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Schizophrenia and Suicide: A 10-Year Review of Kentucky Medical Examiner Cases

ABSTRACT: The risk of suicide is significantly increased in schizophrenics; it is estimated that 10–13% of individuals suffering from schizophrenia commit suicide. Schizophrenia is marked by psychotic exacerbations and remissions, with persistent deterioration in baseline functioning with each relapse. We present a 10-year (1993–2002) retrospective review of Medical Examiners' cases of suicide of schizophrenic victims. Twenty-nine cases were between the ages of 20 and 75 (mean age of 41.6 years). The majority of victims were male (62.1%) and Caucasian (86.2%). The leading method of suicide for both males and females was firearm injury (48.3%) mostly of the head, followed by overdose (20.7%), and hanging (13.8%). A comprehensive investigation of the biopsychosocial factors is warranted in cases of schizophrenics who commit suicide. This study offers an insightful analysis pertaining to the determination of intent in formulating the manner of death in this unique population.

KEYWORDS: forensic science, forensic pathology, suicide, schizophrenia, firearms

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) described schizophrenia as “a disorder that lasts for at least 6 months and includes at least 1 month of active-phase symptoms (i.e., two [or more] of the following: delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, negative symptoms)” (1). Schizophrenia is divided into the following subtypes: paranoid, disorganized, catatonic, undifferentiated, and residual. Approximately 1% of the general population suffers from this disorder. A slightly higher incidence of schizophrenia has been noted in men than in women; the onset is earlier in men (18–25 years) compared with that in women (25–35 years). The illness is characterized by psychotic exacerbations and remissions, with continued deterioration in baseline functioning with each relapse.

In 1911 Eugen Bleuler recognized “the suicidal drive” as the “most serious of all schizophrenic symptoms” (2). Schizophrenics share several risk factors for suicide with the general population, including being an unmarried male, social isolation, previous suicide attempts, family history of suicide, and sense of hopelessness (3–10). Risk factors specific for the schizophrenic population include young age, chronicity of illness with ongoing exacerbations and remissions, depression, poor social or work history, self-awareness of the mental deterioration, excessive reliance on medical treatment, and frustration and negative views towards treatment (3–9,11,12). The risk of suicide among schizophrenics was less related to the psychotic symptoms associated with this disorder and more to the affective symptoms of agitation, motor restlessness, and feelings of hopelessness as well as the realization of the mental disturbances (6,9).

This 10-year (1993–2002) retrospective study summarizes the findings associated with schizophrenics who commit suicide in

Kentucky based on the analysis of autopsy and toxicological reports, and investigatory evidence uncovered by lay Coroners and law enforcement officials. Kentucky is by statute (KRS Chapter 72) a dual Coroner-Medical Examiner system in which the Coroner of jurisdiction determines whether a decedent shall undergo autopsy. In this respect, this study encompasses only those cases that were referred by the Coroner to the Medical Examiner's office for a post-mortem examination, had a documented history of schizophrenia reported by the Coroner, and were subsequently certified as suicide. The authors present an extensive analysis of factors unique to a schizophrenic who commits suicide and provide a discussion concerning the determination of intent in formulating the manner of death.

Materials and Methods

We conducted a 10-year (1993–2002) retrospective review at the Medical Examiners' Offices in Kentucky of suicide victims previously diagnosed with schizophrenia. A Coroner-Medical Examiner's system is in place in Kentucky and, therefore, the coroner in the county of death determines whether a medicolegal post-mortem examination is performed. The age, race, and sex of each victim as well as cause of death and time of year were documented. Each chart was reviewed for the location of pronouncement of death, presence of a suicide note, history of suicide attempts, and recent life stressors such as domestic unrest and legal difficulties. The investigation included an analysis of postmortem toxicological findings.

Toxicological analyses of the Medical Examiners' cases were performed on blood, urine, or other matrices as indicated by case specifics. The screening covered ethanol and other volatiles as well as a multitude prescription, over-the-counter, and illicit drugs. Extraction techniques included both liquid–liquid and solid phase extractions. Preliminary screening was by thin layer chromatography (TLC), Gas chromatography (GC), and immunoassays with confirmation and quantitation by GC or gas chromatography-mass spectroscopy (GCMS). Ethanol and other volatiles were screened by dual column headspace gas chromatography. Immunoassay confirmed the presence of ethanol. Carbon monoxide was analyzed spectrophotometrically.

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Results

Demographics

A total of 2,864 cases from all 120 Kentucky counties were classified as suicidal manner after an extensive scene investigation, postmortem examination, and toxicological analysis at the Medical Examiners' offices between 1993 and 2002 (13). Kentucky legislature (KRS Chapter 72) established a dual Coroner-Medical Examiner system in which the lay Coroner determines whether to perform solely an external examination and toxicological analysis of the victim or to refer cases to the Medical Examiner's office for autopsy. The case may not be referred to the Medical Examiner for autopsy in particular instances of a highly presumptive suicide based on physical findings at the scene and historical evidence documenting verbal or written suicidal ideation. Pursuant to the coroner's investigation, twenty-nine suicide victims had been clinically diagnosed with schizophrenia, accounting for 1.0% of the total number of suicides. The sex and race of these individuals are displayed in Table 1. The population of Kentucky in the 2000 Census was 4,041,769; the racial composition was 90.1% Caucasian and 7.3% African American (14). The majority of schizophrenic victims were males (62.1%) and Caucasian (86.2%). They ranged in age between 20 and 75 years, with a mean age of 41.6 years. During this time period, the ages of the total 2,864 cases examined at the Medical Examiners' offices ranged between 11 and 96 years, with a mean age of 42.0 years; the majority of victims were males (81.7%) and Caucasian (94.8%) (13). The month of the year of schizophrenic suicide was evenly distributed (Fig. 1). The largest number of victims committed suicide in February; no deaths were recorded in April.

An equal number of victims were pronounced dead at a residential home and at a hospital with 12 victims (41.4%) at each location. Of the 12 individuals who were pronounced dead at the hospital, eight were pronounced dead in the Emergency Room, the vast majority arriving with a Glasgow Coma Score of 3. The other four individuals who were pronounced dead at the hospital had been transferred from the Emergency Room to the neurosurgical ICU (two victims), Surgical ICU (one victim), and Medicine ICU (one victim). None of the 29 schizophrenics committed suicide while the individual was hospitalized. The rest were pronounced dead at the following two locations: public location, four cases (13.8%) and a prison, one case (3.4%). A complete postmortem examination was performed on 23 (79.3%) individuals. The rest succumbed to a cranial firearm injury and underwent a limited autopsy consisting solely of an external, cranial, and toxicological examination.

Causes of Death

The most common cause of death of schizophrenic victims was a self-inflicted firearm wound, consisting of 14 (48.3%) victims. The causes of death are highlighted in Table 2. Of the 14

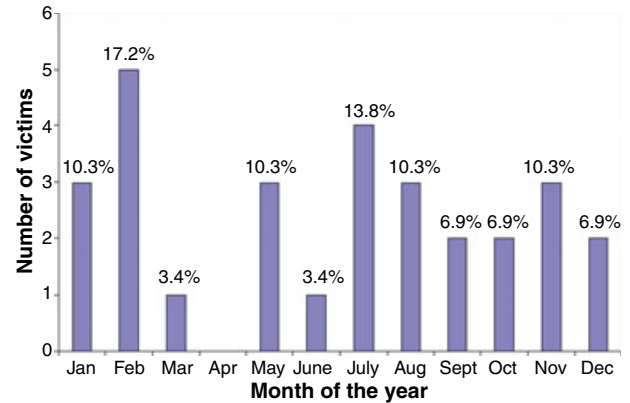


FIG. 1—Schizophrenic suicides in relation to month of the year examined in Kentucky Medical Examiners' Offices, 1993–2002.

individuals who died as a result of a firearm wound, the primary target was the head, accounting for 85.7% of the firearm injuries and 41.4% of all the schizophrenic suicides. Two wounds involved the chest only, representing 14.3% of the firearm injuries and 6.9% of all the schizophrenic suicides. Both males and females selected a firearm as their desired method of suicide (Table 2). The second and third leading causes of death were overdose ("drug intoxication") and hanging, respectively. Table 2 also encompasses all of the causes of death of 2,864 suicides examined at the Medical Examiners' Offices between 1993 and 2002.

The cause of death of two of the schizophrenic victims was drowning, one death following a jump from a bridge. This latter case involved a 33-year-old Caucasian male who had suffered from a "paralytic disorder" and utilized a wheelchair. He had suffered a closed head injury 16 years prior to his death and was subsequently institutionalized. The victim was treated in a psychiatric ward 4 months prior to his death as he had been drinking urine. Two victims died as a result of blunt force injuries, one following a jump from the window of a five-story building. The other case involved a 48-year-old Korean male who succumbed to multiple blunt force cerebral trauma resulting from self-mutilation (15). This individual had been diagnosed with paranoid schizophrenia and had been hospitalized 4 years prior to his death for auditory hallucinations directing him to harm himself. He had attempted suicide approximately 12 years prior to his death by knife stab wounds to the left forearm and abdomen. Scene investigation of the victim's apartment revealed a ransacked kitchen and living room, leading investigators to surmise that the death may represent a homicidal beating. Neighbors contributed that the victim often stomped on his apartment floor as part of a religious ritual. They had heard continuous banging in his apartment in addition to loud moans and crying on the weekend prior to the discovery of his body. A table lamp with dried bloodstains was surmised to be one of the items used in his fatal self-destructive behavior.

Auditory Hallucinations

Investigative evidence revealed that two schizophrenic individuals had experienced auditory hallucinations. In one case, a 52-year-old man committed suicide by a cerebral firearm injury after "hearing voices and demons." He had a history of depression and had not consumed any medications in the month prior to his suicide. The second case was previously described, specifically, the 48-year-old Korean man who committed suicide by cerebral blunt

TABLE 1—Race and sex of schizophrenic suicides examined in Kentucky Medical Examiners' Offices, 1993–2002.

Race	Males (%)	Females (%)
Caucasian 25 subjects (86.2%)	15 (51.7)	10 (34.5)
African American 2 subjects (6.9%)	1 (3.4)	1 (3.4)
Korean 1 subject (3.4%)	1 (3.4)	0 (0)
Indian 1 subject (3.4%)	1 (3.4)	0 (0)
Total 29 subjects	18 (62.1)	11 (37.9)

TABLE 2—Causes of death of schizophrenic suicides and all suicides examined in Kentucky Medical Examiners' Offices, 1993–2002.

Cause of death	Schizophrenic suicides			All suicides
	Males (n = 18)	Females (n = 11)	Total number of victims (%) (n = 29)	Total number of victims (%) (n = 2864)*
Firearm injuries	8	6	14 (48.3)	1933 (67.5) [†]
Directed at head	8	4	12	
Directed at chest	0	2	2	
Overdose	3	3	6 (20.7)	283 (9.9)
Hanging	3	1	4 (13.8)	393 (13.7)
Drowning	2	0	2 (6.9)	35 (1.2)
Blunt force injury (Jump from height; self-mutilation)	2	0	2 (6.9)	35 (1.2) [‡]
Asphyxia via plastic bag	0	1	1 (3.4)	16 (0.56)

*Other causes of death in all suicides examined at the Kentucky Medical Examiners' Offices, 1993–2002: carbon monoxide intoxication: n = 127 (4.4%); incisions/stabbing: 25 (0.87%); self-immolation: 8 (0.28%); other: 9 (0.31%).

[†]Head only: n = 1485 (76.8%) [includes 15 multiple]; chest only: n = 343 (17.8%) [includes 14 multiple]; abdomen: n = 46 (2.4%); neck: n = 35 (1.8%) [includes 1 multiple]; combinations of above: n = 20 (1.0%); other bodily areas: n = 4 (0.2%).

[‡]Also includes impact by a train and pedestrian in traffic.

force injuries (self-mutilation). He had reported "My thoughts, the voices, keep on telling me to harm myself" and had previously attempted suicide by stab injuries to the left forearm and abdomen.

Postmortem Blood Toxicological Analysis

A blood sample was collected for postmortem toxicological analysis in 28 (96.6%) victims (Table 3). Ten (35.7%) individuals had negative postmortem blood toxicological findings. The blood alcohol concentration (BAC) was negative in 24 (85.7%) cases. Antidepressant and antipsychotic medications were detected in only six (21.4%) and two (7.1%) of victims, respectively. A category labeled "Mixed drugs" included a variety of 10 additional substances detected in the blood, including diphenhydramine, dextromethorphan, and acetaminophen. Thirteen (46.4%) suicides had at least one of the drugs listed as "Mixed drugs" present in their blood at autopsy. Six schizophrenic individuals committed suicide pharmaceutically ("overdose"). The BAC was negative in all of these cases. Two of the decedents died as a result of acute salicylate intoxication. In one case, the 34-year-old Caucasian female with a history of schizophrenia and bipolar disorder consumed 250 aspirin. The serum salicylate level at the hospital was 91.0 mg/dL. This woman had experienced a 13-year history of suicidal ideation and previous suicide attempts of cutting her wrists and an overdose. In the other strikingly similar case of acute salicylate intoxication, a 34-year-old Caucasian female with a history of schizophrenia and bipolar disorder had attempted suicide by cutting her wrist 1-week prior to her death. Her postmortem blood salicylate level was 728 mg/L.

TABLE 3—Toxicological analysis of schizophrenic suicides examined in Kentucky Medical Examiners' Offices, 1993–2002.

Psychoactive substance	Number of victims (%)
Blood	28 (96.6)
Negative	10 (35.7)
Ethanol	24 (85.7)
Negative	2 (7.1)
<0.1%	2 (7.1)
≥0.1%	6 (21.4)
Antidepressants	4 (14.3)
Benzodiazepines	1 (3.6)
Opiates	2 (7.1)
Antipsychotics	28 (96.6)

A 25-year-old East Indian male with a history of paranoid schizophrenia and bipolar disorder died as a result of cyanide toxicity. His hospital blood cyanide concentration was 15 mg/dL. Employed in the research laboratory of the College of Pharmacy at a university campus, he was discovered lying alongside an opened carbonated beverage and a container of potassium cyanide. The victim had been discharged from the hospital 3 days prior to his death after being treated for "psychological problems." He had experienced the recent domestic hardship of rejection by a female companion. Investigators revealed that the victim had been well-known to the university police department for previous "psychological problems and events."

The fourth schizophrenic to commit suicide pharmaceutically consisted of a 29-year-old Caucasian male with a history of paranoid schizophrenia, multiple suicide attempts by drug "overdose," and chronic back pain who was discovered inside a parked motor vehicle with the engine running. Numerous medication bottles were found inside the glove compartment. He had previously been involuntarily committed to a mental hospital. Postmortem blood toxicological analysis recorded doxepin 0.49 mg/L, nordoxepin 0.11 mg/L, diazepam 0.92 mg/L, nordiazepam 0.57 mg/L, and trihexyphenidyl and metabolites. The carboxyhemoglobin level was reported as "normal," interpreted as <10% saturation. Postmortem urine toxicology revealed evidence of benzodiazepines, doxepin and metabolites, and trihexyphenidyl and metabolites. A 58-year-old Caucasian male with a history of paranoid schizophrenia succumbed to multiple drug intoxication. He had recently been treated in a psychiatric facility. Diltiazem and trazodone were detected in the postmortem blood toxicology in levels >2.0 mg/L; both of these drugs were also present in postmortem urine toxicological analysis. The final "overdose" victim consisted of a 66-year-old Caucasian female with a history of paranoid schizophrenia and abuse of prescription drugs. Investigators revealed that the victim's son was an "acute delusional psychotic." Postmortem blood toxicology detected fluoxetine 0.8 mg/L, methadone 0.06 mg/L, and promethazine 0.1 mg/L.

Previous Suicide Attempts, Family History of Schizophrenia or Suicide, Recent Life Stressors

The postmortem examination in combination with the Coroners' investigation shed light on the historical suicidal behavior of several of the schizophrenic victims. Seven (24.1%) individuals had attempted suicide at least once previously, in most cases by incised

wounds of the upper extremities or an overdose. Three of them succumbed to an overdose; the others selected one of the following: cephalic firearm wound, drowning, blunt force injury (self-mutilation), and asphyxia via a plastic bag. None had composed a suicide note, however, the scene investigation of one woman's suicide revealed numerous handwritten notes addressed to God scattered throughout her room.

Investigators uncovered that eight (27.6%) suicide victims had been previously hospitalized for their schizophrenia and, in most cases, were released from the hospital within 3 days prior to death. In one case, the body of a 41-year-old man was recovered from the river; death was a result of drowning. He had been discharged from the psychiatric unit at the local hospital on the day of his death after an 11-day hospital stay. Samples and a prescription for an antipsychotic medication were discovered on a shoreline bench. A family history of schizophrenia was disclosed in one case in this study. The mother of a 31-year-old man with paranoid schizophrenia had also been diagnosed with the same 30 years earlier at which time she had abandoned her children. In addition, investigators revealed that the son of a 66-year-old woman in this study suffered from "acute delusional psychosis." One schizophrenic had experienced the death of a family member by suicide. A 35-year-old woman committed suicide by firearm as her brother had 15 years earlier. Her body was discovered at the cemetery where her parents and seven brothers were buried; she frequently visited the cemetery when she was depressed.

Two schizophrenics were confined in prison at the time of their suicide. Both were discovered hanging by a bedsheet within their respective cells. One of the victims was pronounced dead at the prison, whereas the other was pronounced dead at a nearby hospital Emergency Room, arriving pulseless with fixed and dilated pupils. One individual had been serving a life sentence for murder, rape, and theft, while the other had faced assault charges for assaulting her boyfriend.

Discussion

Seven studies in the literature highlight the varied international suicidal causes of death among the schizophrenic population (Table 4). Chute and colleagues conducted a Medical Examiner study of 66 sudden deaths of schizophrenic patients, including 13 suicides, in Maryland between 1994 and 1996 (16). Breier and Astrachan analyzed the suicidal methods of 20 schizophrenic patients in Connecticut between 1970 and 1981 (17). In a follow-up study of 688 schizophrenic patients in Iowa from 1972 through 1981, Black reported the suicide of 18 of these individuals and compared the mortality data with the general Iowan population (18). Roy performed a matched controlled study of 30 schizophrenic

suicides between 1968 and 1979 in Toronto, Canada (19). Heilä and colleagues examined the characteristics of 92 schizophrenic suicide victims during a one-period period (April 1987–March 1988) in Finland (20). Allebeck and colleagues performed a 10-year follow-up study of a group of 1190 schizophrenic patients who had been discharged from hospitals in Stockholm County, Sweden in 1971; thirty-three of these individuals committed suicide (21). Lim and Tsoi conducted a prospective study of 482 schizophrenic patients between 1975 and 1990 in Singapore; forty-one had died of suicide after this time period (22).

The most salient distinction by comparison of these previous studies with the present study is the overwhelming use of a firearm by both male and female schizophrenic patients to commit suicide in Kentucky. Almost half of the individuals in the current study utilized a firearm; a total of 86% of these wounds were directed towards the head. A minority of schizophrenics in four of the previous studies succumbed to a firearm wound: only 15.4% in the Chute and colleagues' study (16) and 3% in the studies by Heilä and colleagues (20) and by Allebeck and colleagues (21), respectively. The majority of suicides (70.8%) in Lim and Tsoi's study (22) jumped from a height. While 40% of the 20 victims in Breier and Astrachan's study (17) committed suicide by firearm, the number of men in their study greatly outnumbered that of women (18 and 2, respectively). Similarly, nine (30%) of the 30 schizophrenic individuals succumbed to a firearm wound in Roy's study (19); eight (88.9%) of these victims were male. The leading method of suicide among schizophrenics in Black's study (18) was by firearm (44.4%), however, the suicidal methods did not differ significantly between the schizophrenic and nonschizophrenic individuals.

While a firearm was rarely utilized in four of the previous studies, the majority of schizophrenics in all of the studies selected a violent method (firearm, hanging, jumping from a height or under a vehicle, self-immolation, cutting, drowning, and asphyxia via a plastic bag) opposed to a nonviolent method (carbon monoxide intoxication and drug overdose) to end their life. Several of the studies in the literature reported a method as "other" or "unknown" and, therefore, the following percentages were tabulated according to the known methods. A violent method was used by 92.1% in Lim and Tsoi's study (22), 88.9% in Roy's study (19), 84.6% in Chute and colleagues' study (16), 80% in Allebeck and colleagues' study (21), 79.3% in the present study, 75% in Breier and Astrachan's study (17), 62.5% in Black's study (18), and 57.1% in Heilä and colleagues' study (20). The latter study reported the highest percentage (37%) of schizophrenics who succumbed to a drug overdose; both males and females were most likely to select this method.

Chute and colleagues (16) commented on the paucity of suicidal gunshot wounds in the schizophrenic population (15.4%) compared

TABLE 4—International variations of suicidal causes of death among schizophrenics.

	FI*	Overdose	Hanging	Drowning	Blunt force†
Present study KY 1993–2002 (<i>n</i> = 29)	14 (48.3)	6 (20.7)	4 (13.8)	2 (6.9)	2 (6.9)
Chute et al. MD 1994–1996 (<i>n</i> = 13)	2 (15.4)	2 (15.4)	4 (30.8)	1 (7.7)	4 (30.8)
Breier & Astrachan CT 1970–1981 (<i>n</i> = 20)	8 (40)	4 (20)	3 (15)	2 (10)	1 (5)
Black IA 1972–1981 (<i>n</i> = 18)	8 (44.4)	3 (16.7)	2 (11.1)	0 (0)	0 (0)
Roy Canada 1968–1979 (<i>n</i> = 30)	9 (30)	3 (10)	2 (6.7)	0 (0)	13 (43.3)
Heilä et al. Finland 1987–1988 (<i>n</i> = 92)	3 (3)	34 (37)	19 (21)	15 (16)	13 (14.1)
Allebeck et al. Sweden 1971–1981 (<i>n</i> = 33)	1 (3)	6 (18.2)	7 (21.2)	7 (21.2)	9 (27.3)
Lim & Tsoi Singapore 1975–1990 (<i>n</i> = 41)	Unknown	3 (7.3)	3 (7.3)	3 (7.3)	29 (70.8)

Values given in parenthesis are in percentage.

*FI, firearm injury.

†Includes cases of jumping from a height, cutting, throwing themselves under subway train.

to the general Maryland population (53–58%). We previously reported the comprehensive findings of 2,864 Medical Examiner cases of suicide in Kentucky between 1993 and 2002 (13). The preferred method of suicide for both sexes was by firearm (67.5%), of which 76.8% involved the head, followed by hanging (13.7%) and overdose (9.9%). Table 2 highlights the causes of death of both the suicides of schizophrenics and the general population who underwent autopsy at the Medical Examiners' Offices in Kentucky between 1993 and 2002. The three leading causes of death were the same for both groups: firearm injuries (48.3% vs. 67.5%) with the vast majority directed at the head, overdose (20.7% vs. 9.9%), and hanging (13.8% vs. 13.7%).

The suicidal rates in the general population in the United States throughout the 20th century have been the highest for Caucasian males and increase with advancing age (23). In 2002 the suicide rate in the United States was 10.9 per 100,000 whereas the rates of individuals over the age of 65 and 85 were 15.5 and 18.1, respectively (24). The present study compares with previous studies with respect to the demographic variables that young males are the most common schizophrenic victims of suicide. Heilä and colleagues reported that the mean age of the schizophrenic suicides was 40.0 years, and 74% were males (20). A total of 54.5% of the victims in Allebeck and colleagues' study were male and 60.6% were between the ages of 20 and 39 (21). Lim and Tsoi documented that 88% of schizophrenics were 10–29 years with a mean age of 23.3; 54% were male (22). Similarly, the mean age of the schizophrenic suicides was 41.6 years in the present study, and 62.1% were males.

While approximately 10–13% of individuals suffering from schizophrenia commit suicide, only 1.0% of the total number of suicides examined at the Medical Examiners' Offices in Kentucky between 1993 and 2002 had been clinically diagnosed with schizophrenia pursuant to the coroner's investigation. This finding may be attributed to two primary features, specifically, that many schizophrenics in Kentucky who commit suicide were not properly identified as schizophrenics by Kentucky coroners or that Kentucky coroners did not deem it appropriate for a schizophrenic who committed suicide to undergo an autopsy. According to the Kentucky statutes, each Kentucky coroner possesses the authority to use his or her judgment whether to conduct only an external examination or schedule the performance of an autopsy. The coroner may not have ordered an autopsy on a schizophrenic individual in a case of a highly presumptive suicide based on physical findings at the scene or historical evidence of suicidal ideation. Furthermore, the percentage of schizophrenic Caucasians who committed suicide and underwent postmortem examination at the Medical Examiners' Offices between 1993 and 2002 is lower than the percentage of Caucasians documented in the Kentucky 2000 Census (86.2% vs. 90.1%). The same principle applies to this finding in that not all schizophrenics who committed suicide during this time period underwent autopsy. According to the Center for Disease Control (CDC), 5,048 individuals committed suicide in Kentucky between 1993 and 2002 (24). During this time period, 2,864 deaths were deemed suicidal after a postmortem examination and toxicological analysis at the Kentucky Medical Examiners' Offices, reflecting 56.7% of the total suicide deaths. In this respect, any conclusions drawn from this study cannot necessarily be applied to the general population since the case population was not indicative of the general population but rather a selected subset of the population based on the coroners' decision to order an autopsy.

Toxicological analysis is an essential component in the investigation of a suicide in combination with a thorough scene inspection, postmortem examination, and historical review to uncover suicidal

ideation or previous suicide attempts. Depression is a common component in schizophrenia and is associated with an increased risk of suicide in this population (7,19,25,26). Depressive symptoms in schizophrenic patients may represent a component of their core pathology or reactive postpsychosis or may be pharmacogenic (7). Chute and colleagues presented the toxicological findings of schizophrenic victims in their Medical Examiner study of various manners of death (16). While these authors did not divide the toxicological results by manner of death, they determined that drugs (including antipsychotics, anticholinergics, anticonvulsants, and antidepressants) were detected in the postmortem blood in 54% of the schizophrenics. They further categorized the blood drug levels as either subtherapeutic or therapeutic and determined that many of the drugs were in subtherapeutic concentration. Our study closely resembles that of Chute and colleagues (16) in that drugs were detected in the postmortem blood toxicological analysis in 64% of schizophrenic suicide victims. Ethanol was present in a minority; 86% had a negative BAC. Antidepressant and antipsychotic medications were detected in only 21% and 7%, respectively. This lack of medications detected in the postmortem blood toxicology most likely reflects either insufficient medical treatment of the schizophrenic patient or noncompliance. Neuroleptic medication noncompliance represents a poor prognosis in schizophrenic patients (27). They may experience frustration with the potential extrapyramidal side effects of akinesia (reduced ability to initiate and maintain motor activity) and akathisia (a disturbing agitation and restlessness), the side effect of tardive dyskinesia, or may develop self-esteem issues with the act of consuming neuroleptic medications (27).

Suicide among schizophrenics is common during hospitalization or following discharge from the hospital (9,19,28,29). Of the 20 discharged schizophrenic patients who committed suicide, Roy discovered that 30% and 65% of decedents had completed the act within 1 and 6 months, respectively (19). Rossau and Mortensen determined that the risk of suicide among schizophrenics within the first 5 days after hospital discharge was more than twice that in the first 5 days of hospital admission, the latter representing a period of acute psychosis (29). These "treated" individuals entered a state of remission while cognizant of the morbidity of their illness and were aware of the difficult challenge of ingratiating themselves into society. Farberow and colleagues conducted a case-control study of 60 schizophrenic patients hospitalized in mental hospitals in the United States, 30 of whom had committed suicide while under hospital jurisdiction (either in or out of the hospital) (30). These authors concluded that patients who had attained an improvement in mental organization were most likely to commit suicide. The suicides were a culmination of a planned action designed to extricate themselves from their life circumstances. The schizophrenic suicide victims demanded to seek a solution to the tension and stress overwhelming their lives. They possessed "good 'reasons' for self destruction" although they continued to suffer from clinical schizophrenia (30).

The resolute desire to escape the tumultuous mental decline of schizophrenia may shed light on the schizophrenics' overwhelming use of violent methods to commit suicide. In addition, the timing of a schizophrenic's suicide in relation to hospitalization stay offers a valuable insight into the selected suicidal method. These individuals have quelled the psychotic grasps of their illness and have attained the ability to realize their life situation in an organized fashion. In an attempt to curtail future exacerbations of their illness, these patients may select a suicidal method that provides the highest likelihood of a fatality. In the present study, a total of 69% of the victims utilized a violent suicide method, including a cerebral

firearm injury in almost half of the cases. Furthermore, eight (27.6%) victims had been previously hospitalized for their schizophrenia and, in most cases, were released from the hospital within 3 days of their death. Farberow and colleagues broach the intriguing concept of whether psychosis may offer protection against suicidal behavior as the majority of schizophrenics who committed suicide in their study exhibited improved organization (30). Further reflection upon a case in our study presented earlier exemplifies this dilemma. Upon discharge from the psychiatric ward after an 11-day hospital stay, a 41-year-old schizophrenic man immediately ventured with samples and a prescription for an antipsychotic medication in hand to the local river where he selected drowning as the means to end his life. Did this man with a history of depression and suicide attempts achieve the level of mental clarity needed to grasp the reality of his life circumstances? Was he frustrated with the intense medical treatment and adamantly refused to experience another exacerbation of his illness? Did he fail to acknowledge a solution to his stressful situation besides suicide?

Approximately 4–10% of schizophrenics who exhibit suicidal behavior (attempted and completed suicide) respond to command auditory hallucinations (31). Farberow and colleagues acknowledge that the term “schizophrenic suicide” often invokes the image of an individual who is afflicted with hallucinations or delusions directing self-harm (30). These authors determined that schizophrenic patients were most likely to commit suicide during an organized state of their illness and not during a period riddled with hallucinated commands and delusions. Similarly, Roy concluded that only two schizophrenics who committed suicide in his matched controlled study of 30 chronic schizophrenic suicides had experienced persistent auditory hallucinations (19). Harkavy-Friedman and colleagues conducted a study of 100 individuals with either schizophrenia or schizoaffective disorder to determine the influence of command auditory hallucinations for suicide (CAHS) (31). Twenty-two individuals had reported a history of CAHS, 10 of whom had previously attempted suicide. Of these 10 suicide attempters, eight individuals had attempted suicide in response to their CAHS. In this respect, 36% of the individuals with CAHS attempted suicide on at least one occasion in response to CAHS. Investigative evidence in the present study revealed that two schizophrenic individuals had experienced auditory hallucinations as previously described.

The forensic pathologist bears the responsibility of ultimately determining the cause and manner of death after thoroughly evaluating the historical and scene evidence and analyzing the pathological and toxicological findings. The determination of suicide is a two-fold process: (i) the death was self-inflicted, and (ii) the decedent intended to kill himself or herself or wished to die and understood that the act may consequently be fatal (32). The self-inflicted nature of the death may be construed by pathological, toxicological, psychological, or investigational means. Intent refers to either the (i) explicit verbal or nonverbal intent to commit suicide or (ii) the implicit or indirect intent to die (32). The latter category includes evidence such as preparations for death in an untimely manner with respect to the decedent's life, hopelessness, emotional or physical pain, previous suicide attempt or threat, stressful events, or serious depression or mental disorder. Donoghue and Lifschultz argue that difficult life situations, serious depression, or mental disorders represent motive, specifically, a reason for doing something, and not intent (33). They emphasize that a death should not be deemed suicidal based on motive; the determination of intent is imperative prior to the classification of a suicide.

The investigation of a schizophrenic individual's presumed suicide poses the unique dilemma of whether the decedent was

capable of forming the intent required of a suicidal manner of death. The determination of suicidal intent represents a complex and multifactorial task with the aims of uncovering the attitudes and preparations for the suicide, precautions against intervention, and communications with others (34). As schizophrenia is marked by hallucinations and delusions, it is important to determine the role of these pivotal features in influencing suicidal behavior. Are self-mutilation wounds of the extremities a valiant attempt to expunge the demons attacking the body or is a cranial firearm wound a desperate effort to eradicate the voices locked within? Did these individuals intend to inflict fatal harm? Is a schizophrenic's suicide an instantaneous reaction to a demanding auditory hallucination? In the throes of psychosis, a schizophrenic may participate in a dangerous act without apprehending the inherent risks in the behavior (27). The altered belief system marked by delusions may provide a false sense of security or the hallucinations may distract a schizophrenic in a time when a focused mindset is imperative.

The determination of a schizophrenic's suicide relies on the historical investigation in the days and weeks prior to the suicide to ascertain whether the decedent understood and intended the consequences of the act prior to its completion (32). This duty may prove challenging as several behaviors characterizing suicidal intent are inherent in the mental illness of schizophrenia, including hopelessness, significant emotional distress, previous suicide attempt and suicidal ideation, and stressful life circumstances. In this respect, it may be difficult to predict when a suicide may occur. Saarinen and colleagues retrospectively investigated the psychological autopsy reports of 17 schizophrenic individuals who committed suicide in Finland between April 1987 and March 1988 (35). All but one were receiving psychiatric care at the time of suicide. Fifty-nine percent of the patients were clinically depressed at the time of suicide. However, the mental health professionals did not recognize the suicidal risk in 76% of the patients during their final appointment. Furthermore, approximately one-third had been evaluated by a therapist on the day of their suicide. Of the 10 schizophrenic patients who committed suicide in the follow-up period after hospitalization, Nyman and Jonsson reported that the majority succeeded in committing suicide without exhibiting premonitory warning signs despite the alertness of family and hospital contacts (36). Families experienced a dichotomy of guilt and relief over their loved ones' death, acknowledging “perhaps it was for the best.” In Allebeck's study (11) of the 10-year follow-up of 1,190 schizophrenic patients who committed suicide, he concluded that the “suicidal acts among schizophrenic patients often are impulsive and difficult to predict.” The inability to discern the urgency of the schizophrenic's situation confirms the challenge in anticipating a suicide and warrants further investigation into detecting suicidal intent.

An anti-suicide effect has been observed with the newer generation antipsychotic clozapine in several prospective studies (37,38). Specifically, the International Suicide Prevention Trial (InterSePT) consisted of a 2-year, prospective, randomized study comparing the use of clozapine with olanzapine in reducing suicidality in both schizophrenia and schizoaffective disorder (39). In this study of 980 international schizophrenic patients with a high risk of suicide (previous attempts or hospitalizations to prevent a suicide attempt in the 3 years prior to enrollment; moderate to severe suicidal ideation with depressive symptoms; or command hallucinations for self harm within 1 week of enrollment), a significantly lower rate of suicidal behavior was noted in individuals treated with clozapine compared to those treated with olanzapine (39). Clozapine is an atypical antipsychotic agent with a low propensity to produce extrapyramidal symptoms and tardive dyskinesia and is less likely to induce akathisia and hyperprolactinemia (38). Similar to lithium's

possible "specific antisuicide effect" in bipolar disorder, clozapine may also demonstrate a possible "specific antisuicide effect" (37). The newer generation antipsychotics, including clozapine, reduce both the negative schizophrenic symptoms and the cognitive aspects of schizophrenia, suggesting that other potential factors contribute to a completed suicide besides the positive symptoms of schizophrenia.

The determination of the accurate manner of death in equivocal cases of schizophrenic suicide may prove difficult. A psychological autopsy may shed light on the decedent's lifestyle and personality and may influence the designation of manner of death. Jobs and colleagues conducted a study of Medical Examiners' determination of manner of death in equivocal cases (single car, child, autoerotic, psychotic, and Russian roulette) with the additional insight into psychological autopsy (40). A total of 195 medical examiners were selected to review a typical psychotic death: a 35-year-old male paranoid schizophrenic was discovered dead by hanging after utilizing a hospital gown as a ligature. The equivocal psychotic death involved a man who was mauled to death by lions at a zoo after he desired to "play with" the animals and had ventured into the lion compound. Despite the typical nature of the first case, 10 medical examiners labeled the manner of death as accident or undetermined. The psychological autopsy disclosed the victim's multiple psychotic exacerbations and previous suicidal behavior, thus, resulting in a unanimous decision of suicidal manner. Prior to insight offered by the psychological autopsy, the medical examiners were evenly divided on the manner of death (accident, suicide, and undetermined) of the equivocal case. The psychological autopsy revealed that the victim had experienced psychotic delusions and hallucinations and believed he "could communicate with and tame lions" (40). With this additional information, the majority of medical examiners confirmed an accidental manner. Jobs and colleagues' study (37) offers a unique perspective into the beneficial role of psychological autopsies on the determination of manner of death.

Conclusion

The attraction of suicide among schizophrenics represents the culmination of years of exacerbations and remissions of an illness coupled with the self-realization of impending and continual mental decline. A psychological profile of the victim developed by a psychologist or psychiatrist may offer a valuable insight into the mental status of the decedent with a particular emphasis on factors representing explicit or implicit evidence of intent.

A cephalic firearm injury was the most likely cause of death in Medical Examiners' cases of suicide as reported in our previous study of the general Kentucky population (13) and in the present study of the schizophrenic population. Compared to previous studies in the international literature highlighting suicidal causes of death among schizophrenics, the present study demonstrates the overwhelming use of a firearm by both male and female schizophrenic individuals to commit suicide in Kentucky (16–22). There are well-established regulations in society to protect the public from the unlawful sale of firearms. The federal Gun Control Act of 1968 prohibited the sale of firearms to several categories of individuals including those with a mental illness (38). The Brady Handgun Violence Prevention Act of 1993 required federally licensed firearms dealers to conduct background checks on prospective handgun purchasers (41). In 1998, the National Instant Background Check System extended the Brady Act to encompass all firearm sales. Despite these federal measures, the majority of schizophrenics of both sexes in the present study succumbed to a firearm injury, in

most cases, directed towards the head. Further investigation is warranted to evaluate a schizophrenic's ability to access firearms in the household.

Schizophrenics commonly experience depression as a component of their illness. A minority of victims in the present study had either antidepressants or antipsychotic medications detected in the postmortem blood toxicology. Astute monitoring of the schizophrenic individual is critical, especially in the immediate time period after release from a psychiatric hospitalization. The prevention of suicide among schizophrenics as a public health mission warrants a multidisciplinary approach to encourage medication compliance and supportive psychotherapy and to ascertain suicidal behavior in a timely manner.

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