk factors, and autopsy findings.

Key Words: Suicide; trends; risk factors; firearms; autopsy; forensic pathology.

### **1.** INTRODUCTION

The determination of a suicidal death ultimately rests on the reasonable inferences establishing the self-inflicted nature of the act and the underlying intent (1). Table 1 indicates certain well-known risk factors. The self-inflicted

Risk Factors for Suicide				
• Male				
Caucasian				
• Elderly				
Divorced				
• Unemployed				
Physical disease				
<ul> <li>Mental illness</li> </ul>				
• Spring and summer seasons				

Tabla 1

basis of the death may be inferred from the pathological and toxicological evidence obtained from a postmortem examination. Certain features apparent on discovery of the victim, such as multiple gunshot wounds of the head, initially may be construed as homicidal. This presumption may well be overcome by a thorough autopsy and collection of pertinent historical information about the decedent. Such investigational evidence may include a detailed scene analysis, police reports, and the victim's medical records. Suicidal intent refers to the decedent's wish to end his or her life and the knowledge that a particular act would result in death (1). Explicit expression of intent in the form of the suicide note occurs in only between 20 and 30% of suicides (2,3). A suicide note may offer explanations as to the motivations behind a suicide and provide a healing or blaming role for the survivors. Ho et al. analyzed the suicide notes of 154 suicides in 1992, accounting for 20% of all suicide victims (2). The majority of authors of the notes were young females of nonwidowed marital status, with no history of previous suicide attempts or psychiatric illness, who held religious beliefs and characteristically wrote passionate letters. Elderly victims composed notes that were more succinct, less emotional, and included detailed instructions pertaining to funeral arrangements and allocations of possessions.

Implicit evidence of intent conveying suicidal ideation may include premature preparations for death, exclamations of farewell in anticipation of an impending death, and a previous suicide attempt. Failed suicide attempts are significant in the psychosocial history of a deceased individual and it is well known that these attempts occur in greater numbers in females. The determination of intent may be obscured by a decedent's history of ethanol intoxication or mental illness (1); however, these conditions do not necessarily preclude an individual from forming intent. Other self-inflicted mortal acts, such as Russian roulette, have been hotly debated without resolution as to whether the underlying motivation is intentional (4,5).

The self-destructive behavior inherent in a suicide may be divided as a triad of intrapersonal and interpersonal characteristics, and implementation (6). The intrapersonal features include both conscious and unconscious intention, specifically, the awareness of the effects of an individual's self-destructive behavior and associated suicidal ideation on others, devices for rescue, and the psychodynamic factors of anxiety, hostility, and dependency. The intrapersonal component also includes "ego organization" in the form of impulsivity versus control, rigidity vs flexibility, and isolation vs relatedness (6). The interpersonal aspect of self-destructive behavior refers to an individual's communicative abilities with others and his or her role in society. Finally, implementation incorporates the lethality of the suicidal method selected, taking into account the reversibility and rescue capability of the action. The contemplation and completion of a suicide encompass a host of biopsychosocial factors. By delving into the underlying motivations behind a suicide and addressing the historical trends of suicide, investigators marshal well-founded support to conclude that the manner of death was suicide.

## 2. INCIDENCE AND PREVALENCE

The World Health Organization estimates an incidence of 1 million suicides and 10 to 20 times as many attempted suicides worldwide in 2000, amounting to one death every 40 seconds and one attempt every 3 seconds (7). Women were three times more likely than men to attempt suicide (8).

Approximately 30,000 individuals committed suicide in the United States in 2001 (9). The manner of suicide ranked as the 11th leading associated causes of death in the United States in 2001 (Table 2[9]). Combining both genders and all ages and races, New Mexico and Montana had the highest suicide rates in 2001 with age-adjusted rates of 20.2 and 19.15 per 100,000, respectively (9). New York and Massachusetts had the lowest suicides rates with age-adjusted rates of 6.45 and 6.43 per 100,000, respectively. Between 1990 and 1994, crude suicide rates in the United States were highest in the west (14.1 per 100,000), followed by the south (13.1), midwest (11.4), and northeast (9.3; ref. 10). The most popular suicide site worldwide is the Golden Gate Bridge in San Francisco, which more than 800 suicide victims have chosen since its opening in 1937 (11).

### 3. TRENDS

The foregoing analysis of distinctive trends of suicide in the United States offers a unique perspective on the methods used to commit suicide, especially

- 1. Heart disease
- 2. Malignant neoplasms
- 3. Cerebrovascular disease
- 4. Chronic respiratory disease
- 5. Unintentional injury
- 6. Diabetes mellitus
- 7. Influenza and pneumonia
- 8. Alzheimer's disease
- 9. Nephritis
- 10. Septicemia
- 11. Suicide (manner; from all types of causes)
- 12. Liver disease

when viewed in combination with a relative mix of gender, race, and age of the victims.

### 3.1. Gender, Age, and Race Trends

Suicide rates have exhibited several striking trends during the past century in the United States with regard to gender, age, and race of victims. The most startling change during this period is the increasing youth suicide rate of both males and females in the 15 to 24 age range. Between 1940 and 1980, the rate for white males aged 15 to 19 years more than tripled, representing a 231% increase, and doubled for white males aged 20 to 24, a 116% increase (12). During this same time span, the rate increased by 262% for non-white males aged 15 to 19 and increased by 182% for non-white males aged 20 to 34. The suicide rate of men older than the age of 65 gradually decreased during this period. The rates for white and non-white women also increased between 1940 and 1980, although not as drastically as seen in the male counterpart.

Between 1980 and 1992, suicide rates in the United States increased for persons aged 10 to 19 years and older than 75 years of age (13, 14). The rate increased by 120% (from 0.8 to 1.7) in persons aged 10 to 14 years for both males and females and in all racial groups (13). Furthermore, the rate increased by 28.3% among those aged 15 to 19 years (from 8.5 to 10.9), with a 165.3% increased rate for black males. The rate also significantly increased in the elderly population: 11% between 75 and 79 years, 35% between 80 and 84 years, and 15% 85 years and older (14). Men constituted 81% of suicides of people aged 65 years or older.

Suicide rates in the United States decreased by 14% between 1990 and 1999 (8), in turn, dropping the manner of suicide from the 8th to the 11th overall associated causes of death. Rates decreased in every age bracket, in all races, and for both men and women during the last decade of the 20th century. In 2001, 24,672 men and 5950 women committed suicide in the United States, ranking the manner of suicide 8th and 19th for men and women, respectively, among leading associated causes of death (9). The manner of suicide ranked as the third leading associated causes of death in 2001 between the ages of 10 and 34 years, after death by unintentional injury and homicide.

During the past century, certain features of suicidal trends have remained the same. The suicidal rates throughout the twentieth century have been the highest for white males and increase with advancing age. In 1999, the suicide rate in the United States was 10.7 per 100,000, whereas the rates for individuals over the age of 65 and 85 were 15.9 and 19.2, respectively (8). Although the number of women aged 65 or older exceeds that of men in this age group in the population, the suicide rate of men is more than six times that of women (15). Furthermore, non-Caucasian suicide rates peak by the fourth decade and subsequently decrease, unlike Caucasian rates, which continue to increase with age.

### 3.2. Methods of Suicide Trends

The earliest statistical reports of methods of suicide in the United States were documented in 1860 as a component of the Eighth Census (16). The leading cause of suicidal death in 1860 was hanging, followed by poisoning and firearm. A total of 993 individuals, 789 men and 204 women, committed suicide. By 1900, poisoning emerged as the leading cause of suicidal death, followed by firearm and hanging (17). Death by firearm was the primary method chosen by suicidal individuals every decade thereafter during the twentieth century in the United States (9,17). Table 3 documents the leading causes of suicidal death, the suicide rate, the male to female ratio, and the race of suicidal victims in the United States between 1860 and 2000 (9,16,17).

Death by firearms has remained the leading cause of suicide in the United States since 1910 for both men and women (17). Approximately 1 million firearm deaths were reported between 1933 and 1982 in the United States, of which suicide comprised 49% of these fatalities (18). Throughout this time period, the firearm suicide rate exceeded that of homicide. The total number of deaths by firearm increased by 137% between 1962 and 1993, with suicide accounting for the largest percentage (19).

An ongoing debate has focused on the relationship between household gun ownership and increased rate of suicide by firearm (20-24). In a regional

1860–2000					
Year <sup>a</sup>	Firearms	Poisoning	Hanging/ strangulation	Males/ females	White/ non-white
1860 <sup>b</sup>	#3	#2	#1	789/204	N/A
1900 (10.2)	#2 (2.2)	#1 (3.1)	#3 (2.0)	15.7/4.7	N/A
1910 (15.3)	#1 (4.6)	#2 (4.1)	#3 (2.4)	23.0/7.2	15.4/11.8
1920 (10.2)	#1 (3.6)	#3 (1.6)	#2 (1.9)	14.5/5.7	10.8/3.6
1930 (15.6)	#1 (5.7)	#3 (2.5)	#2 (2.8)	24.1/6.9	16.8/5.0
1940 (14.4) <sup>c</sup>	N/A	4.3	N/A	21.9/6.8	15.5/4.6
1950 (11.4)	#1 (4.9)	#2 (2.6)	#3 (2.4)	17.3/4.9	11.6/4.7
1960 (10.6)	#1 (5.0)	#2 (2.4)	#3 (1.9)	16.6/5.0	11.1/5.4
1970 (11.6) <sup>d</sup>	#1	#2	#3	16.8/6.6	12.4/5.6
1981 (12.0)	#1 (7.0)	#2 (2.4)	#3 (1.6)	19.1/5.8	12.7/6.5
1990 (12.4)	#1 (7.6)	#2 (2.2)	#3 (1.8)	21.2/4.8	13.2/7.2
2000 (10.4)	#1 (5.9)	#3 (1.7)	#2 (2.0)	17.8/4.0	11.3/5.5

Table 3Suicide in United States With Respect to Methods, Gender, and Race:1860–2000

*Note:* <sup>a</sup>Suicide rate per 100,000 in parentheses. <sup>b</sup>In 1860, the rates of the cause of death were not available, and the male-to-female ratio represents the total number of victims in the United States. <sup>c</sup>In 1940, other causes of suicidal death besides poisoning are grouped with a rate of 10.1. <sup>d</sup>In 1970, the rates of the cause of death were not available.

# Indicates the prevailing cause of death.

and state-level analysis of the United States, a high correlation was obtained between the rates of household firearm ownership and suicide (23). Individuals living in a high-gun state (Louisiana, Alabama, Mississippi, Wyoming, West Virginia, and Arkansas) were 3.8 times more likely to commit suicide using a firearm as compared to a low-gun state (Hawaii, Massachusetts, Rhode Island, and New Jersey). In a study of 803 suicides in both Shelby County, Tennessee and King County, Washington between 1987 and 1990, Kellermann et al. reported 326 (58%) suicides by firearm occurring in the victim's home (24). Handguns were used in 72% of the cases, and the gun had been stored in the victim's home in 80% of the suicides by firearms. The majority of subjects kept guns in the home for months or years prior to their death whereas only a few victims had acquired the weapon within hours or days of their death. On this evidence they concluded that the ready availability of firearms increased the risk of suicide in the home and suggested that individuals should weigh the benefit of gun ownership when it may raise the possibility of a future suicide in a family member or self (24).

### 3.3. International Trends

The comparison of suicidal trends between nations affords a unique outlook into the study of suicide and may provide an innovative method of confirming certain higher risk factors for suicide as a means of achieving the ultimate goal of treatment and prevention. Of the 62 countries reporting suicide data to the World Health Organization between 1960 and 1985, 42 (67.8%) nations experienced increased suicide rates during this period, reflecting an average percent change of 37% and a range from 66 to 437% (25). This increase in rates was primarily observed in the 15- to 20-year age group worldwide. Diekstra pointed out that this age group constituted the children of the post-World War II baby boom whose large numbers spurred competition for jobs and participated in political uproar in Europe and the United States (25). The year 1910 also marked a peak in youth suicide internationally (25). Of interest, the first scientific conference on suicide was held in 1910 in Vienna, where Sigmund Freud was one of the participants. The rampant political, social, and cultural changes at the turn of the twentieth century, which culminated in World War I in 1914 and the Russian Revolution in 1917, may be associated with the increase in youth suicide in 1910. Between 1970 and 1984 the male suicide rate increased in 21 of 23 countries worldwide, while the female rate only increased in 14 nations (26). During the 1980s and 1990s, two striking trends were noted internationally, namely a decrease in the female suicide rate and a substantial rise in the rate of adolescent suicide (27).

In 1990, the highest suicide rates were recorded in Hungary and Sri Lanka, at 39.9 and 33.2, respectively; Kuwait and Egypt had the lowest rates, at 0.8 and 0.004, respectively (27). The male suicide rate was higher than that of females in all countries in 1990 except China. Yip's study of suicide in Beijing between 1987 and 1996 found that the female suicide rate for ages 15 to 44 was higher than that of males (28). Of special note, the female rate was 1.6 times greater than that of males in the age group 15 to 24. Factors attributed to the higher female rate were the patriarchal social structure in China, which may instill hopelessness and helplessness in women and promote suicide (29). Furthermore, approximately half of Chinese women commit suicide by ingestion of poison, specifically, widely available lethal insecticides and herbicides.

Although an increase in adolescent suicide has been observed internationally, France has experienced a substantial rise in suicidal behavior among young adults. Approximately 40,000 adolescents are evaluated annually in a hospital after a suicide attempt, and the manner of suicide ranked as the second most common associated cause of death in the 15 to 24 year age group behind motor vehicle accidents and as the leading associated cause in the 25 to 35 year age group in 1993 (30). Furthermore, a fivefold rise in suicide rate in men aged 15 to 24 and a doubling of the rate in women in the same age group between 1955 and 1987 were recorded in New Zealand (31).

Initially observed in 1910, death by firearm has remained the leading method of suicide in the United States throughout the twentieth century. In contrast to the United States, the three most common causes of death in 1862 suicides in northwest London between 1957 and 1977 were as follows: drug poisoning, in most cases barbiturates, in 48% of the victims, followed by carbon monoxide intoxication in 32%, and physical injury in 20% of the subjects (32). The latter category included all methods of physical self-destruction, specifically shooting, stabbing, drowning, hanging, jumping from a height, and self-immolation. In all modalities, males constituted the majority of cases (77%). Internationally, there also appears to be a striking connection with gun ownership and increased suicide rates. Killias reported findings of an international survey of 11 European countries, Australia, Canada, and the United States focusing on the relationship between gun ownership and the suicide rate (33). He observed a direct correlation between household gun ownership and use of a gun to commit suicide. The highest percentage of households with a gun (48.0%) and the highest rate of suicides using a gun (72.8 per million) were recorded in the United States. On the other hand, the Netherlands reported the lowest percentage of guns in the household (1.9%) and the lowest rate of self-inflicted gunshot wounds (2.8 per million).

#### 3.4. Marital Status

Marriage tends to provide protection against suicide for both genders, more so for men than women (34). Marriage resulting in children confers a protective factor against suicide, with a rate of 11 per 100,000 (11). Although never-married people have a suicide rate twice that of married, divorced individuals have the greatest rate of suicide, where a rate of 69 per 100,000 for men and 18 per 100,000 for women applies. Never-married, divorced, widowed, or separated individuals with a mental illness have the highest risk of suicide (34).

### 3.5. Employment

Unemployment has been closely associated with suicidal risk (35,36). In particular, unemployed men and women ages 24 to 44 and men ages 45 to 64 are two to three times more likely to commit suicide than employed individuals of these ages (35). Unemployment may increase the risk of suicide by either exacerbating a preexisting or provoking a mental illness, such as depression, anxiety disorders, and alcoholism. It may also intensify stressful life situations, including financial hardships and domestic strife.

Studies have documented an inverse relationship between socioeconomic status and suicide. In a study of 1210 suicides in Detroit, Michigan, the suicide rate of blue-collar workers was 44.2 compared with 17.8 for white-collar workers (37). The suicide rate of laborers was 4.6 times that of professionaltechnical workers. Of the high-status societal positions, several studies have suggested that physicians and dentists have an increased risk of suicide (11,38,39), most commonly resulting from substance overdoses rather than firearms, the primary modality among the general population (11). Physicians who commit suicide have often suffered from a mental illness, including depression and substance abuse, in conjunction with a recent professional or domestic hardship. Individuals with a preemployment psychiatric illness often are enticed to pursue specific occupations. Persons with a depressive disorder who seek a high-status position in the medical field are drawn to psychiatry (40). Artists also have a high rate of suicide, which may be attributed to a concomitant psychiatric disorder. Artists have a suicide risk 2.25 higher than that of the general population (41). In a study of 30 creative writers, 80% suffered from an affective disorder, whereas 43% were afflicted with bipolar disorder (42).

### 3.6. Seasons

Contrary to the popular view, suicide frequencies generally peak in the spring and summer months and are at their lowest in the autumn and winter months (43). December frequencies fall 10% below other months, and the Christmas and New Years holidays are the least likely times to commit suicide of the entire year (43,44). Social isolation and stressful situations during the holiday season can lead to suicidal ideation. However, the support system offered by family bonding and religious traditions in December may dispel suicidal thoughts and offer hope and a positive outlook for those contemplating suicide.

Studies have investigated the relationship between season and method of suicide (43,45). Hanging peaked in the spring for both men and women, and drowning and jumping from heights were most common in the summer months (45). Traffic suicides experienced a trough in the winter for both genders. The distribution of suicides throughout the week reveals that the number of suicides is highest on a Monday for both men and women and lowest on Saturday for men and Sunday for women (46).

### 3.7. Physical Health

Physical illness has been associated with an increased risk of suicide (Table 4). Thirty-two percent of suicide victims have received medical atten-

0			
Physical	Emotional		
<ul> <li>Highest suicidal risk associated with diseases of central nervous system: epilepsy, multiple sclerosis, spinal cord and head injuries, Huntington's disease</li> <li>Chronic and debilitating nature of physical disease</li> </ul>	<ul> <li>Loss of control over one's life</li> <li>Severing of ties with support systems</li> <li>Feelings of impending mortality</li> </ul>		

Table 4Suicidal Ideation Resulting From Disease States

tion within 6 months of death (11). Patients with diseases of the central nervous system have the highest risk of suicide, with the most common being epilepsy, multiple sclerosis, spinal cord and head injury, and Huntington's disease (11,47). Individuals suffering from a physical illness may experience a loss of control over their life, leading to helplessness and hopelessness, a severing of ties with one's support system, a feeling of mortality, and an inability to exercise logic and reason (48). The pain often associated with chronic debilitating diseases forces sufferers to depend on others for all aspects of daily life, a dependency that may promote suicidal thoughts (47). The timing of suicide after diagnosis of an illness varies. In certain cases cancer patients are more likely to commit suicide in the advanced stages of their illness when their prognosis is poor (49), as opposed to others, who commit suicide within a short time of receiving their diagnosis, presumably because of the fear of the consequences that will ensue (50).

### 3.8. Mental Health

Three psychiatric diagnoses have been closely linked to an increased risk of suicide: major affective disorder (including unipolar depression and bipolar disorder), schizophrenia, and chronic alcoholism (Table 5 [34,51]). A combination of a depressive-mood disorder and substance abuse significantly increases the risk of suicide, as 70 to 80% of suicide victims are diagnosed with comorbidity (52). Furthermore, about 90% of adults who commit suicide have at least one of the *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) psychiatric diagnoses. The suicidal risk is 3 to 12 times greater for psychiatric patients than the overall general population. The mean age of psychiatric suicide victims is generally younger than the typical older age of suicide victims in the same population (11). The younger age of the

Mental illness	Distinguishing characteristics in relation to suicide
Major affective disorder (unipolar depression, bipolar disorder)	<ul> <li>25–30% lifetime probability of suicide</li> <li>Depression: Initiation of end of depressive episode; Within 6 months of discharge from hospital</li> <li>Bipolar disorder: First-degree family member suicide; History of minida etternate</li> </ul>
Schizophrenia	<ul> <li>10–20% lifetime probability of suicide</li> <li>Young male</li> <li>Early stage of illness</li> <li>Recent discharge from hospital</li> <li>High intelligence and expectations</li> <li>Illness well-controlled with antipsychotic medication</li> </ul>
Chronic alcoholism	<ul> <li>15–25% lifetime probability of suicide</li> <li>Caucasian, middle-aged male</li> <li>Unmarried</li> <li>Within 6 weeks of interpersonal loss/ conflict</li> <li>Increased aggression, psychological distress</li> </ul>

 Table 5

 Mental Illnesses Associated With Increased Risk of Suicide

psychiatric suicides is ascribed to the early-onset illness of major depressive disorder and schizophrenia. Suicide risk is increased in depressed patients at the initiation or end of a depressive episode and within 6 months of discharge from the hospital (11,53). Only 5% of suicidal patients use their prescribed antidepressants as a mode to commit suicide (54,55). These findings suggest that these medications may be underprescribed, ineffective in treating a suicidal patient, or may entice an individual with preexisting suicidal ideation to commit suicide. The volatility of bipolar disorder, which is characterized by inherent mania marked by irritability and excessive energy and coupled with the defeating depressive lows, embraces the escape mechanism that suicide

offers. Risk factors for an individual with bipolar disorder include both a first-degree family history of suicide and a history of suicide attempts (56).

Approximately 10% of individuals with schizophrenia will commit suicide, whereas two to five times as many will attempt suicide (57). Risk factors include being young, male, in the early stages of the illness, recently discharged from the hospital, and possessing high intelligence with high expectations. Similar to other suicide victims, schizophrenics who commit suicide often experience a recent loss or stress, feelings of hopelessness and isolation, and a lack of self-esteem. Paradoxically, schizophrenics are more likely to take their lives when their symptoms are under control, while compliantly taking their antipsychotic medications, without reference to an exacerbation of their illness (58). Explanations for this pattern include postpsychotic depression that may lead to suicidal ideation or akathisia, an uncomfortable restlessness that often accompanies antipsychotic medication, which can induce suicidal behavior. A study by Chute et al. at the Office of the Chief Medical Examiner in Maryland evaluated 66 individuals with schizophrenia who died suddenly between 1994 and 1996. Thirteen (20%) schizophrenic victims committed suicide, compared with approx 6% of suicidal deaths in the general Maryland population (59). The schizophrenics' most common causes of death were hanging and jumping from a height. They were less likely to commit suicide by firearms (<20%), as opposed to 53 to 58% of victims of a self-inflicted gunshot wound in the general population in the state.

Alcohol dependence affects 20.1% of men and 8.2% of women over their lifetimes; 200,000 individuals succumb to alcohol-related deaths annually (60,61). The majority of alcohol-dependent suicide victims are Caucasian, middle-aged males who are unmarried and socially isolated (11). As many as 50% had experienced an interpersonal loss or relationship disruption within 1 year and, in many cases, within 6 weeks of their suicide (11.62.63). Alcohol consumption influences suicidal behavior through a variety of methods. Most common are its ability to increase aggressiveness and psychological distress, to crumble barriers during sobriety that protect against suicide in an individual with preexisting suicidal ideation, and to distort cognitive sensibilities that impair the development of coping strategies (64,65). Alcohol dependence in association with comorbid psychopathology, such as major depressive disorder, increases the risk of suicidal ideation and attempts. The cause-and-effect relationship between alcohol consumption and suicidal ideation remains unclear in that alcohol use may aggravate or ameliorate psychopathology; conversely, one's psychopathology may lead an individual to consume alcohol (65).

- Psychiatric disorders: affective, conduct, and eating disorders, substance abuse, aggressive and antisocial behavior
- Interpersonal conflict with a lack of family support
- Family history of suicide
- Financial and legal difficulties
- Employment and school problems
- Physical and sexual abuse
- Risk-taking behavior: reckless driving, run away from home, theft, assault, truancy

# 4. Highlighting Three Populations: Young Adults, Older Adults, and Women

Special attention should be focused on high-risk groups, specifically adolescents and young unmarried adults and the elderly. Although women have a lower rate of suicide than men, women are significantly more likely to attempt suicide. Each of these groups of individuals possesses features that place them at risk for suicidal behavior.

# 4.1. Young Adults

The estimated ratio of attempted suicides to completed suicides for adolescents is 200:1 (66), which is significantly higher than that of the general population with an estimated 10 to 25 attempts for every completed suicide (8). In a study of 31 suicides in persons who were younger than 18 years of age, 42% had histories of risk-taking behaviors, including reckless motorcycle riding, running away from home, auto theft, assault, and truancy (67). Numerous proposed psychosocial factors increase the risk of adolescent suicide and are tabulated in Table 6. The majority of adolescent suicide victims suffer from either single or combined psychiatric disorders, including affective disorders, substance abuse, anxiety or conduct disorders, eating disorders, and aggressive and antisocial tendencies (68–73). Of special note is the adolescent "exposure to suicides" that poses a significant risk factor for adolescent suicide, namely either experiencing the suicidal death of a member of a young individual's peer group or indirectly gaining awareness of suicide through the media or discussions with friends (72).

Studies have attempted to explain the impact of psychosocial dynamics on the developing and impressionable mind of an adolescent. It is postulated that the youth of our society strive to gain independence as they explore and

- · Chronic and painful medical disease: cancer and cardiovascular disease
- Functional impairment
- · Less inclined to share thoughts of suicidal ideation
- Social isolation
- Major depressive disorder
- Increased suicidal planning and intent
- Use methods that prove lethal caused by limited physical reserves

formulate a unique vision of their own identifying role in society. More than a century ago, Durkheim proposed that societies, in particular social institutions such as the family unit and religion, fail to adequately integrate the young person socially (74). This inability to transform adolescents into productive and functioning members of society may lead to the hopelessness often linked to suicide. Society's quest for individualism and autonomy of its members may lead to detrimental consequences if not attained, resulting in a dichotomy between expectations and realities (75). This sense of personal failure and lack of fulfillment may promote suicidal ideations within adolescents or young adults.

### 4.2. Older Adults

Compared with younger people, older adults face specific age-related suicidal risk factors. These characteristics are given in Table 7 (76–78). Their psychosocial dynamics, consisting of an increased risk of comorbid depression, social isolation, a feeling of hopelessness and rare overt expression of suicidal intentions, play a role in suicidal behavior. Between 71 and 95% of suicide victims aged 65 or older have been diagnosed with a major psychiatric disorder prior to death (79). The elderly are more likely to suffer from depression as opposed to psychotic illness (schizophrenia or delusional disorder), personality disorders, or anxiety disorders. Furthermore, alcoholism and substance disorders are infrequent in the elderly population compared to their younger counterparts (80).

Older adults, as compared with younger people, are more likely to use more immediately lethal modes, which evince increased planning and intent (77,79). They are less likely to survive their injury partly because of their limited physical reserves and of the decreased likelihood of being discovered before a fatality because of diminished social support. Attitudes toward death and dying expressed by elderly persons reveal that they rarely fear death and often experience greater anxiety facing stressful life situations (78).

### 4.3. Women

Although women in the United States are twice as likely to experience major depression compared with men, the suicide rate among men in 2001 was four times that of women (9,81). Estimates suggest that there are 10 to 25 nonfatal suicide attempts for every fatality, and women are three times as likely to attempt suicide vs men (8). The fewer number of nonfatal suicidal acts by men as compared to women may be the result of underreporting, in part attributable to the social stigma of suicidal ideation—regarded inconsistent with masculinity—and the failure of researchers to detect suicidal clues in men (82). However, most male suicides may be due to statistical underreporting of the female suicidal deaths, which have been categorized as accidents or undetermined deaths owing to drug-related toxicity.

A suicide attempt refers to intentional self-harm with an awareness that the act could result in a fatal outcome (70). Individuals who attempt suicide, also known as parasuicides, often behave impulsively, alert others about their intentions, and use methods that are either ineffective or slowly acting (83). At 35 years follow-up, less than 12% of all suicide attempters will succumb to suicide (84). Both men and women are more inclined to select a drug overdose during a suicide attempt (85).

Numerous hypotheses have been offered to explain the lower rate of suicide for women. Men have been socialized to lead independent lives and act decisively without approaching others in times of need (85). Discussion of a man's suicidal ideation may be deemed as a sign of weakness. In turn, depressive and suicidal thoughts may become overpowering, culminating in a suicide. On the other hand, women value close emotional bonds with others and are more likely to disclose turmoil and hardships in their lives. In this respect, women are able to release frustrations and discuss negative thoughts prior to succumbing to the grip of suicide.

Historically, more women chose a drug overdose as their primary means of suicide (86). Currently, the majority of women in the United States in 2001 selected a firearm to commit suicide (9). This difference in method choice may reflect a woman's determination in ensuring a fatality, leaving no ability for method failure or escape. In addition, the increased incidence of self-inflicted gunshot wounds by women may be to the result of the greater availability of firearms in the homes of suicidal individuals and the increased social acceptance of women's use of firearms (87).

### 5. Autopsy Findings

### 5.1. Firearms

A host of injuries may be detected at postmortem examination, which leads to the determination of a suicidal death. The primary mode of suicide for both males and females in the United States is by firearm. Kohlmeier et al. performed a 15-year retrospective review of 1704 firearm-related suicidal cases (88). Both men and women between the ages of 20 and 29 were most likely to use a firearm. The entrance wound site was as follows: head (83.7%), chest (14.0%), abdomen (1.9%), and a combination of these sites (0.4%). Handguns were the most commonly chosen weapons for both sexes. Eisele et al.'s study of 266 suicides confirmed Kohlmeier et al.'s review with respect to entrance wound location; the head was the preferred entrance wound site (74%), followed by chest (18%), and neck and abdomen (both 4% [89]). In Cina et al.'s study of 86 fatalities caused by a self-inflicted gunshot wound to the head, 47% of the cases were temporal, 16% were intraoral, 16% of the entrances were located at the side of the head, 15% were aimed at the face, 3.5% were below the chin, and 2.5% were at the back of the head (90). Handguns were used in 85% of the cases, and 97% of the victims had sustained a contact wound. Although individuals are more likely to shoot themselves on the same side of the head as their dominant hand, this act is not an absolute finding (89).

The majority of suicidal gunshot wounds are single and directed against a specific area of the body; however, suicides resulting from multiple gunshot wounds of various bodily locations using one gun or two guns simultaneously have been reported (91-95). Similarly, atypical features of entrance gunshot wounds are not reliable criteria to exclude a suicidal manner of death (96). Multiple gunshot wounds of the body warrant utmost scrutiny to avoid the hasty judgment of labeling them homicidal. The necessity of multiple gunshot wounds of the head to ensure a fatality may result from the victim's lack of knowledge of anatomy, inability to damage vital centers, or defective weaponry or ammunition (91,92,97).

A thorough scene analysis with particular attention to placement of the weapon is warranted in the investigation of a suicide by firearm. In a study of 574 suicidal gunshot wounds, the gun was discovered in the victim's hand in 24% of the cases, on or within 30 cm of the body in 69%, and more than 30 cm from the victim in 7% of the cases (98). Attention should be addressed to the blood spatter patterns (Fig. 1), position of the firearm with reference to the victim (Fig. 2A–C), and tests of hand wipings for gunshot residues (99,100).



**Fig. 1.** Blowback on the shooting hand in a case of suicide. The weapon used in this case was an automatic pistol caliber 9 mm (Courtesy of Dr. Michael Tsokos, Hamburg, Germany.)

## 5.2. Asphyxia

Asphyxial suicides include both ligature hanging and emplacement of a plastic bag placed over the head. In a series of 61 cases of asphyxial deaths by hanging, a ligature furrow denoting the demarcation of the overlying ligature was noted in each case and was located superior to the thyroid cartilage prominence in most victims (101,102). The presence of conjunctival and facial petechiae was directly proportional to the extent of support below the ligature suspension. Of the victims, 26% had sustained hyoid bone and/or thyroid cartilage fractures and were primarily those individuals who had been discovered completely suspended. The percentage of fractures has been shown to be higher when the suspension time is less than 16 hours (103) and with increasing age of the victims had evidence of petechiae, primarily of the conjunctivae (104). Cutaneous markings about the neck were noted in 19% of victims, and a sole victim had sustained an internal neck injury, specifically thyrohyoid membrane hemorrhage.

Specific attention should be addressed to complex (combined) suicides involving hanging. The question whether capacity to execute a subsequent act was maintained after the infliction of primary injuries may become of major importance in such cases (Fig. 3).





**Fig. 2.** Suicidal gun shot to the head. **(A)** Death scene. Original finding position of the body with the gun still in the hand of the victim. The bloodstain pattern on the left shoulder and chest of the victim's tee-shirt extend from the blowback (drawback) of the shooting hand and pistol. **(B)** Contact wound on the left temple with muzzle imprint. **(C)** Muzzle of the automatic pistol used in this case. (Courtesy of Dr. Michael Tsokos, Hamburg, Germany.)

## 5.3. Sharp Force Injuries

Sharp force injuries, including stabbing and incised wounds, may be associated with a homicidal, suicidal, or accidental manner of death. Specific characteristics of these injuries may reflect a suicidal nature. Suicidal knife wounds are predominantly located in the throat, wrists, and chest (105). Superficial sharp force injuries present at the wrists (Fig. 4A–C), inner forearms, face, or neck are often multiple and known as "tentative incisions" or "hesitation marks," likely reflecting the equivocal nature of the suicide attempt



**Fig. 3.** Complex (combined) suicide of a 59-year-old male with two self-inflicted stab wounds on the midline abdomen and the precordial left chest (arrows). Both stab wounds were nonfatal, resulting in maintained capacity to execute a subsequent act. The victim hanged himself resulting in an asphyxial death by free suspension. A single-edged knife was found at the scene. (Courtesy of Dr. Michael Tsokos, Hamburg, Germany.)



Fig. 4.



**Fig. 4.** Suicide by sharp force. **(A)** Death scene. Original body position of a 67-year-old woman who committed suicide by incising both wrists with a razor blade. Note the dark colored (bloody) water in the bathtub and drip blood pattern on the interior and exterior of the bathtub. **(B)** The fatal incisions on the victim's left inner wrist. **(C)** The razor blade found on a stool in the bathroom. (Courtesy of Dr. Michael Tsokos, Hamburg, Germany.)



**Fig. 5.** Suicide by multiple sharp force injuries. Two deep incised wounds of the anterolateral neck (arrows) and multiple stab wounds to the chest, abdomen, and groin with three different knifes still in the body. (Courtesy of Dr. Michael Tsokos, Hamburg, Germany.)

prior to the lethal cut. Wrist cutting is rarely fatal, and scars may be discerned at autopsy of victims who used a different and more effective suicidal method. Although "tentative incisions" of the wrist or throat are more commonly associated with suicide, a thorough scene investigation is warranted to exclude other manners of death. In some cases, it may be very difficult to discern suicidal vs homicidal sharp force injuries, even when there are multiple wounds identified on the body (Fig. 5). The textbook description of a suicidal cut throat encompasses a single or several trial incisions followed by superimposed deeper cuts at the origin that gradually become shallower as they obliquely traverse the throat (105). In reality, these cuts may be horizontal and do not vary in depth. On the other hand, homicidal incised wounds of the neck inflicted by a perpetrator facing the victim are often short and angled (106). These slashes continue obliquely downward and medially across the neck. Wounds inflicted from the rear may extend deeply to the vertebral column.

Stab wounds constitute the majority of suicidal injuries to the chest and may be multiple and each life-threatening. Nonfatal linear incisions may scatter the precordium or extensive areas of the chest. Forensic investigators should be cognizant of self-inflicted injuries not deemed suicidal, which may be caused by an individual with a mental disorder as a form of self-mutilation (Fig. 6) or by one who deliberately harms oneself for motives of gain (105). The wounds in self-mutilation are often superficial, multiple, and, although found anywhere on the body, not present in visible locations such as the lips, nose, and ears.



**Fig. 6.** Self-mutilation by sharp force in a 28-year-old schizophrenic male on the left inner forearm. These superficial self-inflicted incised wounds are arranged in a chessboard-like pattern. This man ultimately died as a result of jumping from a 16-meter height. (Courtesy of Dr. Michael Tsokos, Hamburg, Germany.)

# 5.4. Self-Immolation

Suicide caused by self-immolation, or self-incineration, is uncommon. However, certain autopsy findings may aid in confirming this manner of death. In a study of 32 self-immolation deaths, the majority of victims had evidence of soot in the airways combined with elevated blood carboxyhemoglobin (COHb) concentrations (107). These findings confirmed that these individuals had been alive at the initiation of the fire and had succumbed to carbon monoxide poisoning caused by smoke inhalation. Of the victims, 88% used an accelerant, specifically gasoline in 86% of these cases. Although these cases are highly suggestive of suicide, the mere autopsy findings discussed in this report are not definitive.

## 5.5. Overdoses

The forensic investigation of overdose suicides may yield negative anatomical findings at autopsy and, therefore, centers primarily on the toxicological analysis. The accuracy of these results depends on numerous factors, including the timing and bodily site of sampling, the containers and preservatives used in the storage of the fluids or tissues, and the type of toxicological testing performed (105). The diffusion effect resulting from the destruction of living cell components after death can profoundly affect the concentrations of physiological and foreign substances by drug redistribution. Postmortem collection of peripheral vein blood, if available, is superior to cardiac blood for most toxicological analyses (105).

### 5.6. Other Suicidal Deaths

Certain categories of suicidal death rely more heavily on the historical and scene investigation than the postmortem examination. Jumps from heights and impact motor vehicle collisions are prime examples. Suicide by self-inflicted blunt force injury is rare (108). In these circumstances, investigatory confirmation of suicidal ideation in addition to a detailed scene reconstruction, complete autopsy, and toxicological evaluation may constitute the sole means of classifying a suicidal death.

The forensic pathologist plays an important role in the investigation of a suicide by performing the postmortem examination and confirming the self-inflicted nature of the death. A detailed scene analysis, an extensive analysis of the victim's background to uncover suicidal intent, and a complete autopsy with toxicology are warranted in these cases. Although specific injuries such as multiple gunshot wounds to the head or stabbing and incisional injuries may represent either a homicidal or suicidal act, the forensic pathologist should be cognizant of several distinctive findings during an autopsy that are associated with a suicidal death. A comprehensive analysis of suicidal trends in combination with a detailed review of significant postmortem evidence may shed light on the underlying motives behind a suicide and provide data for the formulation of strategies aimed at prevention.

### Postscript

In the 20th century, international trends of suicide are similar to those experienced in the United States, with particular regard to the dramatic rise in youth suicide and prevalence of self-inflicted death by firearm in numerous countries worldwide over the twentieth century. International collaboration with mechanisms for coordination and sharing each country's unique struggle with suicide may offer a meaningful opportunity to combat it.

### References

- 1. Rosenberg ML, Davidson LE, Smith JC, et al. (1988) Operational criteria for the determination of suicide. J Forensic Sci 33, 1445–1456.
- 2. Ho TP, Yip PSF, Chui CWF, Halliday P (1998) Suicide notes: what do they tell us? Acta Psychiatr Scand 98, 467–473.
- 3. Litman RE, Curphey TJ, Shneidman ES, Farberow NL, Tabachnick ND (1963) Investigations of equivocal suicides. JAMA 184, 924–929.

- 4. Denny KM (1995) Russian roulette: a case of questions not asked? J Am Acad Child Adolesc Psychiatry 34, 1682–1683.
- 5. Fishbain DA, Fletcher JR, Aldrich TE, Davis JH (1987) Relationship between Russian roulette deaths and risk-taking behavior: a controlled study. Am J Psychiatry 144, 563–567.
- 6. Tabachnick ND, Farberow NL (1961) The assessment of self-destructive potentiality. In Farberow NL, Shneidman ES, eds., The Cry for Help. McGraw-Hill Book Company Inc., New York, pp. 60–77.
- 7. World Health Organization. WHO Statistical Information System. Available at: URL: www.who.int/whosis; Internet; accessed September 22, 2004.
- 8. Maris RW (2002) Suicide. Lancet 360, 319-326.
- 9. Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting System (WISQARS) [online]. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention (producer). Available at: URL: www.cdc.gov/ncipc/wisqars; Internet; accessed September 22, 2004.
- 10. Centers for Disease Control and Prevention (1997) Regional variations in suicide rates—United States, 1990–1994. MMWR 46, 789–793.
- 11. Kaplan HI, Sadock BJ (1998) Psychiatric emergencies. In Kaplan HI, Sadock BJ, eds., Kaplan and Sadock's Synopsis of Psychiatry, 8th ed. Williams & Wilkins, Baltimore, pp. 864–872.
- 12. Stafford MC, Weisheit RA (1988) Changing age patterns of U.S. male and female suicide rates, 1934–1983. Suicide Life Threat Behav 18, 149–163.
- Centers for Disease Control and Prevention (1995) Suicide among children, adolescents, and young adults—United States, 1980–1992. MMWR 44, 289–291.
- 14. Centers for Disease Control and Prevention (1996) Suicide among older persons— United States, 1980–1992. MMWR 45, 3–6.
- 15. McIntosh JL (1992) Epidemiology of suicide in the elderly. Suicide Life Threat Behav 22, 15–35.
- 16. Statistics of the United States in 1860. 8th Census. Washington, DC, Government Printing Office Vol. 4, 1866.
- 17. Centers for Disease Control and Prevention. National Center for Health Statistics [online]. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention (producer). Available at: URL: www.cdc.gov/nchs; Internet; accessed September 22, 2004.
- Wintemute GJ (1987) Firearms as a cause of death in the United States, 1920– 1982. J Trauma 27, 532–536.
- 19. Ikeda RM, Gorwitz R, James SP, Powell KE, Mercy JA (1997) Trends in fatal firearm-related injuries, United States, 1962–1993. Am J Prev Med 13, 396–400.
- 20. American Medical Association Council on Scientific Affairs (1989) Firearms injuries and deaths: A critical public health issue. Public Health Rep 104, 111–120.
- 21. Lester D, Murrell ME (1980) The influence of gun control laws on suicidal behavior. Am J Psychiatry 137, 121–122.
- 22. Markush RE, Bartolucci AA (1984) Firearms and suicide in the United States. Am J Public Health 74, 123–127.

- 23. Miller M, Azrael D, Hemenway D (2002) Household firearm ownership and suicide rates in the United States. Epidemiology 13, 517–524.
- 24. Kellermann AL, Rivara FP, Somes G, Reay DT, Francisco J, Banton JG (1992) Suicide in the home in relation to gun ownership. N Engl J Med 327, 467–472.
- 25. Diekstra RFW (1989) Suicide and the attempted suicide: An international perspective. Acta Psychiatr Scand 354, Suppl, 1–24.
- 26. Lester D (1990) Changes to suicide rates unique to Canada? Can J Public Health 81, 240–241.
- 27. Lester D (1997) Suicide in an international perspective. Suicide Life Threat Behav 27, 104–111.
- 28. Yip PSF (2001) An epidemiological profile of suicides in Beijing, China. Suicide Life Threat Behav 31, 62–70.
- 29. Zhang J (1996) Suicides in Beijing, China, 1992–1993. Suicide Life Threat Behav 26, 175–180.
- Chastang F, Rioux P, Dupont I, Baranger E, Kovess V, Zarifian E (1998) Risk factors associated with suicide attempt in young French people. Acta Psychiatr Scand 98, 474–479.
- 31. Deavoll BJ, Mulder RT, Beautrais AL, Joyce PR (1993) One hundred years of suicide in New Zealand. Acta Psychiatr Scand 87, 81–85.
- 32. Gatter K, Bowen DA (1980) A study of suicide autopsies 1957–1977. Med Sci Law 20, 37–42.
- 33. Killias M (1993) International correlations between gun ownership and rates of homicide and suicide. Can Med Assoc J 148, 1721–1725.
- 34. Klerman GL (1987) Clinical epidemiology of suicide. J Clin Psychiatry 48:12, Suppl, 33–38.
- 35. Blakely TA, Collings SCD, Atkinson J (2003) Unemployment and suicide. Evidence for a causal association? J Epidemiol Community Health 57, 594–600.
- Kposowa AJ (2001) Unemployment and suicide: a cohort analysis of social factors predicting suicide in the US National Longitudinal Mortality Study. Psychol Med 31, 127–138.
- 37. Stack S (1980) Occupational status and suicide: a relationship reexamined. Aggress Behav 6, 223–234.
- Stack S (1998) Education and risk of suicide: an analysis of African Americans. Sociol Focus 31, 295–302.
- 39. Juel K, Mosbech J, Hansen ES (1997) Mortality and cause of death among Danish physicians, 1973–1992. Ugekr Laeger 159, 6512–6518.
- 40. Bedeian A (1982) Suicide and occupation: a review. J Vocational Behav 21, 205-223.
- 41. Stack S (1996) Gender and suicide risk among artists: a multivariate analysis. Suicide Life Threat Behav 26, 374–379.
- 42. Andreasen NC (1987) Creativity and mental illness: prevalence rates in writers and their first degree relatives. Am J Psychiatry 144, 1288–1292.
- 43. Ajdacic-Gross V, Wang J, Bopp M, Eich D, Rössler W, Gutzwiller F (2003) Are seasonalities in suicide dependent on suicide methods? A reappraisal. Soc Sci Med 57, 1173–1181.

- 44. Yip PSF, Chao A, Chiu CWF (2000) Seasonal variation in suicides: diminished or vanished. Experience from England and Wales, 1982–1996. Br J Psychiatry 177, 366–369.
- 45. Rasanen P, Hakko H, Jokelainen J, Tiihonen J (2002) Seasonal variation in specific methods of suicide: a national register study of 20,234 Finnish people. J Affect Disord 71, 51–59.
- 46. Massing W, Angermeyer MC (1985) The monthly and weekly distribution of suicide. Soc Sci Med 21, 433–441.
- Maris RW, Berman AL, Silverman MM, Goldblatt MJ (2000) Physical illness and suicide. In Maris RW, Berman AL, Silverman MM, eds., Comprehensive Textbook of Suicidology. Guilford Press, New York, pp. 342–356.
- Cassell EJ (1979) Reactions to physical illness and hospitalizations. In Usin G, Lewis JM, eds., Psychiatry in General Medical Practice. McGraw-Hill, New York, pp. 103–131.
- 49. Fox BH, Stanek EJ, Boyd SC, Flannerty JT (1982) Suicide rates among cancer patients in Connecticut. J Chronic Dis 35, 89–100.
- 50. Marzuk PM (1994) Suicide and terminal illness. Death Stud 18, 497–512.
- 51. Robins LN, Helzer JE, Croughan J (1981) National Institute of Mental Health Diagnostic Interview Schedule: Its history, characteristics and validity. Arch Gen Psychiatry 38, 381–392.
- 52. Moscicki E (2001) Epidemiology of suicide. In Goldsmith S, ed., Risk Factors for Suicide. National Academy Press, Washington, DC, pp. 1–4.
- 53. Angst J, Angst F, Stassen HH (1999) Suicide risk in patients with major depressive disorder. J Clin Psychiatry 60, Suppl 2, S57–S62.
- Kelleher MJ, Daly M, Kelleher MJA (1992) The influence of antidepressants in overdose on the increased suicide rate in Ireland between 1971 and 1988. Br J Psychiatry 161, 625–628.
- 55. Müller-Oerlinghausen B, Berghofer A (1999) Antidepressants and suicidal risk. J Clin Psychiatry 60, Suppl 2, S94–S99.
- 56. Tsai SY, Kuo CJ, Chen CC, Lee HC (2002) Risk factors for completed suicide in bipolar disorder. J Clin Psychiatry 63, 469–476.
- 57. Siris SG (2001) Suicide and schizophrenia. J Psychopharmacol 15, 127-135.
- Mann JJ (2002) A current perspective of suicide and attempted suicide. Ann Intern Med 136, 302–311.
- 59. Chute D, Grove C, Rajasekhara B, Smialek JE (1999) Schizophrenia and sudden death: a medical examiner case study. Am J Forensic Med Pathol 20, 131–135.
- Kessler RC, McGonagle KA, Zhao S, et al. (1994) Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. Arch Gen Psychiatry 56, 617–626.
- 61. Stoudemire A, Wallack L, Hedenark N (1987) Alcohol dependence and abuse. In Amler RW, Dull HB, eds., Enclosing the Gap: The Burden of Unnecessary Illness. Oxford University Press, New York, pp. 9–18.
- 62. Duberstein PR, Conwell Y, Caine ED (1993) Interpersonal stressors, substance abuse, and suicide. J Nerv Ment Dis 181, 80–85.

- 63. Murphy GE, Armstrong JW, Hermele SL, Fischer JR, Clendenin WW (1979) Suicide and alcoholism: interpersonal loss confirmed as a predictor. Arch Gen Psychiatry 45, 593–594.
- 64. Hufford MR (2001) Alcohol and suicidal behavior. Clin Psychol Rev 21, 797-811.
- 65. Gruenewald PJ, Ponicki WF, Mitchell PR (1995) Suicide rates and alcohol consumption in the United States, 1970–89. Addiction 90, 1063–1075.
- 66. Langley GE, Bayatti NN (1984) Suicides in Exe Vale Hospital, 1972–1981. Br J Psychiatry 145, 463–467.
- 67. Lee CJ, Collins KA, Burgess SE (1999) Suicide under the age of eighteen: a 10year retrospective study. Am J Forensic Med Pathol 20, 27–30.
- 68. Rosewater KM, Burr BH (1998) Epidemiology, risk factors, intervention, and prevention of adolescent suicide. Curr Opin Pediatr 10, 338–343.
- 69. Chan KPM, Hung SF, Yip PSF (2001) Suicide in response to changing societies. Child Adolesc Psychiatr Clin N Am 10, 777–795.
- 70. Beautrais AL (2003) Suicide and serious suicide attempts in youth: a multiplegroup comparison study. Am J Psychiatry 160, 1093–1099.
- 71. Koplin B, Agathen J (2002) Suicidality in children and adolescents: a review. Curr Opin Pediatr 14, 713–717.
- 72. Rosenberg ML, Smith JC, Davidson LE, Conn JM (1987) The emergence of youth suicide: an epidemiologic analysis and public health perspective. Annu Rev Public Health 8, 417–440.
- 73. Runeson BS (1993) History of suicidal behaviour in the families of young suicides. Acta Psychiatr Scand 98, 497–501.
- 74. Durkheim E (1970) Suicide: a study in sociology (Spaulding JA, Simson G, Trans.). Routledge and Kegan Paul, London (first published 1897).
- 75. Eckersley R, Dear K (2002) Cultural correlates of youth suicide. Soc Sci Med 55, 1891–1904.
- Caine ED, Conwell Y (2001) Suicide in the elderly. Int Clin Psychopharmacol 16, Suppl 2, S25–S30.
- 77. Conwell Y (2001) Suicide in later life: a review and recommendations for prevention. Suicide Life Threat Behav 31, Suppl, 32–47.
- 78. Kastenbaum R (1992) Death, suicide and the older adult. Suicide Life Threat Behav 22, 1–14.
- 79. Conwell Y, Duberstein PR, Caine ED (2002) Risk factors for suicide in later life. Biol Psychiatry 52, 193–204.
- Conwell Y, Duberstein PR, Cox C, Herrmann JH, Forbes NT, Caine ED (1996) Relationship of age and Axis I diagnoses in victims of completed suicide: a psychological autopsy study. Am J Psychiatry 153, 1001–1008.
- Kessler RC, McGonagle KA, Zhao S, Nelson CB, Hughes M, Eshleman S, et al. (1994) Lifetime and twelve month prevalence of DSM-III-R psychiatric disorders in the United States: results from a national comorbidity survey. Arch Gen Psychiatry 51, 8–19.
- Canetto SS, Sakinofsky I (1998) The gender paradox in suicide. Suicide Life Threat Behav 28, 1–23.

- Edwards JE, Whitlock FG (1968) Suicide and attempted suicide in Brisbane, I and II. Med J Austr 1, I: 932–938, II: 989–995.
- 84. Dahlgren KG (1977) Attempted suicide—35 years afterward. Suicide Life Threat Behav 7, 75–79.
- 85. Murphy GE (1998) Why women are less likely than men to commit suicide. Compr Psychiatry 39, 165–175.
- Doddakashi V, Wilcox RE (2003) Female suicides in major Texas cities, 1994 through 1998. Tex Med 99, 50–58.
- 87. Frierson RL (1989) Women who shoot themselves. Hosp Community Psychiatry 40, 841–842.
- 88. Kohlmeier RE, McMahan CA, DiMaio VJM (2001) Suicide by firearms: a 15-year experience. Am J Forensic Med Pathol 22, 337–340.
- Eisele JW, Reay DT, Cook A (1981) Sites of suicidal gunshot wounds. J Forensic Sci 36, 480–485.
- Cina SJ, Ward ME, Hopkins MA, Nichols CA (1999) Multifactorial analysis of firearm wounds to the head with attention to anatomic location. Am J Forensic Med Pathol 20, 109–115.
- 91. Jacob B, Barz J, Haarhoff K, Sprick C, Worz D, Bonte W (1989) Multiple suicidal gunshots to the head. Am J Forensic Med Pathol 10, 289–294.
- 92. Hudson P (1981) Multishot firearm suicide: examination of 58 cases. Am J Forensic Med Pathol 2, 239–242.
- 93. Introna F, Smialek JE (1989) Suicide from multiple gunshot wounds. Am J Forensic Med Pathol 10, 275–284.
- 94. Shields LBE, Hunsaker DM, Hunsaker JC 3rd, Rolf CM (2003) Multiple selfinflicted suicidal gunshot wounds of the head: a matter of timing and place[ment]— Simultaneous or sequential? ASCP Check Sample Forensic Pathology No. FP 03-2 (FP-283).
- 95. Parroni E, Caringi C, Ciallella C (2002) Suicide with two guns represents a special type of combined suicide. Am J Forensic Med Pathol 23, 329–333.
- 96. Skinker [Hunsaker] DM, Coyne CM, Lanham C, Hunsaker JC 3rd (1996) Chasing the casing: a 38 Special suicide. J Forensic Sci 41, 709–712.
- 97. DiMaio VJM (1999) Gunshot wounds: practical aspects of firearms, ballistics, and forensic techniques, 2nd ed. CRC Press, Boca Raton, FL.
- 98. Garavaglia JC, Talkington B (1999) Weapon location following suicidal gunshot wounds. Am J Forensic Med Pathol 20, 1–5.
- 99. Stone IC (1992) Characteristics of firearms and gunshot wounds as markers of suicide. Am J Forensic Med Pathol 13, 275–280.
- Stone JC (1987) Observations and statistics relating to suicide weapons. J Forensic Sci 32, 711–716.
- Shields LBE, Hunsaker DM, Hunsaker JC 3rd, Shouse B (2004) Autoerotic asphyxia: summary of a classic case. ASCP Check Sample Forensic Pathology No. FP 04-4 (FP-295).
- 102. Luke JL, Reay DT, Eisele JW, Bonnell HJ (1985) Correlation of circumstances with pathological findings in asphyxial deaths by hanging: a prospective study of 61 cases from Seattle, WA. J Forensic Sci 30, 1140–1147.

- 103. Morild I (1996) Fractures of neck structures in suicidal hanging. Med Sci Law 36, 80–84.
- 104. Haddix TL, Harruff RC, Reay DT, Haglund WD (1996) Asphyxial suicides using plastic bags. Am J Forensic Med Pathol 17, 308–311.
- 105. Knight B (1996) Forensic Pathology, 2nd ed. Arnold, London, Sydney, Auckland.
- 106. DiMaio VJ, DiMaio D (2001) Forensic Pathology, 2nd ed. CRC Press, Boca Raton, FL.
- 107. Shkrum M, Johnston KA (1992) Fire and suicide: a three-year study of self-immolation deaths. J Forensic Sci 37, 208–221.
- Hunsaker DM, Thorne LB (2002) Suicide by blunt force trauma. Am J Forensic Med Pathol 23, 355–359.