Suicide in the United States End-Stage Renal Disease Program

Manjula Kurella,* Paul L. Kimmel,† Belinda S. Young,* and Glenn M. Chertow*

*Division of Nephrology, Moffitt-Long Hospitals and UCSF-Mt. Zion Medical Center, Department of Medicine, University of California San Francisco, San Francisco, California; and †Division of Renal Diseases and Hypertension, Department of Medicine, George Washington University Medical Center, Washington, DC

Although depression and dialysis withdrawal are relatively common among individuals with ESRD, there have been few systematic studies of suicide in this population. The goals of this study were to compare the incidence of suicide with national rates and to contrast the factors associated with suicide with those associated with withdrawal in persons with ESRD. All individuals who were aged 15 yr and older and initiated dialysis between April 1, 1995, and November 30, 2000, composed the analytic cohort. Patients were censored at the time of death, transplantation, or October 31, 2001. Death as a result of suicide in the ESRD population and the general US population was ascertained from the Death Notification Form and the Centers for Disease Control and Prevention, respectively. Standardized incidence ratios for suicide among patient subgroups were computed using national data from the year 2000 as the reference population. The crude suicide rate from 1995 to 2001 was 24.2 suicides per 100,000 patient-years, and the overall standardized incidence ratio for suicide was 1.84 (95% confidence interval, 1.50 to 2.27). In multivariable models, age ≥75 yr, male gender, white or Asian race, geographic region, alcohol or drug dependence, and recent hospitalization with mental illness were significant independent predictors of death as a result of suicide. Persons with ESRD are significantly more likely to commit suicide than persons in the general population. Although relatively rare, risk assessment can be used to identify patients for whom counseling and other interventions might be beneficial.

Two of the authors were prompted to conduct this analysis on the basis of their experience with caring for a patient who was on dialysis and died of suicide. Certain details of the case presentation were modified to retain anonymity.

Case Presentation

The patient was a white man who was in his late 20s, had a history of paranoid schizophrenia and tobacco and alcohol abuse, and developed rapidly progressive glomerulonephritis with pulmonary hemorrhage. Despite aggressive anti-inflammatory and immunosuppressive therapy, he failed to recover kidney function and required long-term hemodialysis. After a prolonged hospital course complicated by respiratory failure that required mechanical ventilation, tracheostomy, and multiple infections, he was discharged, able to ambulate and perform most usual activities. After a brief stay at a "halfway house," he moved to a single-room-occupancy hotel. He continued to receive intermittent counseling at a community-based activities center and occasionally saw a psychiatrist.

Two years after initiating dialysis, the patient requested a change in dialysis modality, as he reported paranoid ideations related to other patients and staff at the hemodialysis facility. Despite initial reluctance, we approved his transition to peritoneal dialysis on the basis of the excellent understanding and technique that he demonstrated during training and his level of enthusiasm, which seemed to provide some focus to his otherwise chaotic behavior and thinking. The patient did well for >1 yr but developed fungal peritonitis and required a transition back to hemodialysis.

Several months later, the patient was admitted to a community hospital for acute psychosis with suicidal ideation. After several days, he was discharged, having been considered at low suicide risk. Approximately 2 d later, the patient fell to his death after jumping off the roof of an apartment building. On autopsy, there was no evidence of alcohol or drug ingestion.

Introduction

The earliest reports on suicide in ESRD, published before Medicare benefits were extended to the ESRD program, suggested extremely high rates of suicide in patients who were treated with hemodialysis [1]. These results were attributed to a highly selected population that underwent an arduous, heroic procedure and have been disputed by those who argue that withdrawal of dialysis and suicide are distinct entities [2]. Despite the high prevalence of depression among individuals with ESRD [3–5], there have been few systematic contemporary studies of suicide in this population. It is unclear whether early estimates of suicide risk in ESRD are applicable today. In 1990, the ESRD Death Notification Form was revised, permitting separation of withdrawal from dialysis from suicide and other causes of death. Accordingly, recent data from the United States Renal Data System (USRDS) indicate that suicide occurs

at a rate of two deaths per 10,000 patient-years, suggesting only a modestly increased risk for suicide compared with the general population (6). However, direct comparison with general population data may be misleading without adjustment for age and other important suicide risk factors. Thus, it remains uncertain whether persons with ESRD are at increased risk for suicide.

In contrast to suicide, withdrawal from dialysis before death is common, occurring approximately 100 times more commonly than suicide (6). Although risk factors for withdrawal have been well characterized (7–9), it is unclear whether patients who withdraw from dialysis and patients who commit suicide share similar characteristics. Moved by the tragic case presented above, we sought to understand better the factors associated with suicide in persons with ESRD and to compare the incidence of suicide in ESRD with national suicide rates by using data on a full national cohort of ESRD patients and the US population.

Methods

We used data from the USRDS on all persons who initiated dialysis between April 1, 1995, and November 30, 2000, and were followed until death, transplantation, or October 31, 2001. Patients who were younger than 15 yr were excluded, leaving 465,563 patients in the analytic cohort. Patient demographics, treatment history, and cause-specific mortality including death from suicide or withdrawal from dialysis before death were obtained from the Standard Analytic Files (Core CD 1). Twenty-two patients were coded as both having died from suicide and as having withdrawn from dialysis before death. These patients were considered to have withdrawn from dialysis for the purposes of these analyses. Demographic characteristics, comorbid conditions, insurance and social history, and selected laboratory data at the time of dialysis initiation were obtained from the Center for Medicare and Medicaid Services (CMS) Medical Evidence form (form 2728). We merged baseline data elements with data on hospitalization for the 12 mo preceding death or the date of last follow-up. We determined the number of hospital admissions, length of stay, and discharge diagnoses for each individual during the 12-mo interval. Hospitalization with a mental illness was indicated by Diagnosis Related Groups (DRG) codes 424 to 431. Patients who were hospitalized with drug or alcohol abuse (indicated by DRG codes 432 to 437) were included with those coded as having alcohol or drug dependence.

Statistical Analyses

Continuous variables were expressed as mean $\pm$ SD or median $\pm$ interquartile range and compared with t test or the Wilcoxon rank sum test, as appropriate. Categorical variables were expressed as proportions and compared using the χ^2 test. We calculated age-, gender-, race-, and network-specific suicide rates using the year 2000 US population as the reference population. National suicide data were available from the Centers for Disease Control and Prevention Web-Based Injury Statistics Query and Reporting System. Standardized incidence ratios (SIR) for suicide among patient subgroups were computed as the ratio of observed *versus* expected suicides. We computed confidence intervals (CI) using the normal approximation to the Poisson distribution (10). Data for ESRD networks were condensed into four geographic regions for ease of presentation and confidentiality concerns: Northeast (networks 1 to 4), South (networks 5 to 8, 13, and 14), Midwest (networks 9 to 12), and West (networks 15 to 18). Note that Web-Based Injury Statistics Query and Reporting System does not contain suicide data from Puerto

Rico and the US Virgin Islands (included in network 3) or from Guam, American Samoa, and Saipan (included in network 17).

We first used simple logistic regression to examine the relation between dialysis vintage and suicide. We then used proportional regression (Cox) models to determine the unadjusted and multivariable-adjusted hazard or relative risk (RR) of suicide for covariates of interest, modeled for censored failure times. Patients were censored with transplantation or on October 31, 2001. After the initial multivariable models were fit, we manually added individual selected variables to evaluate for residual confounding. We evaluated effect modification by including selected multiplicative interaction terms in multivariable models. We also performed companion analyses using dialysis withdrawal, rather than suicide, as the outcome of interest. For all analyses, two-tailed $P < 0.05$ was considered significant. Analyses were conducted using SAS Version 8.2 (SAS Institute, Cary, NC).

Results

Patient Characteristics

Of the 465,563 patients included in the analysis, 44,465 (9.6%) withdrew from dialysis before death and 264 (0.005%) died from suicide. Table 1 shows the demographic characteristics of the study population. Patients who withdrew from dialysis before death had a mean age of 71 $\pm$ 12 yr, 49.2% were male, and 81.1% were white. Patients who died from suicide had a mean age of 63 $\pm$ 15 yr, 86.0% were male, and 85.2% were white. Compared with patients who withdrew before death, patients who died from suicide were younger ($P < 0.001$); more likely to be male ($P < 0.001$), uninsured ($P < 0.001$), and have alcohol or drug dependency ($P < 0.001$); and were less likely to be black ($P = 0.04$) and nonambulatory ($P = 0.02$) and have diabetes ($P = 0.002$), congestive heart failure ($P = 0.01$), or previous stroke ($P = 0.04$).

Risk Factors for Suicide

In unadjusted analyses, age $\geq$75 yr, male gender, white or Asian race, residence outside the Northeast, ischemic heart disease, peripheral vascular disease, cancer, chronic obstructive pulmonary disease, alcohol or drug dependence, serum albumin <3.5 g/dl, and hospitalization within the preceding 12 mo were associated with a significantly increased risk for suicide (Table 2). Hospitalization with mental illness was associated with a fivefold increased risk for suicide. In multivariable models, age $\geq$75 yr, male gender, white or Asian race, geographic region, alcohol or drug dependence, and recent hospitalization, particularly hospitalization with mental illness, remained significant, independent predictors of suicide (Table 2). Age modified the association between mental illness and suicide risk, as the risk for suicide associated with hospitalization for mental illness was accentuated among younger patients. Diabetes was associated with a significantly reduced risk for suicide, even after adjustment for a number of potential confounders. Considering the combination of findings for the patient described in the case presentation (a young white man from the West with a history of alcohol dependence and recent hospitalization for mental illness), the risk for death as a result of suicide could be estimated at 2% annually, a risk >90-fold higher than baseline.

Table 1. Patient characteristics[a]

Characteristic	All Patients (n = 465,563)	Patients Who Withdrew from Dialysis (n = 44,465)	Patients Who Died from Suicide (n = 264)
Age (yr; %)			
15–29	4.0	0.6	2.3
31–44	12.7	3.9	14.0
45–59	24.2	12.5	20.5
60–74	37.1	42.4	36.0
75+	22.0	40.7	27.3
Male (%)	53.3	49.2	86.0
Race (%)			
white	64.2	81.1	85.2
black	29.3	15.1	10.6
Asian	3.2	1.9	3.8
other/unknown	3.4	1.9	0.4
Region (%)			
Northeast (networks 1–4)	21.0	19.4	12.5
South (networks 5–8, 13, and 14)	37.1	34.8	37.9
Midwest (networks 9–12)	23.0	27.9	26.1
West (networks 15–18)	18.9	17.9	23.5
Time since initiation of dialysis (mo; %)			
0–3	7.9	16.2	24.6
3–6	6.3	14.4	13.3
6–12	8.9	18.6	14.0
12–24	25.9	24.0	21.6
24+	50.9	26.9	26.5
Modality at initiation (%)			
hemodialysis	89.5	90.9	88.3
peritoneal dialysis	10.5	9.1	11.7
Diabetes (%)	40.1	42.1	32.6
Ischemic heart disease (%)	23.6	32.6	31.1
Peripheral vascular disease (%)	14.6	20.7	17.1
Congestive heart failure (%)	32.5	42.0	34.5
Stroke/TIA (%)	9.0	13.9	9.5
Cancer (%)	5.2	9.6	8.0
COPD (%)	7.0	10.6	11.0
HIV (%)	0.7	0.6	0.4
Alcohol or drug dependence (%)	2.5	2.2	6.8
Nonambulatory (%)	4.4	7.2	3.4
Uninsured (%)	7.5	2.7	7.6
Work status (%)			
employed (full or part time)	10.5	3.3	9.9
unemployed	20.3	12.6	20.1
student or retired	69.2	84.1	70.0

[a]TIA, transient ischemic attack; COPD, chronic obstructive pulmonary disease.

Suicide versus *Dialysis Withdrawal*

Suicide and dialysis withdrawal were strongly associated with dialysis vintage, although the pattern of risk differed somewhat between the two outcomes. The risk for suicide was highest in the first 3 mo after dialysis initiation and diminished steadily over time, whereas the likelihood of dialysis withdrawal was relatively high for the first year of dialysis and lessened considerably thereafter. Several patient characteristics were independent correlates of both suicide and dialysis withdrawal, although the magnitude of the associations varied between the two outcomes (Tables 2 and 3). For example, older age and recent hospitalization were stronger predictors of dialysis withdrawal, whereas white or Asian race, alcohol or drug dependence, and hospitalization for mental illness were stronger predictors of suicide. Several additional factors that were significantly associated with withdrawal were identified, in-

Table 2. Unadjusted and multivariable-adjusted risk for suicide among patients with ESRD[a]

Characteristic	Unadjusted RR (95% CI)	Multivariable-Adjusted[b] RR (95% CI)
Age (yr)		
15–29	0.56 (0.24–1.31)	0.65 (0.28–1.53)
30–44	1.18 (0.78–1.79)	1.17 (0.77–1.78)
45–59	Referent	Referent
60–74	1.37 (0.98–1.92)	1.13 (0.81–1.59)
75+	2.25 (1.58–3.22)	1.49 (1.03–2.16)
Gender		
female	Referent	Referent
male	5.32 (3.76–7.52)	5.10 (3.60–7.19)
Race	Referent	Referent
black	4.17 (2.82–6.18)	3.65 (2.43–5.48)
white	3.26 (1.58–6.70)	3.62 (1.71–7.68)
Asian	0.32 (0.04–2.35)	0.38 (0.05–2.83)
other/unknown		
Region		
Northeast (networks 1–4)	Referent	Referent
South (networks 5–8, 13, and 14)	1.67 (1.13–2.47)	1.89 (1.27–2.81)
Midwest (networks 9–12)	1.91 (1.26–2.89)	1.78 (1.17–2.69)
West (networks 15–18)	2.01 (1.32–3.07)	2.06 (1.34–3.16)
Diabetes	0.77 (0.60–0.99)	0.76 (0.59–0.99)
Ischemic heart disease	1.81 (1.39–2.35)	NS
Peripheral vascular disease	1.48 (1.07–2.03)	NS
Cancer	2.04 (1.31–3.19)	NS
COPD	2.11 (1.43–3.10)	NS
Alcohol or drug dependence	2.74 (1.70–4.43)	2.62 (1.60–4.28)
Hospitalization with mental illness (in preceding 12 mo)	4.92 (2.76–8.78)	2.42 (1.34–4.39)
Albumin <3.5 g/dl	1.44 (1.02–2.02)	NS
No. of hospital admissions (in preceding 12 mo)		
0	Referent	Referent
1–2	3.20 (2.36–4.33)	3.07 (2.25–4.19)
≥3	4.01 (2.99–5.38)	3.67 (2.69–5.01)

[a]RR, relative risk; CI, confidence interval; LR, likelihood ratio.
[b]Model adjusted for all covariates listed, LR χ^2 = 350.41, $P < 0.0001$.

cluding female gender, hemodialysis (rather than peritoneal dialysis), and a number of comorbid conditions. The power to detect these and other associations among clinical characteristics and suicide was considerably lower because of sample size.

Age modified the associations among several comorbid conditions and the likelihood of dialysis withdrawal. For example, HIV was associated with a roughly sevenfold increased risk for withdrawal among patients 15 to 29 yr of age, compared with a roughly twofold increased risk among patients 60 to 74 yr of age. Analogous findings were noted for cancer.

SIR for Suicide in the United States

The crude suicide rate from 1995 to 2001 was 24.2 suicides per 100,000 patient-years. The overall SIR for suicide during this period was 1.84 (95% CI, 1.50 to 2.27). In other words, patients with ESRD had an 84% higher rate of suicide com-

pared with the general US population, after accounting for differences in population distribution. The SIR for suicide stratified by age, gender, race, and geographic region are shown in Table 4. The rates of suicide among ESRD patients were higher for all age groups relative to the US population, with the exception of 15- to 29-yr-olds, and tended to increase with age. Although crude suicide rates were higher for men, the gender-stratified SIR suggest that the association between ESRD and suicide was more prominent among women (standardized rates were 78% higher for women with ESRD and 47% higher for men). Whites and Asians with ESRD had a two- to almost fourfold increased rate of suicide, respectively. In contrast, the rate of suicide among blacks with ESRD was similar to national rates for blacks. With the exception of the Northeast region, the SIR across geographic regions were similar to the overall SIR for ESRD, indicating that network variation generally con-

Table 3. Multivariable-adjusted risk for dialysis withdrawal among patients with ESRD

Characteristic	Unadjusted RR (95% CI)	Multivariable-Adjusted[a] RR (95% CI)
Age (yr)		
15–29	0.22 (0.19–0.25)	0.31 (0.28–0.36)
30–44	0.53 (0.50–0.55)	0.61 (0.58–0.65)
45–59	Referent	Referent
60–74	2.70 (2.62–2.77)	1.89 (1.84–1.95)
75+	5.80 (5.63–5.97)	3.34 (3.23–3.44)
Gender		
female	Referent	Referent
male	0.84 (0.82–0.85)	0.89 (0.87–0.91)
Race		
black	Referent	Referent
white	2.82 (2.74–2.88)	2.20 (2.14–2.26)
Asian	1.17 (1.09–1.25)	1.32 (1.23–1.42)
other/unknown	1.12 (1.04–1.20)	1.22 (1.13–1.31)
Region		
Northeast (networks 1–4)	Referent	Referent
South (networks 5–8, 13, and 14)	0.99 (0.96–1.01)	1.14 (1.11–1.17)
Midwest (networks 9–12)	1.31 (1.27–1.35)	1.27 (1.23–1.30)
West (networks 15–18)	0.98 (0.95–1.01)	1.23 (1.19–1.27)
Modality		
hemodialysis	Referent	Referent
peritoneal dialysis	0.74 (0.72–0.76)	0.93 (0.90–0.96)
Diabetes	1.17 (1.15–1.18)	NS
Ischemic heart disease	1.97 (1.93–2.01)	1.03 (1.01–1.06)
Peripheral vascular disease	1.90 (1.85–1.93)	1.11 (1.08–1.14)
Congestive heart failure	1.89 (1.85–1.92)	1.07 (1.05–1.09)
Stroke/TIA	2.03 (1.97–2.08)	1.31 (1.28–1.35)
Cancer	2.57 (2.49–2.64)	1.64 (1.59–1.70)
COPD	2.05 (2.00–2.12)	1.09 (1.06–1.13)
HIV	0.95 (0.85–1.06)	3.88 (3.44–4.38)
Alcohol or drug dependence	0.85 (0.80–0.90)	1.20 (1.13–1.28)
Hospitalization with mental illness (in preceding 12 mo)	3.45 (3.27–3.63)	1.24 (1.18–1.32)
Albumin <3.5 g/dl	1.67 (1.61–1.73)	1.29 (1.26–1.32)
Nonambulatory	2.50 (2.41–2.59)	1.54 (1.48–1.59)
No. of hospital admissions (in preceding 12 mo)		
0	Referent	Referent
1–2	4.53 (4.40–4.65)	3.54 (3.44–3.64)
≥3	10.82 (10.56–11.09)	7.37 (7.18–7.55)

[a]Model adjusted for all covariates listed, LR χ^2 = 66,061.66, $P < 0.001$.

formed to the underlying national geographic variation in suicide rates.

Discussion

Although dialysis withdrawal and its clinical correlates have been well described, little is known about suicide in persons with ESRD. Withdrawal from dialysis occurs in 9 to 20% of ESRD patients and is more likely to occur in older, white, female patients (7,8,11). Several studies have also demonstrated that patients who withdraw from dialysis have a high burden of illness, including malnutrition, physical impairment, and a high frequency of dementia, malignancy, and other chronic diseases (7,12,13). Although dialysis withdrawal and suicide are frequently considered together, it is not clear whether these outcomes are indeed related. Indeed, some authors have advocated considering them as separate entities (2). No study to our knowledge previously compared factors associated with withdrawal from dialysis with those associated with suicide.

Table 4. Standardized incidence ratios of suicide among patients with ESRD

Characteristic	Suicides	Patient-Years	Crude Incidence (per 100,000 Patient-Years)	SIR (95% CI)[a]
Age (yr)				
15–29	6	63,604	9.43	0.87 (0.32–1.90)
30–44	37	183,112	20.21	1.47 (1.03–2.03)
45–59	54	306,867	17.60	1.26 (0.95–1.64)
60–74	95	376,931	25.20	2.09 (1.69–2.55)
75+	72	162,466	44.32	2.44 (1.91–3.07)
Gender				
female	37	506,832	7.30	1.78 (1.03–2.02)
male	227	586,147	38.73	1.47 (1.42–2.22)
Race				
black	28	354,058	7.91	1.10 (0.73–1.59)
white	225	660,339	34.07	2.38 (1.86–3.06)
Asian	10	39,046	25.61	3.89 (1.86–7.15)
Region				
Northeast (networks 1–4)	33	224,624	14.69	1.51 (1.04–2.12)
South (networks 5–8, 13, and 14)	100	410,115	24.38	1.71 (1.39–2.08)
Midwest (networks 9–12)	69	246,404	28.00	2.18 (1.70–2.77)
West (networks 15–18)	62	211,844	29.27	1.99 (1.52–2.55)

[a]SIR, standardized incidence ratio. SIR adjusted for year 2000 US data.

Previous estimates of the risk for suicide among ESRD patients vary widely. Early data suggesting that suicide rates in ESRD were 100- to 400-fold greater than in the general population did not separate dialysis withdrawal from suicide (1) and may have been biased because of the era and the highly selected patient population. Neu *et al.* (8) studied dialysis withdrawal and suicide among 1766 dialysis patients. The incidence of suicide in the study population was 0.2%, approximately 15 times greater than the general population rate. More recently, Ojo *et al.* (14) reported a suicide rate of 15.7 per 1000 patient-years among kidney transplant recipients, 75% higher than the general population. Self-reported kidney disease has also been associated with a threefold increased risk for attempted suicide in the National Comorbidity Survey (15).

Using data on a national cohort of ESRD patients, we demonstrated an increased risk for death from suicide in persons with ESRD, even after accounting for demographic differences between the ESRD population and the general population. These data are consistent with unadjusted data reported for kidney transplant recipients (14) and similar in magnitude to the risk for suicide associated with other chronic or debilitating illnesses, including HIV infection, chronic lung disease, and stroke (15–17). Suicide rates were uniformly increased in ESRD across most major demographic groups, with the exception of blacks and patients who were younger than 30 yr. The presence of ESRD tended to accentuate existing national patterns of suicide according to age, race, and geographic region but not by gender (18). These observations suggest that ESRD acts to exacerbate a preexisting vulnerability or tendency toward suicidal behavior among certain high-risk groups.

In the general population, the elderly, in particular white men who are older than 75 yr, are especially at risk, although the rate of suicide in adolescents and young adults has increased sharply over the last several years (18). We identified several independent predictors of suicide among individuals with ESRD. A number of patient characteristics, including older age, male gender, white race, substance abuse, and geographic region, have been previously identified as predictors of suicide in the general population (18–20). Although we cannot readily explain the observed differences in suicide risk by race among patients who are on dialysis, previous studies in other populations have attributed these differences to cultural factors such as religious beliefs and social support (21). Similarly, some have speculated that geographic variation in suicide risk may reflect social or environmental factors such as gun ownership or regional economic stability (20). The absence of an increased risk for suicide in adolescents with ESRD may be attributable to the improved survival of this subgroup and the higher probability of transplantation for adolescents with ESRD (22).

These data also indicate that suicide differs from dialysis withdrawal with respect to specific risk factors and to a lesser extent by temporal pattern. In contrast to patients who withdrew from dialysis, patients who died from suicide were less burdened with comorbid conditions, malnutrition (defined by low serum albumin), and debility (defined by nonambulatory status). The temporal pattern and risk profile may suggest that suicide is prompted by a failure to cope with the stress of dialysis in the context of maladaptive patient and environmental psychosocial factors, rather than by declining health status.

Several studies have identified mental illness, especially depression, as a risk factor for suicide in many chronic conditions, ranging from migraine headaches to cancer (23,24). However,

although higher rates of mental illness are observed among persons with a variety of chronic illnesses, increased rates of suicide are not uniformly observed. For example, diabetes is associated with increased rates of depression (25), yet previous studies have not demonstrated an association between diabetes and suicide risk in adults (26,27). AIDS and chronic lung disease have been associated with an increased risk for suicide independent of mental illness, suggesting that other psychosocial, environmental, or genetic factors may be linked directly with suicide risk in specific clinical settings (15,28). Some studies have suggested that the burden of physical illness is an important risk factor for suicide (15,29). Although physical impairment is relatively common in ESRD, the extent of extra-renal comorbidity did not markedly influence suicide risk in this population.

In 1999, the Surgeon General's Call to Action to Prevent Suicide (19) addressed the importance of several psychosocial factors as risk factors for suicide. These psychosocial factors include substance abuse and mental illness disorders, unwillingness to seek treatment because of social stigma, barriers to gaining access to mental health treatment, social isolation, stressful life events, and easy access to lethal methods. Indeed, an increased prevalence of many of these psychosocial factors may mediate some of the observed increased risk for suicide among persons with ESRD. Depressive symptoms and clinical depression are extremely common among ESRD patients, especially at dialysis initiation (4,5). In the National Comorbidity Survey, adjustment for coexisting mental illness significantly attenuated the risk for attempted suicide among persons with self-reported kidney disease (15). Substance abuse is also highly prevalent in the ESRD population (5,30). Other psychosocial factors identified in the Surgeon General's Call to Action, such as stressful life events and easy access to lethal methods, apply to almost all ESRD patients (31). These findings along with the Surgeon General's Call to Action should help health care professionals who care for persons with ESRD to identify those who are at greatest risk for suicide, *i.e.*, socially isolated older white or Asian men with mental illness or substance abuse, particularly at the start of dialysis or after other stressful life events. Identifying and addressing risk is an important first step for the formulation and testing of effective prevention strategies.

This study has several limitations. First, suicides among persons with ESRD could not be separated from the national data that we used as a referent group. However, because these deaths represent <1% of all national suicides, the magnitude of this problem is negligible. Second, suicide deaths may be underreported as a result of uncertainty and social stigma. Therefore, these data may underestimate the risk for suicide among persons with ESRD. Third, we used administrative data for these analyses; thus, these associations are subject to ascertainment bias, and the RR associated with various conditions may be attenuated as a result of misclassification. For example, persons with less severe substance abuse may not have been captured in these data, which would tend to inflate the RR assigned to substance abuse reported here. Fourth, the USRDS tends to underascertain hospitalization data during the first 90 d after initiation. Thus, we may have underestimated the association between cause-specific hospitalization and death from suicide among patients who died from suicide within 15 mo of dialysis initiation, possibly counterbalancing the effects of misclassification noted above. Fifth, we were unable to assess the direct contribution of mental illness or depressive symptoms, except by the proxy variable mental illness hospitalization. Other important covariates such as marital status and education are not collected in the USRDS database. Finally, we lacked data on the mechanism of suicide deaths in persons with ESRD. Such information may have provided insight as to the provoking factors for suicide death among these individuals and potential mechanisms for prevention.

In summary, persons with ESRD are significantly more likely to commit suicide than persons in the general population. More than 30 yr after the organization and expansion of the ESRD program, despite major technological advances, the rigors of the short- and long-term adjustment to dialysis still exact a heavy toll on patients in terms of mortality and self-destruction. The increased risk for suicide associated with ESRD is seen across most demographic patient subgroups and tends to accentuate national suicide patterns. A number of suicide risk factors are distinct from those of dialysis withdrawal, suggesting that these are divergent outcomes rather than a continuum of a similar underlying process. These data establish a high-risk profile for suicide in ESRD patients for whom it may be advisable to seek counseling and other interventions in an effort to reduce risk. Further studies are urgently needed to understand the causal factors for suicide death and determine the best methods for suicide prevention in these individuals.

Acknowledgments

References

1. Abram HS, Moore GL, Westervelt FB Jr: Suicidal behavior in chronic dialysis patients. *Am J Psychiatry* 127: 1199–1204, 1971
2. Kimmel PL: Psychosocial factors in dialysis patients. *Kidney Int* 59: 1599–1613, 2001
3. Kimmel PL: Depression in patients with chronic renal disease: What we know and what we need to know. *J Psychosom Res* 53: 951–956, 2002
4. Watnick S, Kirwin P, Mahnensmith R, Concato J: The prevalence and treatment of depression among patients starting dialysis. *Am J Kidney Dis* 41: 105–110, 2003
5. Kimmel PL, Thamer M, Richard CM, Ray NF: Psychiatric illness in patients with end-stage renal disease. *Am J Med* 105: 214–221, 1998

6. United States Renal Data System: *Researcher's Guide to the USRDS Database*, Bethesda, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 2003

7. Leggat JE Jr, Bloembergen WE, Levine G, Hulbert-Shearon TE, Port FK: An analysis of risk factors for withdrawal from dialysis before death. *J Am Soc Nephrol* 8: 1755–1763, 1997

8. Neu S, Kjellstrand CM: Stopping long-term dialysis. An empirical study of withdrawal of life-supporting treatment. *N Engl J Med* 314: 14–20, 1986

9. Bordenave K, Tzamaloukas AH, Conneen S, Adler K, Keller LK, Murata GH: Twenty-one year mortality in a dialysis unit: Changing effect of withdrawal from dialysis. *ASAIO J* 44: 194–198, 1998

10. Selvin S: *Epidemiologic Analysis: A Case-Oriented Approach*, Oxford, Oxford University Press, 2001

11. Port FK, Wolfe RA, Hawthorne VM, Ferguson CW: Discontinuation of dialysis therapy as a cause of death. *Am J Nephrol* 9: 145–149, 1989

12. Mailloux LU, Bellucci AG, Napolitano B, Mossey RT, Wilkes BM, Bluestone PA: Death by withdrawal from dialysis: A 20-year clinical experience. *J Am Soc Nephrol* 3: 1631–1637, 1993

13. Bajwa K, Szabo E, Kjellstrand CM: A prospective study of risk factors and decision making in discontinuation of dialysis. *Arch Intern Med* 156: 2571–2577, 1996

14. Ojo AO, Hanson JA, Wolfe RA, Leichtman AB, Agodoa LY, Port FK: Long-term survival in renal transplant recipients with graft function. *Kidney Int* 57: 307–313, 2000

15. Goodwin RD, Marusic A, Hoven CW: Suicide attempts in the United States: The role of physical illness. *Soc Sci Med* 56: 1783–1788, 2003

16. Dannenberg AL, McNeil JG, Brundage JF, Brookmeyer R: Suicide and HIV infection. Mortality follow-up of 4147 HIV-seropositive military service applicants. *JAMA* 276: 1743–1746, 1996

17. Teasdale TW, Engberg AW: Suicide after a stroke: A population study. *J Epidemiol Community Health* 55: 863–866, 2001

18. Gaynes BN, West SL, Ford CA, Frame P, Klein J, Lohr KN: Screening for suicide risk in adults: A summary of the evidence for the US Preventive Services Task Force. *Ann Intern Med* 140: 822–835, 2004

19. US Public Health Service: *The Surgeon General's Call to Action to Prevent Suicide*, Washington, DC, US Public Health Service, 1999

20. Regional variations in suicide rates—United States, 1990–1994. *MMWR Morb Mortal Wkly Rep* 46: 789–793, 1997

21. Gibbs JT: African-American suicide: A cultural paradox. *Suicide Life Threat Behav* 27: 68–79, 1997

22. McDonald SP, Craig JC: Long-term survival of children with end-stage renal disease. *N Engl J Med* 350: 2654–2662, 2004

23. Breslau N, Davis GC, Andreski P: Migraine, psychiatric disorders, and suicide attempts: An epidemiologic study of young adults. *Psychiatry Res* 37: 11–23, 1991

24. Hietanen P, Lonnqvist J: Cancer and suicide. *Ann Oncol* 2: 19–23, 1991

25. Nichols GA, Brown JB: Unadjusted and adjusted prevalence of diagnosed depression in type 2 diabetes. *Diabetes Care* 26: 744–749, 2003

26. Quan H, Arboleda-Florez J, Fick GH, Stuart HL, Love EJ: Association between physical illness and suicide among the elderly. *Soc Psychiatry Psychiatr Epidemiol* 37: 190–197, 2002

27. Kyvik KO, Stenager EN, Green A, Svendsen A: Suicides in men with IDDM. *Diabetes Care* 17: 210–212, 1994

28. Druss B, Pincus H: Suicidal ideation and suicide attempts in general medical illnesses. *Arch Intern Med* 160: 1522–1526, 2000

29. Juurlink DN, Herrmann N, Szalai JP, Kopp A, Redelmeier DA: Medical illness and the risk of suicide in the elderly. *Arch Intern Med* 164: 1179–1184, 2004

30. Hegde A, Veis JH, Seidman A, Khan S, Moore J Jr: High prevalence of alcoholism in dialysis patients. *Am J Kidney Dis* 35: 1039–1043, 2000

31. Kaveh K, Kimmel PL: Compliance in hemodialysis patients: Multidimensional measures in search of a gold standard. *Am J Kidney Dis* 37: 244–266, 2001