Medicaid Expansion and Medicare-Financed Hospitalizations Among Adult Patients With Incident Kidney Failure

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Abstract

IMPORTANCE Although Medicare provides health insurance coverage for most patients with kidney failure in the US, Medicare beneficiaries who initiate dialysis without supplemental coverage are exposed to substantial out-of-pocket costs. The availability of expanded Medicaid coverage under the Patient Protection and Affordable Care Act (ACA) for adults with kidney failure may improve access to care and reduce Medicare-financed hospitalizations after dialysis initiation.

OBJECTIVE To examine the implications of the ACA’s Medicaid expansion for Medicare-financed hospitalizations, health insurance coverage, and predialysis nephrology care among Medicare-covered adults aged 19 to 64 years with incident kidney failure in the first year after initiating dialysis.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional study used a difference-in-differences approach to assess Medicare-financed hospitalizations among adults aged 19 to 64 years who initiated dialysis between January 1, 2010, and December 31, 2018, while covered by Medicare Part A (up to 5 years postexpansion). Data on patients were obtained from the Renal Management Information System’s End Stage Renal Disease Medical Evidence Report, which includes data for all patients initiating outpatient maintenance dialysis regardless of health insurance coverage, treatment modality, or citizenship status, and these data were linked with claims data from the Medicare Provider Analysis and Review. Data were analyzed from January to August 2022.

EXPOSURE Living in a Medicaid expansion state.

MAIN OUTCOMES AND MEASURES Primary outcomes were number of Medicare-financed hospitalizations and hospital days in the first 3 months, 6 months, and 12 months after dialysis initiation. Secondary outcomes included dual Medicare and Medicaid coverage at 91 days after dialysis initiation and the presence of an arteriovenous fistula or graft at dialysis initiation for patients undergoing hemodialysis.

RESULTS The study population included 188,671 adults, with 97,071 living in Medicaid expansion states (mean [SD] age, 53.4 [9.4] years; 58,329 men [60.1%]) and 91,600 living in nonexpansion states (mean [SD] age, 53.0 [9.6] years; 52,677 men [57.5%]). In the first 3 months after dialysis initiation, Medicaid expansion was associated with a significant decrease in Medicare-financed hospitalizations (−4.24 [95% CI, −6.70 to −1.78] admissions per 100 patient-years; \(P = .001\)) and hospital days (−0.73 [95% CI, −1.08 to −0.39] days per patient-year; \(P < .001\)), relative reductions of 8% for both outcomes. Medicaid expansion was associated with a 2.58–percentage point (95% CI, 0.88-4.28 percentage points; \(P = .004\)) increase in dual Medicare and Medicaid coverage at 91 days after dialysis initiation and a 1.65–percentage point (95% CI, 0.31-3.00 percentage points; \(P = .02\)) increase in arteriovenous fistula or graft at initiation.

(continued)

Key Points

Question Was Medicaid expansion under the Patient Protection and Affordable Care Act (ACA) associated with lower rates of Medicare-financed hospitalizations among adults with incident kidney failure?

Findings In this cross-sectional study of 188,671 US adults aged 19 to 64 years with kidney failure initiating dialysis, the ACA Medicaid expansion was associated with a reduction in the number of Medicare-financed hospitalizations in the first 3 months after dialysis initiation.

Meaning Findings of this study suggest that decreases in Medicare-financed hospitalizations may indicate favorable spillover outcomes from the ACA’s Medicaid expansion to Medicare through reduced spending on hospitalizations among a clinically complex patient population.

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CONCLUSIONS AND RELEVANCE  In this cross-sectional study with a difference-in-differences analysis, the ACA’s Medicaid expansion was associated with decreases in Medicare-financed hospitalizations and hospital days and increases in dual Medicare and Medicaid coverage. These findings suggest favorable spillover outcomes of Medicaid expansion to Medicare-financed care, which is the primary payer for patients with kidney failure.

Introduction

Nearly 800,000 people in the US have kidney failure, with Black and Hispanic or Latino populations and those with low household incomes disproportionately affected.1-3 Among persons with kidney failure treated with dialysis, the period immediately after initiating dialysis carries substantial risk of mortality, frequent hospitalizations, infections, and cardiovascular events.4-6 Although mortality rates have declined in recent years, reported mortality rates among patients with incident kidney failure were 8% at 90 days and 22% at 1 year.7

Medicare is the primary insurer for individuals in the US aged 65 years and older as well as those younger than 65 with disabilities who receive Social Security Disability Insurance (SSDI). Medicare also provides health insurance coverage for most patients with kidney failure, and coverage begins at 91 days after initiating in-center hemodialysis or at the time of enrolling in training for home-based dialysis. In 2017, Medicare fee-for-service spending for all beneficiaries with kidney failure was approximately $36 billion (or 6% of total spending).1 However, Medicare beneficiaries who initiate dialysis without supplemental coverage (eg, Medigap plans, employer-sponsored retiree benefits, or Medicaid) are exposed to substantial out-of-pocket costs, and Medicare Part D prescription drug coverage requires premiums and cost sharing.8,9 As part of the Patient Protection and Affordable Care Act (ACA), states had the option of expanding Medicaid eligibility to adults with low household incomes, and as of April 2022, 38 states and the District of Columbia have done so.10 Medicaid expansion has had favorable outcomes for patients with kidney disease, including increases in health insurance coverage, Medicaid-covered preemptive listings for kidney transplantation, and 1-year survival after dialysis initiation.11,12 State Medicaid expansion decisions and Medicaid generosity (eg, levels of state Medicaid coverage) are associated with lower kidney failure incidence and increased use of an arteriovenous fistula or graft at dialysis initiation.13,14

In addition to providing assistance with Medicare premiums and cost sharing,15 Medicaid expansion may facilitate access to predialysis nephrology care for adult patients initiating dialysis,8 thereby preventing complications and reducing the number of Medicare-financed hospitalizations and hospital days immediately after dialysis initiation. These implications may be evident among adults with low household incomes eligible for Medicaid after the ACA and for those who were previously eligible for Medicaid but enrolled in the program after the ACA expansions, a phenomenon sometimes referred to as the woodwork or welcome mat effect. The aim of the study was to examine the implications of Medicaid expansion for Medicare-financed hospitalizations, health insurance coverage, and receipt of predialysis nephrology care among Medicare-covered adults aged 19 to 64 years with incident kidney failure.

Methods

Study Design

In this cross-sectional study, we used a difference-in-differences approach to compare changes in the number of Medicare-financed hospitalizations, health insurance coverage, and receipt of predialysis nephrology care over time in Medicaid expansion vs nonexpansion states. The study population
included persons aged 19 to 64 years with kidney failure who initiated dialysis between January 1, 2010, and December 31, 2018, while covered by Medicare Part A. The study period included 4 years during which patients initiated treatment before Medicaid expansion (2010-2013) and 5 years after expansion (2014-2018). Consistent with previous work, we considered expansion states as those that implemented the ACA’s Medicaid expansion from 2014 and afterward and excluded 5 states that extended Medicaid eligibility to adults with low household incomes between 2010 and 2013 (eTable 1 in the Supplement). Each state’s postexpansion period was defined by its own implementation date, which was January 1, 2014, for most states. The Brown University Institutional Review Board and the Centers for Medicare & Medicaid Services (CMS) Privacy Board approved the study protocol and waived the requirement for informed consent because only deidentified data were used. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies.

Data Sources
We used data from the Renal Management Information System’s End Stage Renal Disease Medical Evidence Report (CMS 2728), which is completed for all people initiating outpatient maintenance dialysis regardless of health insurance coverage, treatment modality, or citizenship status. Because CMS 2728 includes patients’ primary mailing addresses, we geolocated patients into US Census tracts using ArcGIS spatial mapping software, version 10.5.1 (Esri). Hospitalizations were assessed by linking the CMS 2728 data to the Medicare Provider Analysis and Review, which includes information about all Medicare-financed hospitalizations, including primary diagnoses and number of hospital days. Data sets were linked using patients’ Medicare beneficiary identifiers. We included patients with both traditional Medicare and Medicare Advantage because the Medicare Provider Analysis and Review includes more than 90% of hospitalizations for enrollees in Medicare Advantage. The 2009 to 2013 American Community Survey data provided the poverty rate in each patient’s US Census tract.

Outcomes
The primary outcomes were the number of Medicare-financed acute care hospitalizations and number of acute care hospital days in the first 3 months, 6 months, and 12 months after initiation of dialysis. Secondary outcomes were dual Medicare and Medicaid coverage at 91 days after dialysis initiation, receipt of predialysis nephrology care, presence of arteriovenous fistula (AVF) or graft at dialysis initiation for patients undergoing hemodialysis, receipt of home dialysis, and dialysis type at initiation (hemodialysis vs peritoneal dialysis). We also assessed hospitalizations due to cardiovascular disease or infectious conditions using the US Renal Data System’s approach to classify these conditions. We attributed hospitalizations to the quarter of the patient’s date of dialysis initiation.

Statistical Analysis
Data were analyzed from January to August 2022. We used a linear regression model with Huber-White robust SEs clustered at the state level. Covariates included age, sex, race and ethnicity, primary cause of kidney failure, presence of congestive heart failure, atherosclerotic heart disease, other cardiac disease, hypertension, diabetes, diabetic retinopathy, cancer, obesity (body mass index >30, calculated as weight in kilograms divided by height in meters squared), smoking status, alcohol dependence, and hemoglobin and serum albumin levels at dialysis initiation. The CMS 2728 specifies that a patient’s race and ethnicity should be collected using patient self-report at treatment initiation and was classified as Hispanic or Latino, non-Hispanic African American or Black, non-Hispanic Asian, non-Hispanic White, or non-Hispanic other race (American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or other race). Consistent with previous work, for observations missing serum albumin and hemoglobin levels, we used the mean value of the covariates for nonmissing observations. All models included state and year-quarter fixed effects.
Analyses were conducted in Stata, version 17 (StataCorp LLC) and used 2-tailed hypothesis testing with a significance threshold of $P < .05$.

We compared characteristics of persons with kidney failure aged 19 to 64 years who had Medicare Part A at treatment initiation vs those who did not during the study period to assess the generalizability of our findings. To assess the validity of the difference-in-differences study design and to test the robustness of the findings, we conducted several sensitivity analyses (eAppendix in the Supplement). First, we visually inspected preexpansion trends. Using quarterly data before 2014, we then tested the statistical significance of an expansion-by-time trend and separately used a categorical time specification. Second, we reran the analyses to include states that expanded Medicaid before January 1, 2014, or late-expanding states (eTable 1 in the Supplement). Third, we examined changes in patient characteristics over time by state expansion status to account for potential shifts in patient composition. Fourth, we used a Poisson model to examine changes in number of hospital days. Fifth, we ascertained the sensitivity of the results to inclusion and exclusion of hemoglobin and serum albumin levels in the risk-adjusted model and included missing hemoglobin and serum albumin levels as an indicator variable. Sixth, we modeled the postperiod as an event study (comparing annual changes in outcomes to a pooled preperiod), for which a state’s postexpansion period was defined by its own implementation date (eTable 1 in the Supplement). Seventh, in exploratory analyses, we examined whether there were differential changes in outcomes by age, sex, race and ethnicity, or area-level poverty (ie, living in a US Census tract where 20% or more of the population was living below the poverty threshold, which varies based on the size of the family and number of children in the household) by testing the significance of 3-way interactions among expansion status, time period, and each characteristic. In addition, to account for the competing risk of death, we calculated mortality rates within 3-month, 6-month, and 12-month periods after initiating treatment.

Results

The study population included 188 671 adults aged 19 to 64 years who initiated dialysis while covered by Medicare Part A. Of this total, 97 071 resided in Medicaid expansion states (mean [SD] age, 53.4 [9.4] years; 58 329 men [60.1%] and 38 742 women [39.9%]; 13.3% Hispanic or Latino, 26.4% non-Hispanic African American or Black, 3.4% non-Hispanic Asian, and 54.5% non-Hispanic White individuals and 2.5% non-Hispanic individuals of other races), and 91 600 resided in nonexpansion states (mean [SD] age, 53.0 [9.6] years; 52 677 men [57.5%] and 38 923 women [42.5%]; 12.6% Hispanic or Latino, 40.2% non-Hispanic African American or Black, 1.0% non-Hispanic Asian, and 45.0% non-Hispanic White individuals and 1.2% non-Hispanic individuals of other races) (Table 1). The most common original reason for Medicare eligibility among both groups was disability insurance benefits (59.5% in expansion states, 51.9% in nonexpansion states) and disability and end-stage kidney disease (24.5% in expansion states, 29.7% in nonexpansion states).

Primary and Secondary Outcomes

In the first 3 months after dialysis initiation, Medicaid expansion was associated with a significant decrease in Medicare-financed acute care hospitalizations ($-4.24$ [95% CI, $-6.70$ to $-1.78$] admissions per 100 patient-years; $P = .001$) and acute care hospital days ($-0.73$ [95% CI, $-1.08$ to $-0.39$] days per patient-year; $P < .001$), with relative reductions of 8% (Table 2, Figure 1). Medicaid expansion was also associated with significant decreases in hospitalizations ($-5.79$ [95% CI, $-10.36$ to $-1.23$] admissions per 100 patient-years; $P = .01$) in the first 6 months after initiation of dialysis (eFigures 1 and 2 in the Supplement).

Medicaid expansion was associated with a 2.58-percentage point increase (95% CI, 0.88-4.28 percentage points; $P = .004$) in dual Medicare and Medicaid coverage at 91 days after dialysis initiation (a 6% relative increase) (Table 2, Figure 2A). Although there were no statistically significant differences in receipt of predialysis nephrology care, home dialysis, or dialysis type (hemodialysis or
peritoneal) by state expansion status (eFigures 3 and 4 in the Supplement). Medicaid expansion was associated with a significant 1.65–percentage point increase (95% CI, 0.31-3.00 percentage points; \( P = .02 \)) in the presence of an AVF or graft at dialysis initiation for patients undergoing hemodialysis (a 7% relative increase) (Figure 2B).

Medicaid expansion was associated with a significant reduction in the number of hospital days for cardiac conditions in the 3 months after dialysis initiation (−0.13 [95% CI, −0.24 to −0.01] days per patient-year; \( P = .04 \)) (Table 3; eFigures 5-7 in the Supplement). Medicaid expansion was also associated with significant decreases in the number of hospitalizations related to infections at 3 months (−1.55 [95% CI, −2.41 to −0.68] admissions per 100 patient-years; \( P < .001 \)), 6 months (−1.76

### Table 1. Characteristics of Adults Aged 19 to 64 Years With Medicare Part A Coverage at Dialysis Initiation by State Medicaid Expansion Status, 2010 to 2018

| Characteristic                                | Residing in expansion states (n = 97 071) | Residing in nonexpansion states (n = 91 600) | \( P \) value |
|-----------------------------------------------|-------------------------------------------|---------------------------------------------|--------------|
| Age, mean (SD), y                             | 53.4 (9.4)                                | 53.0 (9.6)                                  | <.001        |
| Age category, y                               |                                           |                                             |              |
| 19-34                                         | 5442 (5.6)                                | 5516 (6.0)                                  | <.001        |
| 35-44                                         | 10 739 (11.1)                             | 11 114 (12.1)                               | <.001        |
| 45-54                                         | 26 075 (26.9)                             | 25 171 (27.5)                               | <.001        |
| 55-64                                         | 54 815 (56.5)                             | 49 799 (54.4)                               | <.001        |
| Sex                                           |                                           |                                             |              |
| Male                                          | 58 329 (60.1)                             | 52 677 (57.5)                               | <.001        |
| Female                                        | 38 742 (39.9)                             | 38 923 (42.5)                               |              |
| Race and ethnicity                            |                                           |                                             |              |
| Hispanic or Latino                            | 12 925 (13.3)                             | 11 507 (12.6)                               | <.001        |
| Non-Hispanic African American or Black        | 25 585 (26.4)                             | 36 787 (40.2)                               | <.001        |
| Non-Hispanic Asian                            | 3276 (3.4)                                | 946 (1.0)                                   | <.001        |
| Non-Hispanic White                            | 52 902 (54.5)                             | 41 217 (45.0)                               | <.001        |
| Non-Hispanic other race\(^c\)                | 2383 (2.5)                                | 1143 (1.2)                                  |              |
| Original reason for Medicare entitlement      |                                           |                                             |              |
| Old age and survivor’s insurance              | 460 (0.5)                                 | 407 (0.4)                                   | .34          |
| Disability insurance benefits                 | 57 784 (59.5)                             | 47 572 (51.9)                               | <.001        |
| End-stage kidney disease                      | 15 037 (15.5)                             | 16 429 (17.9)                               | <.001        |
| Disability and end-stage kidney disease       | 23 790 (24.5)                             | 27 192 (29.7)                               | <.001        |
| Primary cause of kidney failure\(^d\)         |                                           |                                             |              |
| Diabetes                                      | 47 398 (48.8)                             | 44 327 (48.4)                               | .06          |
| Hypertension                                  | 18 300 (18.9)                             | 21 521 (23.5)                               | <.001        |
| Other                                         | 31 367 (32.3)                             | 25 740 (28.1)                               | <.001        |
| Comorbid conditions                           |                                           |                                             |              |
| Congestive heart failure                      | 25 101 (25.9)                             | 23 172 (25.3)                               | .005         |
| Atherosclerotic heart disease                 | 12 111 (12.5)                             | 10 572 (11.5)                               | <.001        |
| Other cardiac disease                         | 15 952 (16.4)                             | 14 734 (16.1)                               | .04          |
| Hypertension                                  | 84 366 (86.9)                             | 81 511 (89.0)                               | <.001        |
| Diabetes                                      | 60 257 (62.1)                             | 57 715 (63.0)                               | <.001        |
| Diabetic retinopathy                          | 9895 (10.2)                               | 9006 (9.8)                                  | .009         |
| Cancer                                        | 4366 (4.5)                                | 3759 (4.1)                                  |              |
| BMI >30 (obesity)\(^e\)                      | 46 654 (48.1)                             | 45 652 (49.8)                               | <.001        |
| Current smoker                                | 8476 (8.7)                                | 8666 (9.5)                                  | <.001        |
| Alcohol dependence                            | 1792 (1.8)                                | 1492 (1.6)                                  | <.001        |
| Hemoglobin level, mean (SD), g/dl\(^f\)      | 9.65 (7.91)                               | 9.69 (14.65)                                | .49          |
| Serum albumin level, mean (SD), g/dl\(^g\)   | 3.22 (2.48)                               | 3.19 (3.32)                                 | .03          |
| % Of patients in US Census tract living below poverty threshold, mean (SD)\(^h\) | 20.06 (11.02) | 22.12 (10.52) | <.001 |

Abbreviation: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).

SI conversion factors: To convert albumin level to grams per liter, multiply by 10; to convert hemoglobin level to grams per liter, multiply by 10.

\(^a\) Sample deduplicated patients with multiple events because there were 190 378 events for 188 671 patients, and the first observation in the End Stage Renal Disease Medical Evidence Report was used.

\(^b\) Individuals initiated dialysis between January 1, 2010, and December 31, 2018.

\(^c\) Other races included American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and those who marked “other” race.

\(^d\) The primary cause of kidney failure was missing for less than 1% of patients residing in expansion (\( n = 6 \)) and nonexpansion states (\( n = 12 \)). Other primary causes include, for example, glomerulonephritis, interstitial nephritis or pyelonephritis, and transplant complications.

\(^e\) Obesity data were missing for less than 1% of patients residing in expansion (\( n = 381 \)) and nonexpansion states (\( n = 356 \)).

\(^f\) Hemoglobin levels were missing for 15.0% of patients residing in expansion states (\( n = 14 531 \)) and 18.7% of patients residing in nonexpansion states (\( n = 17 148 \)).

\(^g\) Serum albumin levels were missing for 32.4% of patients residing in expansion states (\( n = 31 453 \)) and 30.6% of patients residing in nonexpansion states (\( n = 28 050 \)).

\(^h\) Area-level poverty refers to the US Census tract–level proportion of the population living below the poverty threshold, which varies based on the size of the family and number of children in the household.
[95% CI, −3.06 to −0.46] admissions per 100 patient-years; \( P = .009 \), and 12 months (−3.23 [95% CI, −5.41 to −1.06] admissions per 100 patient-years; \( P = .004 \)) after dialysis initiation (Table 3; eFigures 8-10 in the Supplement). Medicaid expansion was also associated with fewer hospital days for infection-related hospitalizations 3 months (−0.22 [95% CI, −0.34 to −0.09] days per patient-year; \( P = .001 \)) and 6 months (−0.22 [95% CI, −0.40 to −0.04] days per patient-year; \( P = .02 \)) after dialysis initiation.

### Table 2. Changes in Medicare and Medicaid Coverage, Predialysis Nephrology Care, All-Cause Hospitalization Rates, and Number of Hospital Days Among Adults Aged 19 to 64 Years Initiating Dialysis After Medicaid Expansion

| Outcome                                      | Expansion states | Nonexpansion states | Adjusted difference-in-differences estimate (95% CI) | \( P \) value |
|----------------------------------------------|------------------|---------------------|-----------------------------------------------------|--------------|
| **Primary outcomes**                         |                  |                     |                                                     |              |
| No. of hospital admissions per 100 patient-years |                  |                     |                                                     |              |
| 3 mo After dialysis initiation               | 58.43            | 51.05               | −7.38                                               |              |
| 6 mo After dialysis initiation               | 103.80           | 92.12               | −11.67                                              |              |
| 12 mo After dialysis initiation              | 182.20           | 165.87              | −16.33                                              |              |
| No. of hospital days per patient-year        |                  |                     |                                                     |              |
| 3 mo After dialysis initiation               | 8.46             | 6.94                | −1.52                                               |              |
| **Secondary outcomes**                       |                  |                     |                                                     |              |
| Dual Medicare and Medicaid coverage          | 45.30            | 48.96               | 3.66                                                | 2.58 (0.88 to 4.28) | .004 |
| Receipt of predialysis nephrology care\(b\)  | 76.35            | 81.54               | 5.19                                                | 0.93 (−0.08 to 1.95) | .07  |
| Arteriovenous fistula or graft\(c\)          | 23.84            | 24.68               | 0.84                                                | 1.65 (0.31 to 3.00) | .02  |
| Home dialysis                                | 16.80            | 18.47               | 1.67                                                | 0.05 (−1.44 to 1.54) | .95  |
| Type of dialysis at initiation               |                  |                     |                                                     |              |
| Hemodialysis                                 | 83.99            | 82.31               | −1.68                                               | −0.03 (−0.14 to 0.31) | .97  |
| Peritoneal dialysis                          | 16.01            | 17.69               | 1.68                                                | 1.74 (0.31 to 3.18) | .97  |

\( a \) Point estimates at baseline and postexpansion are unadjusted. Adjusted models included indicators for Medicaid expansion, the postperiod, and their interaction (expansion \( \times \) postperiod). A state's postperiod was defined by its own implementation date, which was January 1, 2014, for most expansion states. Models were also adjusted for age, sex, race and ethnicity, primary cause of kidney failure, comorbid conditions, current smoker status, alcohol dependence, body mass index, hemoglobin and serum albumin levels at dialysis initiation, and area-level poverty. The model included quarter-year and state fixed effects, and SEs were clustered at the state level.

\( b \) This variable was unknown for 12.0% of patients.

\( c \) This variable was unknown for 18.2% of patients and included only patients undergoing dialysis. Estimates for number of hospital days per patient-year 6 and 12 months after dialysis initiation were excluded because trends between Medicaid expansion and nonexpansion states were not parallel.

### Figure 1. Changes in All-Cause Hospitalizations and Hospital Days Within 3 Months of Dialysis Initiation

A Hospitalization rate

B Hospitalization days

Expansion states were limited to those that expanded Medicaid coverage in 2014 and exclude those that did not expand in 2015 and afterward. The vertical line represents Medicaid expansion in 2014.
Sensitivity Analysis

A total of 212,221 persons (37.8%) aged 19 to 64 years with kidney failure who initiated dialysis had Medicare Part A coverage (eTable 2 in the Supplement). There were several differences in sociodemographic and clinical characteristics between adult persons aged 19 to 64 years with kidney failure who initiated dialysis and had Medicare Part A coverage compared with those who did not have such coverage. Before 2014, trends in outcomes were not statistically different by state expansion status for all outcomes except number of all-cause hospital days per patient-year within 6
months and 12 months of dialysis initiation. We therefore did not investigate the implications of Medicaid expansion for these outcomes (eTable 3, eFigures 11-16 in the Supplement). There were some changes in the characteristics of persons with kidney failure over time in both expansion and nonexpansion states, but these changes were modest (eTable 4 in the Supplement). Estimates were robust to different model specifications, although magnitudes of differences were attenuated when we included states that expanded Medicaid before 2014 (eTable 5 in the Supplement). Estimates using Poisson models were similar in direction and statistical significance, although the magnitude of differences was smaller compared with the main model. There was some variation in changes over time when respecifying the postperiod as an event study (eTable 6 in the Supplement). In exploratory analyses of differential outcomes by patient sociodemographic characteristics, we observed only statistically larger increases in dual Medicare and Medicaid coverage at 91 days after dialysis initiation among Hispanic or Latino patients (change by expansion status, 7.40 percentage points) compared with White patients (change by expansion status, 1.81 percentage points; 3-way interaction, 5.59 [95% CI, 3.32-7.86] percentage points; \( P < .001 \)) (eTables 7-15 in the Supplement). We did not identify statistically significant changes in 3- and 6-month mortality rates by state expansion status; however, Medicaid expansion was associated with a significantly lower 12-month mortality rate (0.55 [95% CI, −1.09 to −0.01] deaths per 100 patient-years; \( P = .04 \)) (eTable 16 in the Supplement).

**Discussion**

Among adults aged 19 to 64 years with kidney failure and Medicare coverage who initiated dialysis, Medicaid expansion was associated with a decrease in Medicare-financed hospitalizations 3 months after dialysis initiation and decreases in the number of hospital days at 3 and 6 months after dialysis initiation. Medicaid expansion was also associated with increases in dual Medicare and Medicaid health insurance coverage, particularly for Hispanic or Latino patients with kidney failure. Although there were no significant changes in the receipt of predialysis nephrology care, rates of dialysis initiation with an AVF or graft present among patients undergoing hemodialysis significantly increased in states that expanded Medicaid. Building on previous work, findings of the present study suggest that, among Medicare beneficiaries aged 19 to 64 years with incident kidney failure, Medicaid expansion was associated with a significant decrease in mortality rates 12 months after dialysis initiation.11

This study builds on the previous literature in 3 ways: first, it provides new information about the implications of Medicaid expansion for health insurance coverage gains among those already eligible preexpansion. Previous studies indicated that Medicaid expansion was associated with increases in Medicaid coverage among patients with incident kidney failure.11,13 The present study sample was composed of people who had Medicare coverage at dialysis initiation, most of whom were eligible for Medicare because of disability through SSDI. In most states before implementation of the ACA, SSDI Medicare beneficiaries aged 19 to 64 years were eligible only for supplemental Medicaid coverage if they concurrently received Supplemental Security Income disability, which is strictly means tested for disabled individuals.23,24 The ACA expanded access to Medicaid for SSDI recipients aged 19 to 64 years with low household incomes in addition to increasing Medicaid participation among those already eligible for coverage because of publicity, enrollment efforts, and other factors, which is sometimes referred to as the woodwork or welcome mat effect.25,26 Recent evidence suggests that Medicaid expansion was associated with increases in dual Medicare and Medicaid coverage for older adults with low household incomes and individuals with disabilities.25 This study supports these estimates, suggesting that patients with incident kidney failure had pronounced increases in dual Medicare and Medicaid coverage after expansion.

Second, the present study contributes new evidence to the implications of Medicaid expansion for changes in care use. Some policy makers hypothesized that expanded Medicaid coverage could reduce acute hospitalizations by bolstering access to primary care and other outpatient care. Most
studies, however, have suggested that expanding Medicaid led to either increased hospitalizations or no changes in hospitalizations.\textsuperscript{16,27-29} Findings of the present study, which used national data and focused on a high-need and clinically complex patient population, suggest that Medicaid expansion was associated with significant reductions in all-cause and infection-related hospitalizations. These results align with past work finding that, among Medicare beneficiaries, particularly those with chronic conditions, lower cost sharing may increase access to effective outpatient care and generate offsetting reductions in acute hospitalizations.\textsuperscript{30,31} The present study's findings suggest spillovers from the ACA's Medicaid expansion to Medicare in the form of health benefits for Medicare enrollees and reduced spending on hospitalizations, the largest source of expenditures in the Medicare program.

Third, compared with other groups of Medicare beneficiaries, hospitalization rates are higher among people with kidney failure.\textsuperscript{32} There is evidence that the number of annual admissions and hospital days for all-cause, cardiovascular, and infection-related hospitalizations have been declining among all patients with kidney failure since 2007, which are trends observed in our study.\textsuperscript{22} For example, between 2007 and 2016, hospitalization rates for all patients undergoing dialysis decreased by approximately 15%, with 1 study noting that the decreases could be affected by changes in clinical care and policies that incentivize use of ambulatory care services.\textsuperscript{1,33} Findings of the present study suggest that, among patients aged 19 to 64 years initiating dialysis for incident kidney failure, reductions in hospitalizations and number of hospital days were more pronounced for patients residing in states that expanded Medicaid. The relative 8% decreases associated with Medicaid expansion were large in magnitude considering the secular trend between 2007 and 2016 was a 15% decline. This finding is critical because reducing hospitalizations among the population with kidney failure is a clinical and policy priority, including public reporting on hospitalization rates for dialysis facilities. Furthermore, Medicare is the primary payer for care among people with kidney failure, and hospitalizations account for approximately 40% of Medicare expenditures for patients undergoing dialysis.\textsuperscript{22} Significant decreases in 1-year mortality rates associated with Medicaid expansion support past findings\textsuperscript{11} and extend this work to Medicare beneficiaries initiating dialysis treatment.

Several studies have evaluated the role of health insurance coverage on access to care, and dual Medicare and Medicaid coverage may provide additional financial protection to access health services and medications for patients with low household incomes who are initiating dialysis.\textsuperscript{8,34} Although we did not identify significant changes in receipt of predialysis nephrology care by Medicaid expansion status, it is possible that increases in dual Medicare and Medicaid coverage changed accessibility to prescription drugs, primary care, or other specialty care that mitigated the number of hospitalizations and hospital days after dialysis initiation. The finding that Medicaid expansion was associated with increases in AVF may provide a mechanism for the outcomes studied: placement of permanent vascular access has been associated with fewer hospitalizations or emergency department use and lower mortality among patients with kidney failure.\textsuperscript{35,36} Initiating hemodialysis with an AVF has been associated with lower mortality compared with initiating dialysis with a catheter.\textsuperscript{11,37}

**Limitations**

This study has several limitations. First, the study sample was limited to individuals who initiated dialysis while covered by Medicare Part A insurance and may not be representative of the entire population with kidney failure. It is possible changes associated with Medicaid expansion would be different for those who initiate treatment without Medicare coverage. However, we found that nearly 40% of adults aged 19 to 64 years initiating maintenance dialysis had Medicare Part A coverage at the time of dialysis initiation. In addition, because the CMS 2728 is completed for patients initiating maintenance dialysis, individuals who received only dialysis for acute kidney failure and those who received dialysis in the hospital and died before initiating outpatient treatment were not included in the analysis. Second, we were restricted to events that occurred after a patient...
acquired Medicare coverage, and we did not have data on hospitalizations before enrollment in Medicare. Third, it is possible that we were unable to detect changes for subgroups because of smaller sample sizes. Fourth, the study period coincided with several changes in CMS rules around hospital stays (e.g., Hospital Readmissions Reduction Program in 2012, introduction of the Two-Midnight Rule in 2013), but it is unlikely that these rules would differentially affect states by expansion status. Fifth, although the difference-in-differences approach and inclusion of state fixed effects account for secular trends and potential state-specific policy contexts, it is plausible that changes or differences in outcomes for patients who initiated treatment for kidney failure were not associated with a state’s decision to expand Medicaid. Sixth, for the outcome examining changes in dialysis type at initiation, it is possible that individuals switched their dialysis type (hemodialysis vs peritoneal) after initiation. Seventh, we were unable to assess differences in hospitalization-related out-of-pocket costs because the data set did not include information such as having supplemental coverage or hospital networks (for Medicare Advantage beneficiaries). However, additional work to understand the potential changes in out-of-pocket costs associated with Medicaid expansion among Medicare beneficiaries with kidney failure is warranted.

Conclusions

In this cross-sectional study, Medicaid expansion was associated with decreases in Medicare-financed hospitalizations and fewer acute care hospital days in the first year after initiating dialysis, which is a high-risk period, as well as increases in dual Medicare and Medicaid coverage. This study suggests that there may have been favorable spillover outcomes of Medicaid expansion to Medicare-financed care, which is the primary payer for patients with kidney failure.
Mehrotra reported serving as chair of the Northwest Kidney Centers Board of Trustees and editor in chief of *Clinical Journal of the American Society of Nephrology*. Dr Trivedi reported receiving grants from the National Institute of Diabetes and Digestive and Kidney Diseases during the conduct of the study and the National Institute on Aging, National Institute on Minority Health and Health Disparities, Agency for Healthcare Research and Quality, US Department of Defense, and US Department of Veterans Affairs outside the submitted work. No other disclosures were reported.

**Funding/Support:** This study was funded by the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health (grant RO1DK113398-05, Dr Trivedi).

**Role of Funder/Sponsor:** The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**Disclaimer:** The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the US Department of Veterans Affairs or the US government.

**Meeting Presentation:** A preliminary version of these findings was presented at the AcademyHealth Annual Research Meeting; June 5, 2022; Washington, DC.

**REFERENCES**

1. United States Renal Data System. 2019 Annual Data Report. National Institutes of Health National Institute of Diabetes and Digestive and Kidney Diseases. Accessed August 24, 2022. [https://www.usrds.org/annual-data-report/](https://www.usrds.org/annual-data-report/)

2. Patzer RE, McClellan WM. Influence of race, ethnicity and socioeconomic status on kidney disease. *Nat Rev Nephrol*. 2012;8(9):533-541. doi:10.1038/nrneph.2012.117

3. Nguyen KH, Thorsness R, Swaminathan S, et al. Despite national declines in kidney failure incidence, disparities widened between low- and high-poverty US counties. *Health Aff (Millwood)*. 2021;40(12):1900-1908. doi:10.1377/hlthaff.2021.00458

4. Wachterman MW, O'Hare AM, Rahman O-K, et al. One-year mortality after dialysis initiation among older adults. *JAMA Intern Med*. 2019;179(7):987-990. doi:10.1001/jamainternmed.2019.0125

5. Chang CH, Fan -C, Kuo G, et al. Infection in advanced chronic kidney disease and subsequent adverse outcomes after dialysis initiation: a nationwide cohort study. *Sci Rep*. 2020;10(1):2938. doi:10.1038/s41598-020-59794-7

6. Collins AJ, Foley RN, Gilbertson DT, Chen S-C. The state of chronic kidney disease, ESRD, and morbidity and mortality in the first year of dialysis. *Clin J Am Soc Nephrol*. 2009;4(suppl 1):S5-S11. doi:10.2215/CJN.05980809

7. Saran R, Robinson B, Abbott KC, et al; United States Renal Data System. US renal data system 2017 annual data report: epidemiology of kidney disease in the United States. *Am J Kidney Dis*. 2018;71(3)(suppl 1):A7. doi:10.1053/j.ajkd.2018.01.002

8. Trivedi AN, Sommers BD. The Affordable Care Act, Medicaid expansion, and disparities in kidney disease. *Clin J Am Soc Nephrol*. 2018;13(3):480-482. doi:10.2215/CJN.10520917

9. Koma W, Cubanski J, Neuman T. *A Snapshot of Sources of Coverage Among Medicare Beneficiaries in 2018*. Kaiser Family Foundation; 2021.

10. Kaiser Family Foundation. Status of state Medicaid expansion decisions. Accessed February 14, 2022. [https://www.kff.org/medicaid/issue-brief/status-of-state-medicaid-expansion-decisions-interactive-map/](https://www.kff.org/medicaid/issue-brief/status-of-state-medicaid-expansion-decisions-interactive-map/)

11. Swaminathan S, Sommers BD, Thorsness R, Mehrotra R, Lee Y, Trivedi AN. Association of Medicaid expansion with 1-year mortality among patients with end-stage renal disease. *JAMA*. 2018;320(21):2242-2250. doi:10.1001/jama.2018.16504

12. Harhay MN, McKenna RM, Boyle SM, et al. Association between Medicaid expansion under the Affordable Care Act and preemptive listings for kidney transplantation. *Clin J Am Soc Nephrol*. 2018;13(7):1069-1078. doi:10.2215/CJN.00100118

13. Thorsness R, Swaminathan S, Lee Y, et al. Medicaid expansion and incidence of kidney failure among nonelderly adults. *J Am Soc Nephrol*. 2021;32(6):1425-1435. doi:10.1681/ASN.2020101511

14. Kurella-Tamura M, Goldstein BA, Hall YN, Mitani AA, Winkelmayer WC. State Medicaid coverage, ESRD incidence, and access to care. *J Am Soc Nephrol*. 2014;25(6):1321-1329. doi:10.1681/ASN.2013060658

15. Kirchhoff SM. Medicare coverage of end-stage renal disease (ESRD). Congressional Research Service. August 16, 2018. Accessed August 24, 2022. [https://sgp.fas.org/ars/misc/R45290.pdf](https://sgp.fas.org/ars/misc/R45290.pdf)

16. Wherry LR, Miller S. Early coverage, access, utilization, and health effects associated with the Affordable Care Act Medicaid expansions: a quasi-experimental study. *Ann Intern Med*. 2016;164(12):795-803. doi:10.7326/M15-2234
Medicaid Expansion and Medicare-Financed Hospitalizations Among Adult Patients With Incident Kidney Failure

17. Miller S, Wherry LR. Health and access to care during the first 2 years of the ACA Medicaid expansions. *N Engl J Med.* 2017;376(10):947-956. doi:10.1056/NEJMsa1612890

18. US Department of Health and Human Services; Centers for Medicare & Medicaid Services. End Stage Renal Disease Medical Evidence Report: Medicare entitlement and/or patient registration: form CMS-2728-U3. Accessed August 24, 2022. [https://www.cms.gov/medicare/cms-forms/cms-forms/downloads/cms2728.pdf](https://www.cms.gov/medicare/cms-forms/cms-forms/downloads/cms2728.pdf)

19. Nguyen KH, Thorsness R, Hayes S, et al. Evaluation of racial, ethnic, and socioeconomic disparities in initiation of kidney failure treatment during the first 4 months of the COVID-19 pandemic. *JAMA Netw Open.* 2021;4(10):e2127369. doi:10.1001/jamanetworkopen.2021.27369

20. Panagiotou OA, Kumar A, Gutman R, et al. Hospital readmission rates in Medicare Advantage and traditional Medicare: a retrospective population-based analysis. *Ann Intern Med.* 2019;171(2):99-106. doi:10.7326/M18-1795

21. Huckfeldt PJ, Escarce JJ, Rabideau B, Karaca-Mandic P, Sood N. Less intense postacute care, better outcomes for enrollees in Medicare Advantage than those in fee-for-service. *Health Aff (Millwood).* 2017;36(1):91-100. doi:10.1377/hlthaff.2016.1027

22. Sarah R, Robinson B, Abbott KC, et al. US renal data system 2016 annual data report: epidemiology of kidney disease in the United States. *Am J Kidney Dis.* 2017;69(3)(suppl 1):A7-A8. doi:10.1053/j.ajkd.2016.12.004

23. Musumeci M, Orega K. Supplemental Security Income for people with disabilities: implications for Medicaid. Kaiser Family Foundation. June 23, 2021. Accessed August 24, 2022. [https://www.kff.org/medicaid/issue-brief/supplemental-security-income-for-people-with-disabilities-implications-for-medicaid/](https://www.kff.org/medicaid/issue-brief/supplemental-security-income-for-people-with-disabilities-implications-for-medicaid/)

24. Social Security Administration. Overview of our disability programs. Accessed April 25, 2022. [https://www.ssa.gov/redbook/eng/overview-disability.htm?tl=0%2C1%2C2%2C3](https://www.ssa.gov/redbook/eng/overview-disability.htm?tl=0%2C1%2C2%2C3)

25. McNerney M, Mellor JM, Sabik LM. Welcome mats and on-ramps for older adults: the impact of the Affordable Care Act’s Medicaid expansions on dual enrollment in Medicare and Medicaid. *J Policy Anal Manage.* 2021;40(1):12-41. doi:10.1002/pam.22259

26. Frean M, Gruber J, Sommers BD. Premium subsidies, the mandate, and Medicaid expansion: coverage effects of the Affordable Care Act. *J Health Econ.* 2017;53:72-86. doi:10.1016/j.jhealeco.2017.02.004

27. Garthwaite C, Graves JA, Gross T, Karaca Z, Marone VR, Notowidigdo MJ. All Medicaid expansions are not created equal: the geography and targeting of the Affordable Care Act. Brookings Institute. September 5, 2019. Accessed August 24, 2022. [https://www.brookings.edu/bpea-articles/all-medicaid-expansions-are-not-created-equal-the-geography-and-targeting-of-the-affordable-care-act/](https://www.brookings.edu/bpea-articles/all-medicaid-expansions-are-not-created-equal-the-geography-and-targeting-of-the-affordable-care-act/)

28. Finkelstein A, Taubman S, Wright B, et al; Oregon Health Study Group. The Oregon health insurance experiment: evidence from the first year. *QJE c o n.* 2012;127(3):1057-1106. doi:10.1093/qje/qjs020

29. Duggan M, Gupta A, Jackson E. The impact of the Affordable Care Act: evidence from California’s hospital sector. *Am Econ J Econ Policy.* 2022;14(1):111-151. doi:10.1257/pol.20190279

30. Trivedi AN, Moloo H, Mor V. Increased ambulatory care copayments and hospitalizations among the elderly. *N Engl J Med.* 2010;362(4):320-328. doi:10.1056/NEJMsa0904533

31. Chandra A, Gruber J, McKnight R. Patient cost-sharing and hospitalization offsets in the elderly. *Am Econ Rev.* 2010;100(1):193-213. doi:10.1257/aer.100.1.193

32. Srivastava A, Cai X, Mehta R, et al; CRIC Study Investigators. Hospitalization trajectories and risks of ESKD and death in individuals with CKD. *Kidney Int Rep.* 2021;6(6):1592-1602. doi:10.1016/j.ekir.2021.03.883

33. United States Renal Data System. 2020 Annual Data Report. National Institutes of Health National Institute of Diabetes and Digestive and Kidney Diseases; 2020. Accessed August 24, 2022. [https://adr.usrds.org/2020](https://adr.usrds.org/2020)

34. Sommers BD, Gawande AA, Baicker K. Health insurance coverage and health—what the recent evidence tells us. *N Engl J Med.* 2017;377(6):586-593. doi:10.1056/NEJMsa1706645

35. Lovasik BP, Zhang R, Hockenberry JM, et al. Trends in incident hemodialysis access and mortality. *JAMA Surg.* 2015;150(5):441-448. doi:10.1001/jamasurg.2014.3484
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