

## ORIGINAL RESEARCH

## Health Policy

# Emergency department visits for hemodialysis by insurance status in the United States

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**Abstract**

**Objective:** Many uninsured patients with end-stage kidney disease (ESKD) depend upon the emergency department (ED) for hemodialysis (HD). We sought to characterize ED visits for emergent HD by insurance status.

**Methods:** We performed a cross-sectional analysis of the 2017 Nationwide Emergency Department Sample, including ED visits by patients  $\geq 18$  years old with a length of stay  $\leq 1$  day and performance of HD. Insurance status determined by “insured” as Medicare, Medicaid, or commercial and “uninsured” as self-pay or charity.

**Results:** Of 118,034,396 adult ED visits, 235,988 were associated with HD: uninsured 62,503 (incidence 5.30 per 10,000, 95% confidence interval [CI]: 5.26–5.34) and insured 172,889 (incidence 14.65 per 10,000, 95% CI: 14.60–14.74). The south census region accounted for 89% of uninsured ED HD (odds ratio [OR] 31.55, 95% CI: 8.97–110.97). Compared to insured patients, uninsured ED HD patients were more likely to be younger (age 18–44, 37.6% vs 19.9%). The most common primary diagnosis for uninsured and insured ED HD patients was hypertensive chronic kidney disease (34.6% and 26.2%, respectively). Uninsured ED HD patients were less likely to be admitted (3.4% vs 36.0%, OR 0.06, 95% CI: 0.02–0.20). Most ED HD patients were discharged home (95.2% uninsured vs 57.6% insured). ED charges per visit were \$5,992.32 for uninsured and \$10,985.87 for insured ED HD patients.

**Conclusions:** Our findings highlight the health care burden of ED HD. Novel system approaches are needed for the management of uninsured and insured patients with ESKD.

**KEYWORDS**

chronic dialysis, chronic hemodialysis, dialysis, end-stage kidney disease, end-stage renal disease, ESRD, hemodialysis

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## 1 | INTRODUCTION

### 1.1 | Background

Patients with end-stage kidney disease (ESKD) require renal replacement therapy, including chronic treatment with hemodialysis (HD), peritoneal dialysis (PD), or kidney transplant. In the United States, the Centers for Medicare and Medicaid Services offer nearly universal insurance coverage for ESKD and provide scheduled dialysis for eligible individuals.<sup>1</sup> Funded mostly through Medicare, renal replacement therapies are generally not available for individuals who are not US citizens or qualified residents.<sup>2</sup> Many US citizens also do not qualify for Medicare coverage as they do not have social security benefits.<sup>3</sup> Many of these uninsured individuals with ESKD must then depend on unscheduled intermittent “compassionate” dialysis.<sup>1</sup>

Obtaining emergency dialysis in the emergency department (ED) is possible through the Emergency Medical Treatment and Active Labor Act, which requires hospitals to provide emergency care regardless of immigration or insurance status.<sup>4,5</sup> However, specific policies accommodating uninsured ESKD patients are not formally delineated by federal regulations and are instead decided by state and local policies.<sup>4,5</sup> These policies vary widely based on the availability of safety-net provisions and depend on each state’s Medicaid and Emergency Medicaid benefits.<sup>4</sup> For example, uninsured ESKD patients in California and Colorado receive thrice-weekly outpatient dialysis or PD, but many similar patients in Texas must receive emergent HD in the ED.<sup>5,6</sup>

### 1.2 | Importance

The system of providing HD through the ED presents several major system level challenges. ED HD visits add to already overcrowded urban EDs, tax hospital dialysis resources, and incur significant health care costs.<sup>7</sup> The determination of need for HD often requires additional diagnostic tests, further adding to ED resource consumption. Owing to their intermittent presentation and lack of scheduled dialysis treatment, uninsured ESKD patients often present in clinical crisis, requiring rescue interventions and acute care in addition to dialysis. Because of the critical nature of emergent dialysis, the health care burden is not limited to resources or financial constraints but also includes the significant detriment to the quality of life of these individuals.<sup>7</sup> Uninsured ESKD patients have higher rates of unemployment, mental illness, morbidity, and mortality.<sup>6–12</sup>

A paucity of literature describes the impact of HD on the ED. Prior studies characterizing the size and use of ED HD for ESKD patients have been limited to single regions or states.<sup>1,9–16</sup> These small studies estimate that there are  $\approx$  7000 uninsured patients with ESKD in the United States and describe this population as mostly undocumented Latino immigrants who must rely on the ED for HD.<sup>16,17</sup> Despite this knowledge, there is a lack of large-scale data comparing insurance status and characteristics of this patient population that also quantifies the size and cost of ED HD.<sup>16,18</sup>

#### The Bottom Line

Using the 2017 Nationwide Emergency Department Sample, the authors analyzed approximately 236,000 patients who received hemodialysis and a hospital length of stay less than 1 day. Of these, nearly one quarter were uninsured, and those from the south census region of the United States accounted for 89% of the uninsured, with the uninsured being younger and more likely to be hospitalized. These findings highlight the need for system approaches to improving the care continuum for these patients.

### 1.3 | Goals of this investigation

We sought to provide a national analysis of the health care use of ED visits associated with emergent HD. We also sought to characterize differences between the uninsured and insured ESKD patients requiring ED HD.

## 2 | METHODS

### 2.1 | Study design and setting

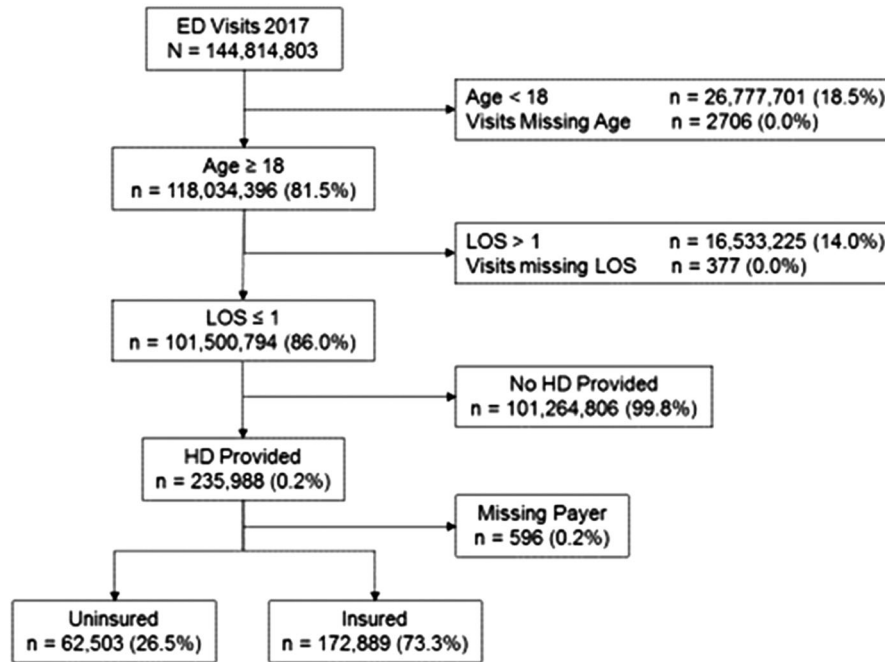
We performed a cross-sectional analysis using the 2017 Healthcare Cost and Utilization Project (HCUP) Nationwide Emergency Department Sample (NEDS).<sup>19</sup> The Committee for the Protection of Human Subjects of the University of Texas Health Science Center at Houston approved this study.

### 2.2 | Data source

The NEDS tracks ED visits across the United States and records information regarding geographic, hospital, patient, and visit characteristics. The NEDS was constructed from a sample of hospital-based EDs participating in the HCUP State Emergency Department Databases (SEDD) and the State Inpatient Databases (SID) by using a stratified, random-sampling design. The SEDD capture discharge information on ED visits that do not result in admission, either treat-and-release or transfers. The SID contain information on patients seen in the ED and then admitted to the same hospital. For patients treated in the ED and also admitted, their visit appears as an observation in the SID only.

### 2.3 | Selection of participants

To best identify the cohort of patients presenting to the ED for HD, we identified adult ( $\geq$ 18 years) ED visits that were associated with HD and a hospital length of stay (LOS)  $\leq$ 1 day (Figure 1). We reasoned that this strategy would capture patients treated and discharged from the ED as well as those admitted for a short stay or on observation



**FIGURE 1** Flow diagram of study inclusion criteria. A total of 144,814,803 emergency department visits were obtained from the State Inpatient Databases (SID) and State Emergency Department Databases (SEDD) for the 2017 calendar year. Only patients age  $\leq 18$  were included. We limited the analysis to ED visits with a LOS  $\leq 1$  day and then identified the occurrence of hemodialysis (HD). The total study population was 235,988 ED visits in which HD was provided. Finally, we characterized those visits as either uninsured or insured. There were 62,503 uninsured adult ED HD visits and 172,889 insured adult ED HD visits. Abbreviations: HD, hemodialysis; LOS, length of stay

status. We identified HD treatment by the presence of the *International Classification of Diseases-10* (ICD-10) procedure codes 5A1D00Z and 5A1D60Z-5A1D90Z, the Clinical Classifications Software code (CCS) 58, and the Healthcare Common Procedure Coding System/Current Procedural Terminology (HCPCS/CPT) codes G0257, 90935, 90937, 90957-90970, and 90999.<sup>20-22</sup>

We did not capture the very rare patient who might have undergone urgent PD during a hospital encounter of  $< 24$  hours, and we did not include ESKD patients seen in the ED and treated conservatively without dialysis, including those who might have received non-dialytic therapy for hyperkalemia before discharge without HD.

## 2.4 | Primary exposure

The primary exposure of interest was insurance status, which we broadly defined as insured versus uninsured. We ascertained insurance status using the "Payer Information" variable, specifically the expected primary payer, which contains information on the patient's primary insurance status. We classified Medicare, Medicaid, and commercial insurance as insured. Medicaid included visits covered by Emergency Medicaid. We classified self-pay and charity as uninsured.

## 2.5 | Primary outcomes

The primary outcome was the occurrence of an ED visit associated with HD. An ED visit included all ED visits limited to patients  $\geq 18$  years

old with LOS  $\leq 1$  day. HD treatment was ascertained using the relevant ICD-10 procedure, HCPCS/CPT, and CCS codes from the "CPT Procedure Information" variable.

## 2.6 | Characteristics

For each included hospitalization, we determined patient demographics, primary diagnoses, disposition from ED, median household income of patient's ZIP code, hospital region, and ED charges. Demographics included age and sex. Primary diagnosis included the 10 most prevalent diagnoses for uninsured ED HD and were identified by ICD-10 clinical modification codes. Disposition from ED included discharge home or with home health, transfer to short-term hospital, other transfer including skilled nursing and intermediate care, against medical advice, admitted as inpatient, died in ED, and unknown. Median household income for patient's ZIP code was divided into 4 percentile groups. We identified the hospital census region. We also examined the total charges associated with the ED visit as reported in the data set.

## 2.7 | Data analysis

We first determined the number and incidence of ED visits with LOS  $\leq 1$  day associated with HD, stratifying by insurance status. We compared characteristics between insured and uninsured HD using binomial proportions and univariate logistic regression models, defining insurance status as the dependent variable and evaluating each characteristic as

**TABLE 1** Primary insurance payer for uninsured versus insured emergency department hemodialysis (HD) patients

Payer	Uninsured ED HD	Insured ED HD
	N = 62,503 n (%)	N = 172,889 n (%)
Medicare	0 (0.0)	110,026 (63.6)
Medicaid, including emergency Medicaid	0 (0.0)	46,337 (26.8)
Private, including health maintenance organization	0 (0.0)	13,767 (8.0)
Self-pay	60,705 (97.1)	0 (0.0)
Charity	1798 (2.9)	0 (0.0)
Other	0 (0.0)	2758 (1.6)

an independent variable. We accounted for the survey weights of the data set to obtain nationalized estimates and confidence intervals. We analyzed all data using Stata 15.1 (Stata, Inc., College Station, TX, USA).

### 3 | RESULTS

#### 3.1 | Analysis sample

Among 144,814,803 ED visits in the United States in 2017, we excluded 26,780,407 visits with patients <18 years old or those cases in which age was missing (Figure 1). We excluded 16,533,602 visits with LOS >1 day and for those observations with unknown LOS. We also excluded 101,264,806 cases in which HD was not provided. The final sample included 235,988 adult ED visits with LOS ≤1 day and performance of HD.

#### 3.2 | Main results

Of 118,034,396 adult ED visits, 235,988 were associated with HD with LOS ≤1 day. 62,503 (26.5%) were uninsured and 172,889 (73.3%) were insured. The incidence of uninsured HD with LOS ≤1 day throughout the United States in 2017 was 5.30 per 10,000 adult ED visits (95% confidence interval [CI]: 5.26–5.34). The incidence of insured ED HD with LOS ≤1 day was 14.65 per 10,000 (95% CI: 14.60–14.74). Of the uninsured ED HD population, most visits were classified as self-pay or charity (Table 1). For insured ED HD, the most common coverages were Medicare and Medicaid.

The most common age group for both uninsured and insured ED HD was 45–64 years (Table 2). Compared to insured ED HD visits, uninsured ED HD visits were more likely to be younger patients (age 18–44 years, Table 2). Although most ED HD patients were male, there were no sex differences between insured and uninsured ED HD (odds ratio [OR] 0.97, 95% CI: 0.87–1.10).

ED HD primarily occurred in the south census hospital region (OR 31.55, 95% CI: 8.97–110.97). The most common primary diagnosis for

both uninsured and insured ED HD was hypertensive chronic kidney disease with stage 5 chronic kidney disease or end-stage renal disease (Table 2). Although most ED HD were discharged home or with home health, uninsured ED HD were less likely to be admitted as inpatients (OR 0.06, 95% CI: 0.02–0.20). Uninsured ED HD were more likely to reside in lower income regions (Table 2).

Per visit ED charges were greater for insured than uninsured ED HD (\$10,985.87 vs \$5,992.32). Uninsured ED HD visits charges totaled \$374,537,977. Insured ED HD visits totaled \$1,899,336,078.

#### 3.3 | Limitations

These findings must be interpreted with respect to the inherent limitations of the data set. The NEDS does not report timing or indications, only primary diagnoses, for procedures. We could not account for some patients receiving HD as part of their chronic dialysis schedule. We subjected HD treatment to LOS ≤1 day in hopes to adjust for this limitation. Our figures do not include individuals discharged from the ED without HD and thus underestimate the total ED burden.

### 4 | DISCUSSION

We identified 62,503 uninsured ED visits associated with HD in 2017. These ED visits resulted in charges over \$374 million. This is one of the largest and most comprehensive descriptions of the national burden of uninsured ESKD requiring ED HD.<sup>1,9–16</sup>

The enormous burden of ED HD falls most heavily on the southern census region of the United States. Most of the states in this region failed to adopt the Medicaid expansion under the Affordable Care Act,<sup>23</sup> and the resulting coverage gap could explain the greater amount of uninsured ED HD in southern states.<sup>2,4,17,23–25</sup> Just 12 states use Emergency Medicaid to fund scheduled dialysis for eligible uninsured ESKD.<sup>17</sup> In states that do not allow for Emergency Medicaid to cover outpatient dialysis, uninsured patients with ESKD must then rely on insurance funded by charitable organizations or safety-net hospitals, county-funded outpatient dialysis centers, and EDs.<sup>17</sup> Consequently, there is much variability with regard to the care patients receive. This study underscores the importance of the ED as a safety net for the most vulnerable populations.<sup>26,27</sup>

In addition to the uninsured ED HD, there were 172,889 insured ED visits associated with HD, totaling over \$1.8 billion in hospital charges. Our findings suggest that even though insured individuals with ESKD are eligible for chronic and scheduled dialysis (HD and PD) funded by Medicare and Medicaid, they also contribute to the enormous health care burden of ED HD. A possible explanation includes these patients missing their scheduled appointments or needing additional sessions.<sup>28</sup> It is presumable that for those ESKD patients that have regular access to HD but are presenting to the ED may be experiencing clinical crisis. What drives this clinical crisis and subsequent ED presentation will require further study but could be the result of potential undertreatment between sessions leading to acute

**TABLE 2** Characteristics of emergency department visits associated with hemodialysis, stratified by insurance status

Characteristic	Uninsured ED HD; N = 62,503 visits; n (%) <sup>a</sup>	Insured ED HD; N = 172,889 visits; n (%)	Relative odds ratio of being uninsured (95% CI) <sup>b</sup>
<b>Age</b>			
18–44	23,519 (37.6)	34,464 (19.9)	Reference
45–64	31,189 (49.9)	80,410 (46.4)	0.57 (0.47–0.70)
65–74	6545 (10.5)	34,566 (19.9)	0.28 (0.22–0.35)
75+	1250 (2.0)	24,035 (13.9)	0.08 (0.02–0.31)
<b>Sex</b>			
Male	34,513 (55.2)	93,977 (54.4)	Reference
Female	27,990 (44.8)	78,912 (45.6)	0.97 (0.87–1.10)
<b>Hospital region<sup>c</sup></b>			
Northeast	438 (0.7)	25,736 (14.9)	Reference
Midwest	6094 (9.8)	24,885 (14.4)	14.38 (2.33–88.75)
South	55,612 (89.0)	103,506 (59.9)	31.55 (8.97–110.97)
West	358 (0.6)	18,763 (10.9)	1.12 (0.52–2.43)
<b>Primary diagnosis</b>			
Hypertensive CKD (I12.0) <sup>d</sup>	19,690 (34.6)	24,942 (26.2)	Reference
Hyperkalemia (E87.5)	15,219 (26.7)	13,932 (14.6)	1.38 (0.75–2.56)
Fluid Overload (E87.70, E87.79)	7865 (13.8)	16,822 (17.7)	0.59 (0.35–0.99)
ESRD (N18.6)	4684 (8.2)	4879 (5.1)	1.22 (0.33–4.48)
Hypertensive heart and CKD (I13.2)	4318 (7.6)	13,177 (13.8)	0.42 (0.30–0.57)
T2DM <sup>e</sup> with diabetic CKD (E11.22)	4180 (7.3)	4641 (4.9)	1.14 (0.36–3.59)
Shortness of breath (R06.02)	376 (0.7)	3000 (3.2)	0.16 (0.08–0.30)
Chest pain (RO7.89, RO7.9)	289 (0.5)	8814 (9.3)	0.04 (0.02–0.11)
Hypertensive urgency (I16.0)	187 (0.3)	2145 (2.3)	0.11 (0.05–0.25)
Thrombosis due to vascular prosthetic devices, implants, and grafts (T82.868A)	116 (0.2)	2901 (3.1)	0.05 (0.01–0.18)
<b>Disposition from ED</b>			
Discharge home or with home health	59,526 (95.2)	99,645 (57.6)	Reference
Transfer to short-term hospital	93 (0.1)	727 (0.4)	0.21 (0.52–0.86)
Transfer to other facility <sup>e</sup>	119 (0.2)	5720 (3.3)	0.03 (0.02–0.05)
Against medical advice	580 (0.9)	4320 (2.5)	0.22 (0.10–0.51)
Admitted as inpatient	2155 (3.4)	62,280 (36.0)	0.06 (0.02–0.20)
Died in ED	0 (0.0)	142 (0.0)	–
Unknown	31 (0.0)	5 (0.0)	0.92 (0.29–2.90)
<b>Median household income by zip code</b>			
0–25th percentile	26,427 (42.4)	83,655 (49.0)	Reference
26–50th percentile	19,410 (31.1)	39,064 (22.9)	1.57 (1.09–2.28)
51–75th percentile	9599 (15.4)	27,913 (16.4)	1.09 (0.65–1.82)
76th–100th percentile	6919 (11.1)	19,947 (11.7)	1.10 (0.61–1.98)
<b>ED charges</b>			
			Difference
Per visit – mean (95% CI)	\$5,992.32; (4,946.70–7,037.93)	\$10,985.87; (9,831.91–12,139.82)	4,993.55; (4,885.21–5,101.89)
Total across nation (millions)	\$374.5	\$1,899.3	1,524.8

<sup>a</sup>Because of rounding, not all percentages sum to 100%<sup>b</sup>Relative odds ratios depict odds of insurance status relative to the reference category. For example, the odds of being uninsured in the age group 45–64 is 0.57 times the odds of being uninsured in the age group 18–44.<sup>c</sup>Northeast: Maine, Vermont, New York, Massachusetts, Rhode Island, Connecticut, New Jersey; Midwest: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Ohio; South: Texas, Arkansas, Mississippi, Florida, Georgia, South Carolina, North Carolina, Tennessee, Kentucky; West: Montana, Oregon, Wyoming, Colorado, California, Nevada, Utah, Arizona.<sup>d</sup>I12.0: Hypertensive Chronic Kidney Disease with Stage 5 Chronic Kidney Disease or End Stage Renal Disease.<sup>e</sup>Including skilled nursing or intermediate care.

Abbreviations: CI, confidence interval; CKD, chronic kidney disease; ED, emergency department; ESRD, end-stage renal disease; HD, hemodialysis; T2DM, type 2 diabetes mellitus.

decompensation requiring emergency care. This is plausible because, although all patients in our study had a total LOS of 1 day or less, there was a large disparity in discharge rates between uninsured and insured visits. Insured patients were much more likely to be admitted (36% of insured patients were admitted as an inpatient versus 3.4% of uninsured). As total charges per visit were also much higher for the insured (\$10,985.87 vs 5,992.32), the difference in inpatient status may represent the need for more costly treatment options secondary to decompensation but could also reflect adverse financial incentives. These driving factors are beyond the scope of this study and warrant further investigation, but with the enormous price that comes with ED HD, solutions targeting the health care burden of ED HD also need to reflect the insured HD population.

Novel solutions are needed to provide adequate dialysis treatment for the ESKD population. One possible solution is to provide scheduled outpatient dialysis (HD and PD) for uninsured ESKD patients. Since 2019, Harris County (Houston, TX, USA) has established a county-funded dialysis clinic for undocumented immigrants.<sup>3</sup> The county has also partnered with private dialysis facilities to reduce the burden on the individual county hospitals and to offer more treatment options. Broader initiatives include federal funding, which could mirror the current use of Medicaid in some states, and ESKD Seamless Care Organizations (ESCO).<sup>17</sup> The ESCO model, a pilot project of a type of affordable care organization for ESKD patients sponsored by Medicare, has demonstrated improvement in care and reduction in costs through a greater availability of outpatient dialysis services with centers providing quality-measured treatment outside of conventional hours.<sup>29</sup> In addition to ESCO, another cost-effective option is at-home PD.<sup>3,30</sup> Increasing access to these novel treatment resources could lead to better outcomes, quality measures, and care use at reduced cost for both uninsured and insured ESKD patients.

In conclusion, we found that in 2017 there were over 235,000 ED visits associated with emergent dialysis treatment. These visits totaled >\$2.2 billion in hospital charges. Because of the large size and enormous charges associated with emergent HD, policymakers should consider expanding alternate dialysis treatment modalities for both uninsured and insured patients with ESKD.

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## CONFLICTS OF INTEREST

The authors have no disclosures to report.

## AUTHOR CONTRIBUTIONS

Henry Wang designed the study. Summer Chavez, Julianna West, Hei Kit Chan, analyzed the data. Summer Chavez, Julianna West made the figures. Henry Wang, Summer Chavez, Julianna West, Hei Kit Chan, Donald Molony, John Foringer, Ryan Huebinger, and David Robinson

drafted and revised the paper. All authors approved the final version of the manuscript.

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