

Psychiatric Illness and Mortality in Hospitalized ESKD Dialysis Patients

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Abstract

Background and objectives Limited existing data on psychiatric illness in ESKD patients suggest these diseases are common and burdensome, but under-recognized in clinical practice.

Design, setting, participants, & measurements We examined hospitalizations with psychiatric diagnoses using inpatient claims from the first year of ESKD in adult and pediatric Medicare recipients who initiated treatment from 1996 to 2013. We assessed associations between hospitalizations with psychiatric diagnoses and all-cause death after discharge in adult dialysis patients using multivariable-adjusted Cox proportional hazards regression models.

Results In the first ESKD year, 72% of elderly adults, 66% of adults and 64% of children had at least one hospitalization. Approximately 2% of adults and 1% of children were hospitalized with a primary psychiatric diagnosis. The most common primary psychiatric diagnoses were depression/affective disorder in adults and children, and organic disorders/dementias in elderly adults. Prevalence of hospitalizations with psychiatric diagnoses increased over time across groups, primarily from secondary diagnoses. 19% of elderly adults, 25% of adults and 15% of children were hospitalized with a secondary psychiatric diagnosis. Hazards ratios of all-cause death were higher in all dialysis adults hospitalized with either primary (1.29; 1.26 to 1.32) or secondary (1.11; 1.10 to 1.12) psychiatric diagnoses than in those hospitalized without psychiatric diagnoses.

Conclusions Hospitalizations with psychiatric diagnoses are common in pediatric and adult ESKD patients, and are associated with subsequent higher mortality, compared with hospitalizations without psychiatric diagnoses. The prevalence of hospitalizations with psychiatric diagnoses likely underestimates the burden of mental illness in the population.

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Introduction

Psychiatric illnesses in the ESRD population include depression, anxiety, organic disorders, dementias, alcohol- and drug-related disorders, and schizophrenic disorders, among others (1). Although psychiatric illnesses are considered common in patients on dialysis, determining the true prevalence is confounded by varying definitions and screening methods, overlap of symptoms with uremia, and medication effects (2–4). As a result, psychiatric disorders in patients with ESRD may be under-recognized in research and clinical care (3,5).

A comprehensive analysis of psychiatric illnesses in a large, adult ESRD population found 8.9% of patients on dialysis were hospitalized with a primary or secondary psychiatric diagnosis (1). A more recent study of 69 patients with ESRD in Brazil found 46.4% had at least one psychiatric diagnosis, and 21.7% met criteria for two or more (6). Other recent studies have focused on individual psychiatric illnesses, primarily depression, widely considered the most common psychiatric illness in the ESRD population (4,7–9).

Prevalence estimates for depression vary on the basis of case definition, from approximately 10% for major depressive disorder to 20%–30% for all depressive disorders (2). A systematic review and meta-analysis found prevalence estimates for depression in patients on dialysis ranged from 1.4% to 94.9%, with a summary prevalence estimate of 39.3% when depression was assessed by questionnaire and 22.8% when assessed by interview (10).

The limited data on psychiatric illnesses in pediatric ESRD populations are primarily from small studies. As with adults, pediatric patients with ESRD appear to have higher rates of depression compared with healthy children (11,12). Studies show both reduced and elevated rates of anxiety in pediatric patients treated with hemodialysis (HD) (11,13).

The presence of depression or anxiety is associated with lower quality of life in adult and pediatric patients with kidney disease (1–4,11,14–17). Additionally, depression in adults with ESRD is associated with lower treatment adherence (18–20), more frequent hospitalizations (21,22), and increased mortality (20–23).

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In pediatric patients with HD, anxiety was associated with increased disease duration and hospitalizations (13). Psychiatric illnesses may affect outcomes through psychosocial and biologic pathways. For example, depression may worsen outcomes and survival in ESRD by interacting with familial relationships or affecting immunologic and stress responses, nutritional status, or treatment adherence (4,24).

How common psychiatric illnesses are in the hospitalized ESRD HD population and their associations with outcomes is unknown. We assessed the prevalence of hospitalizations with psychiatric diagnoses within a year of treatment initiation in adult and pediatric patients with ESRD who started treatment from 1996 to 2013. In addition, associations between hospitalizations with psychiatric diagnoses and death were examined in adult patients treated with dialysis.

Materials and Methods

Study Design, Data Sources, and Sample Selection

Using standard US Renal Data System (USRDS) analysis files, we performed a retrospective cohort study of patients who started ESRD treatment from 1996 to 2013, to describe the number and percentage of patients who were hospitalized with psychiatric diagnoses within 1 year of treatment initiation, and to examine the association between hospitalizations with psychiatric diagnoses and death after discharge in adults on dialysis. We limited assessments to patients surviving after hospitalization because in-hospital mortality for patients with psychiatric diagnoses was low and may confound analysis of long-term results.

Figure 1 shows the formation of the cohorts. To describe the number and percentage of patients with ESRD who were hospitalized with psychiatric diagnoses, we designed a cohort of pediatric (ages 0–21 years), adult (ages 22–64 years), and elderly (age ≥ 65 years) patients with ESRD who initiated treatment in 1996–2013, for whom Medicare was the primary payer, and who were continuously enrolled in Medicare Part A and B from the date of ESRD initiation (or initiation of Medicare coverage after the waiting period) until the date of death, loss to follow up, discontinued dialysis, recovery of renal function, or day 365, whichever came first. Because of different survival between patients on dialysis and after kidney transplantation, to assess the association between hospitalizations with psychiatric diagnoses and death, we limited the study cohort to the subset of adults treated with dialysis and ever hospitalized during the first year of ESRD. Mortality rates were too low in the pediatric ESRD population (25) to conduct similar analyses.

Definition of Measures

We obtained data for hospitalizations with psychiatric diagnoses from Part A Medicare inpatient claims. Of 1,033,958 total incident patients with ESRD, 214,225 patients (21% overall, 66% of children, 52% of adults, and 0.1% of elderly adults) with no Medicare coverage before ESRD had a waiting period of up to 3 months after treatment initiation to be Medicare eligible. To ensure we obtained 1-year hospitalization information, we defined day 1 of the observation period for patients with a waiting period as the first day after the waiting period. For patients

without a waiting period, we defined day 1 as the first date of ESRD.

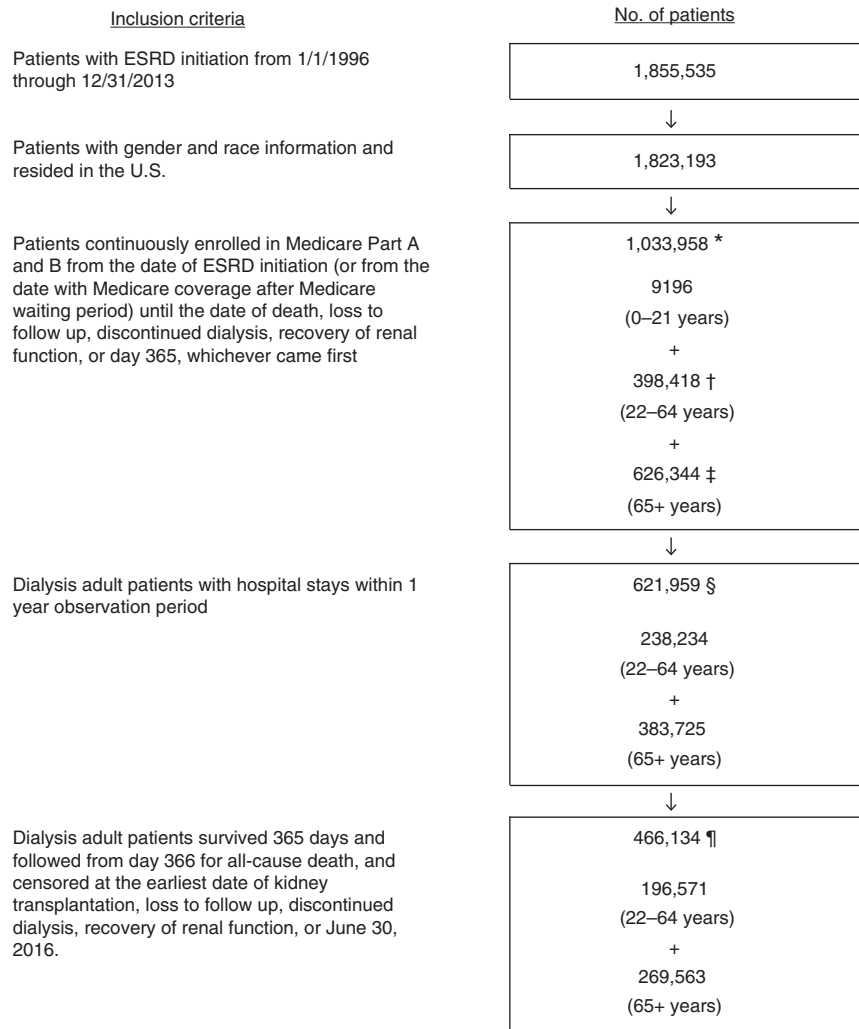
Our definition of hospitalizations with psychiatric diagnoses was on the basis of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes from Medicare claims incurred during days 1–365 of the observation period. Patients hospitalized with psychiatric diagnoses were assigned to one of ten categories of psychiatric illness, depending on their primary and secondary diagnoses: those with primary diagnoses for (1) multiple psychiatric illnesses, (2) depression and affective disorders, (3) organic disorders and dementias, (4) alcohol-related disorders, (5) drug disorders not alcohol related, (6) schizophrenic disorders, (7) other psychoses, (8) anxiety and personality disorders, (9) other mental disorders (not psychoses), and (10) those with any secondary but no primary psychiatric diagnosis. The ICD-9-CM codes for the psychiatric illnesses by category are shown in Supplemental Table 1.

Patient characteristics were taken from the Centers for Medicare and Medicaid Services Medical Evidence Form (CMS-2728), including age (0–21, 22–64, or ≥ 65 years), sex, race (white, black, or other), ethnicity, first treatment modality (HD, peritoneal dialysis, or transplantation), primary cause of ESRD (diabetes mellitus, hypertension, GN, cystic kidney disease, and other urological diseases), and comorbid conditions (congestive heart failure, peripheral vascular disease, cerebrovascular disease, atherosclerotic heart disease, chronic obstructive pulmonary disease, or cancer) at ESRD (26). We categorized years into six ranges: 1996–1998, 1999–2001, 2002–2004, 2005–2007, 2008–2010, and 2011–2013. We categorized information on residential area into large metropolitan area, medium or small metropolitan area, and rural area, using the National Center for Health Statistics Urban-Rural Classification Scheme for counties (27). We assigned patients dual status, an indication of poverty, if they were ever eligible for insurance coverage by both Medicare and Medicaid in Medicare Part A or B (28).

On the basis of diagnoses in Medicare Part A claims, we used a standardized coding algorithm to calculate Charlson scores for patients hospitalized within the 1-year observation period (26,28,29). The Charlson score is a widely used composite value based on number and seriousness of comorbid medical illnesses that alter mortality risk (29,30). To represent patients' health status within 1 year after ESRD initiation, we grouped patients with a hospitalization into four categories on the basis of Charlson scores (0–3, 4–5, 6–7, or ≥ 8), as previously described (26,28).

Statistical Analyses

The number of patients who were hospitalized with psychiatric diagnoses within 1 year after ESRD was determined and stratified by category of psychiatric illness in children, adults, and elderly adults separately. Number and percentage of patients hospitalized with a primary psychiatric diagnosis by psychiatric illness were also counted. Percentage distribution of patients without a hospitalization, hospitalized without psychiatric diagnoses, or hospitalized with one or more psychiatric diagnoses were presented by year of ESRD, sex, race, residential area, dual status, and first modality. We used chi-squared tests to compare distributions in patients without hospitalizations, hospitalized without psychiatric



* Study cohort for Table 1.

† ESRD patients 22–64 years hospitalized with a primary psychiatric diagnosis for Table 2.

‡ ESRD patients 65 years or above hospitalized with a primary psychiatric diagnosis for Table 3.

§ Study cohorts for supplemental Table 4.

¶ Study cohorts for Table 4.

ESRD = end-stage renal disease.

Figure 1. | Cohort formation flow chart. *Study cohort for Table 1. †Patients with ESRD aged 22–64 years hospitalized with a primary psychiatric diagnosis for Table 2. ‡Patients with ESRD aged 65 years or above hospitalized with a primary psychiatric diagnosis for Table 3. §Study cohorts for Supplemental Table 4. ¶Study cohorts for Table 4.

diagnoses, and hospitalized with psychiatric diagnoses by patient characteristics.

Multivariable-adjusted logistic regression models and Cox proportional hazards regression models were used to assess associations between hospitalizations with psychiatric diagnoses and death within the first year and death after 1 year. For patients who survived <365 days from the date of dialysis initiation, we can only use logistic regression to examine the association between a psychiatric hospitalization and a death within the first year, because their observation periods varied and a fair day to start the follow-up for death was not available. Death after

1 year was defined from day 366 for all-cause death and censoring at the earliest date of kidney transplantation, loss to follow up, discontinued dialysis, recovery of renal function, or June 30, 2016 in adults treated with dialysis with a hospitalization within 1 year after ESRD. Models were adjusted for patient demographics, residential area, dual eligibility, Charlson score, and comorbid conditions.

Because the number of diagnosis codes allowed in Medicare Part A claims increased from nine in 2009 to 25 in 2010, the prevalence of psychiatric illness in later years may be higher because of secondary diagnoses. We replicated the mortality analyses for 1996–2009 and 2010–2013 cohorts,

separately, to test for evidence of upcoding bias. Another sensitivity analysis was conducted to investigate whether similar results are found when defining hospitalizations by 1 year after onset of ESRD instead of 1 year after entry into Medicare.

Statistical significance was defined as $P < 0.05$ using two-tailed tests. Analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC).

Results

Prevalence of Hospitalizations with Psychiatric Diagnoses

Table 1 shows the number and percentage of 1996–2013 patients with ESRD hospitalized with psychiatric diagnoses. Overall, 64% of 9196 children had a first-year hospitalization, including 48%, 1%, and 15% with no, primary, and secondary psychiatric diagnoses, respectively. First-year hospitalizations occurred in 66% of 398,418 adults and 72% of 626,344 elderly adults. The corresponding percentages for hospitalizations with no, primary and secondary psychiatric diagnoses were 39%, 2%, and 25% in adults and 51%, 2%, and 19% in elderly adults, respectively.

The most common primary psychiatric diagnosis in children hospitalized with psychiatric diagnoses was depression/affective disorders (67 patients; 4%). In adults hospitalized with psychiatric diagnoses, the most common primary psychiatric diagnosis was depression/affective disorders

(2907 patients; 3%), followed by alcohol-related (1142 patients; 1%) and drug disorders (1041 patients; 1%). The top primary psychiatric diagnoses in elderly adults hospitalized with psychiatric diagnoses were organic disorders/dementias (3680 patients; 3%), depression/affective disorders (1825 patients; 1%), and drug disorders (1205 patients; 1%).

Study Population Characteristics

Supplemental Tables 2–4 show the distribution of hospitalization status during the first year of ESRD, including no hospitalizations, hospitalizations without psychiatric diagnoses, and hospitalizations with psychiatric diagnoses by selected characteristics in children, adults, and elderly adults. The percent of patients hospitalized with psychiatric diagnoses increased over time from 9% in 1996–1998 to 26% in 2011–2013 for children, from 19% to 40% for adults, and from 17% to 39% in elderly adults. Women and patients with dual eligibility were more likely than men (17% versus 16% in children, 29% versus 26% in adults, and 25% versus 21% in elderly adults) and patients without dual eligibility (17% versus 10% in children, 30% versus 22% in adults, and 28% versus 21% in elderly adults) to have hospitalizations with psychiatric diagnoses.

Almost the entire increase in hospitalizations with psychiatric diagnoses was because of secondary diagnoses (Supplemental Figure 1), likely resulting in part from the increased number of secondary diagnostic codes allowed

Table 1. Number and percentage of ESRD incident patients hospitalized with psychiatric diagnosis during a 1-year observation period, 1996–2013

	Pediatric Patients		Adult Patients		Elderly Adult Patients	
	(ages 0–21 yr)		(ages 22–64 yr)		(ages ≥65 yr)	
	N	%	N	%	N	%
Total patients with ESRD	9196	100	398,418	100	626,344	100
No hospitalization	3251	36	134,197	34	148,214	28
Nonpsychiatric hospitalization	4434	48	155,912	39	335,728	51
Primary psychiatric hospitalization	122	1	8570	2	9058	2
Secondary psychiatric hospitalization	1389	15	99,739	25	133,344	19
Patients with psychiatric hospitalizations	1511	100	108,309	100	142,402	100
Hospitalization with multiple psychiatric illnesses as primary diagnosis	<10	—	778	1	411	0.3
Depression and affective disorders as primary diagnosis	67	4	2907	3	1825	1
Organic disorders and dementias as primary diagnosis	0	0	704	1	3680	3
Alcohol-related disorders as primary diagnosis	0	0	1142	1	484	0.3
Drug disorders not alcohol related as primary diagnosis	10	1	1041	1	1205	1
Schizophrenic disorders as primary diagnosis	<10	—	788	1	163	0.1
Other psychoses as primary diagnosis	<10	—	418	0.4	694	1
Anxiety and personality disorders as primary diagnosis	16	1	363	0.3	294	0.2
Other mental disorders (not psychoses) as primary diagnosis	15	1	429	0.4	302	0.2
Hospitalization with psychiatric illness as secondary diagnosis	1389	92	99,739	92	133,344	94
Dialysis patients	8494	100	393,517	100	622,888	100
No hospitalization	2971	35	132,721	34	147,626	24
Nonpsychiatric hospitalization	4079	48	153,483	39	333,528	54
Primary psychiatric hospitalization	116	1	8490	2	9032	1
Secondary psychiatric hospitalization	1328	16	98,823	25	132,702	21
Transplant patients	702	100	4901	100	3456	100
No hospitalization	280	40	1476	30	588	17
Nonpsychiatric hospitalization	355	50	2429	49	2200	64
Primary psychiatric hospitalization	<10	—	80	2	26	1
Secondary psychiatric hospitalization	61	9	916	19	642	18

ESRD, end-stage renal disease.

in Medicare Part A claims from nine in 2009 to 25 in 2010. Percentages of children with anxiety/personality disorders as secondary diagnoses were relatively stable at 13% in 1996–1998 and 16% in 2008–2010, but increased to 24% in 2011–2013. Similarly, percentages of adults and elderly adults with anxiety/personality disorders as secondary diagnoses were stable at 9%–12% and 7%–10%, respectively, between 1996–1998 and 2008–2010, but increased to 24% and 20%, respectively, in 2011–2013. In addition, percentages of adults and elderly adults with depression/affective disorders increased from 23% and 27%, respectively, in 1996–1998 to 40% and 35%, respectively, in 2011–2013 (data not shown). Among those hospitalized with psychiatric illness, the median time from initiation of dialysis to first psychiatric hospitalization was 96 days (interquartile range, 30–205).

Tables 2 and 3 show the distribution of psychiatric illnesses in adult and elderly adult patients hospitalized with primary diagnoses by patient characteristics. Percentages of hospitalizations with alcohol-related disorders as a primary diagnosis increased, whereas those with organic disorders/dementias as a primary diagnosis decreased over study periods in both adult groups. Men were more likely than women to be hospitalized with a primary alcohol-related disorder diagnosis, whereas women were more likely to be hospitalized with a primary depression/affective disorder diagnosis in both adult groups.

Hospitalizations with Psychiatric Diagnoses and Mortality

During a mean 35 months follow-up, 328,752 deaths occurred. The overall mortality rate was 242.4 deaths/1000 person-years (95% confidence interval [95% CI], 241.6 to 243.2). The mortality rate was 237.2 (95% CI, 236.2 to 238.2) in patients hospitalized without psychiatric diagnoses, 252.1 (95% CI, 250.5 to 253.6) in patients hospitalized with secondary psychiatric diagnoses, and 275.3 (95% CI, 269.4 to 281.3) in patients hospitalized with primary psychiatric

diagnoses. Table 4 shows associations between hospitalizations with psychiatric diagnoses within 1 year of dialysis initiation and all-cause death after 1-year observation in adults with a hospitalization, adjusted for demographic characteristics, residential area, dual eligibility, Charlson score, and comorbid conditions at dialysis initiation. Compared with those hospitalized without psychiatric diagnoses, the hazard ratios of death were 1.29 (95% CI, 1.26 to 1.32) in all adults hospitalized with primary psychiatric diagnoses, and 1.11 (95% CI, 1.10 to 1.12) in all adults hospitalized with secondary psychiatric diagnoses.

Findings were similar for associations between hospitalizations with psychiatric diagnoses and first year death (Supplemental Table 5). The odds ratios of 1-year mortality were 1.23 (95% CI, 1.18 to 1.28) and 1.09 (95% CI, 1.08 to 1.11) in all adults hospitalized with primary and secondary psychiatric diagnoses, respectively, compared with those hospitalized without psychiatric diagnoses.

Similar results were observed for 1996–2009 and 2010–2013 cohorts, separately, and when defining hospitalizations by 1 year after ESRD initiation instead of 1 year after onset of Medicare (data not shown).

Discussion

This study updates our understanding of the prevalence of and outcomes associated with hospitalizations with psychiatric diagnoses in adult patients with ESRD, and expands that understanding to a large sample of pediatric patients for perhaps the first time, across a spectrum of psychiatric diagnoses. Between 1996 and 2013, approximately 27% of adults and 21% of elderly adults in the United States ESRD program had hospitalizations with psychiatric diagnoses. Prevalence was slightly lower in pediatric patients at 16%. This represents a substantial increase from the 8.9% of patients hospitalized with psychiatric diagnoses

Table 2. Demographic characteristics of adult patients with ESRD hospitalized with a primary psychiatric diagnosis, 1996–2013

Characteristics	Total n=8570	Multiple Psychiatric Diseases n=778	Depression and Affective Disorders n=2907	Organic Disorders and Dementias n=704	Alcohol-Related Disorders n=1142	Drug Disorders Not Alcohol Related n=1041	Schizophrenic Disorders n=788	Other Psychoses n=418	Anxiety and Personality Disorders n=363	Other Disorders (Nonpsychoses) n=429
Year of ESRD initiation										
1996–1998	1493	11%	35%	13%	9%	14%	7%	5%	4%	4%
1999–2001	1453	11%	35%	11%	11%	13%	8%	5%	4%	3%
2002–2004	1500	10%	33%	10%	13%	13%	9%	5%	4%	3%
2005–2007	1474	8%	34%	6%	15%	12%	10%	5%	4%	5%
2008–2010	1388	8%	35%	6%	15%	11%	11%	4%	5%	6%
2011–2013	1262	7%	32%	3%	18%	9%	11%	5%	5%	10%
Sex										
Male	5107	10%	31%	8%	18%	12%	9%	5%	3%	4%
Female	3463	8%	39%	9%	6%	12%	9%	5%	6%	7%
Race										
White	5031	8%	36%	8%	15%	11%	8%	4%	5%	5%
Black	3274	10%	31%	8%	10%	15%	12%	6%	3%	5%
Other	265	6%	37%	7%	22%	8%	5%	6%	5%	5%
Residential area										
Large metro	4438	10%	34%	7%	14%	12%	10%	4%	4%	5%
Medium/small metro	2707	9%	34%	9%	12%	14%	9%	5%	5%	5%
Rural	1415	8%	34%	11%	13%	11%	7%	7%	5%	5%
Dual status in Medicare and Medicaid										
No	2181	7%	34%	10%	16%	11%	7%	5%	4%	6%
Yes	6389	10%	34%	8%	12%	12%	10%	5%	4%	5%
First modality										
Hemodialysis	8115	9%	33%	8%	14%	12%	10%	5%	4%	5%
Peritoneal dialysis	341	8%	43%	11%	3%	13%	2%	6%	7%	8%
Transplant	80	4%	44%	3%	23%	11%	3%	5%	8%	1%

Table 3. Demographic characteristics in elderly adult patients with ESRD hospitalized with a primary psychiatric diagnosis, 1996–2013

Characteristics	Total	Multiple Psychiatric Diseases	Depression and Affective Disorders	Organic Disorders and Dementias	Alcohol-Related Disorders	Drug Disorders Not Alcohol Related	Schizophrenic Disorders	Other Psychoses	Anxiety and Personality Disorders	Other Disorders (Nonpsychoses)
	n=9058	n=411	n=1825	n=3680	n=484	n=1205	n=163	n=694	n=294	n=302
Year of ESRD initiation										
1996–1998	1805	5%	23%	46%	3%	9%	1%	6%	2%	4%
1999–2001	1942	5%	19%	46%	3%	11%	2%	8%	2%	3%
2002–2004	1752	4%	17%	44%	5%	15%	1%	7%	3%	4%
2005–2007	1377	4%	19%	38%	7%	15%	2%	9%	4%	3%
2008–2010	1187	4%	21%	30%	8%	18%	2%	9%	5%	3%
2011–2013	995	4%	23%	31%	9%	14%	4%	7%	5%	3%
Sex										
Male	4561	4%	19%	41%	8%	13%	1%	7%	2%	4%
Female	4497	5%	22%	40%	3%	13%	2%	8%	4%	3%
Race										
White	6845	4%	22%	38%	6%	15%	1%	8%	3%	3%
Black	1993	5%	13%	50%	4%	9%	4%	8%	3%	3%
Other	220	6%	23%	34%	8%	9%	3%	8%	3%	7%
Residential area										
Large metro	4438	5%	22%	39%	6%	12%	2%	7%	3%	3%
Medium/small metro	2825	4%	19%	41%	6%	15%	2%	8%	3%	3%
Rural	1776	4%	17%	44%	4%	15%	1%	8%	3%	4%
Dual status in Medicare and Medicaid										
No	6184	4%	20%	41%	6%	15%	1%	7%	3%	3%
Yes	2874	6%	20%	41%	5%	10%	4%	8%	3%	4%
First modality										
Hemodialysis	8636	4%	20%	41%	6%	13%	2%	8%	3%	3%
Peritoneal dialysis	364	8%	25%	36%	1%	14%	1%	7%	3%	6%
Transplant	26	0%	27%	12%	23%	15%	0%	0%	19%	4%

found in 1998 (1). This disparity in estimates may partly result from the increased number of secondary diagnosis codes allowed in Medicare Part A claims beginning in 2010. Indeed, we found the rate of hospitalizations with psychiatric diagnoses increased from 19% in 1996–1998 to 40% in 2011–2013 for adults, and from 17% to 39% in elderly adults. Most of the increase was due to secondary psychiatric diagnoses. However, the increase also may be partly because of changes in ESRD patient characteristics (*e.g.*, age, presence of comorbidities) (31) or greater awareness of psychiatric illness by medical personnel since the prior study. Although prevalence of hospitalizations with psychiatric diagnoses in patients with ESRD may serve as a proxy for prevalence of mental illness in this population, this analysis is limited to patients with severe illness requiring

hospitalization, and therefore likely underestimates the true prevalence.

Depression/affective disorders was the most common primary psychiatric diagnosis for both adult and pediatric patients with ESRD at 3% and 4%, respectively, and the second most common diagnosis in elderly adults at 1%. The high prevalence of primary depression/affective disorder diagnoses in hospitalized patients with ESRD is consistent with the current consensus regarding depression as the most common psychiatric condition in adults with ESRD (7–9), and may also indicate the predominance of this disorder in children with ESRD. Indeed, depression appears quite common in the general pediatric population. Data from National Surveys on Drug Use and Health suggest the 12-month prevalence of major depressive events was 11.3%

Table 4. Adjusted associations between hospitalization with psychiatric diagnosis and death in adult and elderly adult patients treated with dialysis during 1-year observation period

Hospitalizations	No. of Patients	No. of Death	Hazard Ratio ^a (95% Confidence Interval)
Adults aged 22–64 yr			
Nonpsychiatric hospitalization	115,358	70,688 (61%)	1.00
Primary psychiatric hospitalization	6154	4223 (69%)	1.31 (1.27 to 1.35)
Secondary psychiatric hospitalization	75,059	45,834 (61%)	1.13 (1.12 to 1.15)
Elderly adults aged ≥65 yr			
Nonpsychiatric hospitalization	190,347	149,646 (79%)	1.00
Primary psychiatric hospitalization	5031	4014 (80%)	1.28 (1.24 to 1.32)
Secondary psychiatric hospitalization	74,185	54,347 (73%)	1.10 (1.09 to 1.11)
All adults			
Nonpsychiatric hospitalization	305,705	220,334 (72%)	1.00
Primary psychiatric hospitalization	11,185	8237 (74%)	1.29 (1.26 to 1.32)
Secondary psychiatric hospitalization	149,244	100,181 (67%)	1.11 (1.10 to 1.12)

^aCox proportional hazards model adjusted for gender, race, ethnicity, age, residential area, dual eligibility status, cause of ESRD, Charlson score, and comorbid conditions (congestive heart failure, peripheral vascular disease, cerebrovascular disease, atherosclerotic heart disease, chronic obstructive pulmonary disease, and cancer) at ESRD initiation.

in adolescents aged 12–17 years in 2014, which was significantly increased from 8.7% in 2005 (32). Further, these data indicate only 5.5% of United States adolescents with depression were hospitalized for depression (32). If hospitalization for depression is similarly low in children with ESRD, the 4% prevalence of hospitalization with a primary depression diagnosis found for children with ESRD in this study may vastly underestimate the true burden of depression in this population.

Dementias/organic disorders comprised the most common primary psychiatric diagnostic category in elderly adults treated with dialysis at 3%. The predominance of these conditions in elderly adults is consistent with findings in the general population that suggest increasing prevalence of dementia with age, and high prevalence rates of dementia in the range of 12%–14% in those over age 65 years (33–35). In pediatric, adult and elderly adult groups, anxiety was relatively uncommon, perhaps reflecting infrequent assessment during hospitalization, poor recognition, or limited coding of the disorder rather than low prevalence (3).

In both adults and elderly adults, hospitalizations with psychiatric diagnoses within a year of ESRD initiation were associated with higher mortality after adjusting for demographic characteristics, residential area, dual eligibility, Charlson score, and comorbid conditions at ESRD initiation. In all adults, primary and secondary psychiatric diagnoses during hospitalization within 1 year of dialysis initiation were associated with 29% and 11% higher hazards of death, respectively. This higher mortality in individuals hospitalized with psychiatric diagnoses is consistent with previous literature showing elevated mortality rates among dialysis patients with depression (20–22), and expands such associations to a broader set of psychologic conditions. Psychiatric illness may increase risk of mortality in individuals treated with dialysis through a variety of pathways, acting alone or in combination. Barriers to treatment adherence may be increased with psychiatric illness, making maintenance of dialysis treatment—a particularly demanding and intrusive therapy—and other life-sustaining treatments especially difficult for individuals with coexisting ESRD and psychiatric illness. Psychiatric conditions, including depression and substance abuse, have been associated with missed dialysis treatments (36), and may mediate the relationship between depression and mortality in individuals on dialysis (37). Psychiatric illnesses may also affect immunologic and stress responses and nutritional status in ESRD (24). Depression alters metabolism of glucocorticoids, a class of stress hormones that are often elevated in ESRD (4,38,39). Finally, psychiatric illness in conjunction with ESRD may overwhelm resources available for care in conventional outpatient treatment settings, reducing quality of care and survival (1).

Several limitations of this study should be noted. Data for the primary and secondary hospitalization diagnoses rely on clinician diagnosis and are delineated by ICD-9-CM codes. In a systematic review of studies assessing the accuracy of diagnostic codes in identifying patients with mental illness for research, the reliability of such administrative data varied by disease, with greater validity for psychotic disorders, and poorer reliability for anxiety, substance use disorders, and schizoaffective disorder (40). Given the complexities of diagnosing psychiatric illnesses in the ESRD population and

the overlap of symptoms of uremia (such as neuropathy, encephalopathy, anorexia, sleep disturbance) with those of psychiatric disorders (such as weight change, psychomotor agitation or retardation, sleep disturbances, and decreased appetite), missed psychiatric diagnoses may occur in patients treated with dialysis. Therefore, International Classification of Diseases coding may underestimate true prevalence of hospitalization associated with psychiatric disorders in this population. Although the USRDS contains accurate and complete mortality data for all patients with ESRD, it lacks information on several treatment factors and psychosocial patient characteristics that may influence ESRD patient mortality, such as medication prescription. We did not control for dialytic parameters or adequacy measures. Additionally, the USRDS is an observational registry, so causal relationships between hospitalizations with psychiatric diagnosis and mortality cannot necessarily be inferred. Further, it is important to note that this analysis applies to dialysis patients, and findings may not be applicable to transplant patients.

In addition, there are important limitations to the analysis of hospitalization rates for psychiatric diagnosis in children, so conclusions in this population must be tentative. The number of patients included in the analysis is small and the hospitalization events are infrequent, as there is a strong preference for outpatient management. There is wide geographic variance in the availability of child psychiatry consultation and hospitalization, which may limit diagnostic accuracy.

We conclude that hospitalizations with psychiatric diagnoses are common in United States adult and pediatric patients on dialysis, and such hospitalizations are associated with higher mortality in adults. This study likely underestimates the true burden of these conditions within the dialysis population. Further research is needed to understand their prevalence in cases where the conditions may not result in (or be coded during) hospitalization. The findings suggest clinicians who care for hospitalized dialysis patients should be aware of and prepared to manage psychiatric disorders and associated negative outcomes within these populations.

Disclosures

Dr. Kimmel reports that, along with Dr. Mark Rosenberg of University of Minnesota, he is the editor of a textbook published by Elsevier, *Chronic Renal Disease*, which has more than 70 chapters and multiple authors. Dr. Moxey-Mims reports her position as the Steering Committee Chair for the APOLLO study. Dr. Abbott, Dr. Eggers, Dr. Fwu, Dr. Mendley, and Dr. Norton have nothing to disclose.

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Supplemental Material

This article contains the following supplemental material online at <http://cjasn.asnjournals.org/lookup/suppl/doi:10.2215/CJN.14191218/-/DCSupplemental>.

Supplemental Table 1. ICD-9-CM codes for psychiatric diagnosis.

Supplemental Table 2. Demographic characteristics of pediatric patients with ESRD with and without hospitalization with a psychiatric diagnosis, 1996–2013.

Supplemental Table 3. Demographic characteristics of adult patients with ESRD with and without hospitalization with a psychiatric diagnosis, 1996–2013.

Supplemental Table 4. Demographic characteristics of elderly adult patients with ESRD with and without hospitalization with a psychiatric diagnosis, 1996–2013.

Supplemental Table 5. Adjusted associations between hospitalization with psychiatric diagnosis and death within the first year in adult dialysis patients with hospitalization during 1-year observation period.

Supplemental Figure 1. Percentage of ESRD incident adult patients hospitalized with psychiatric diagnosis during a 1-year observation period, by year of ESRD initiation.

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