



Trends in Receipt of Intensive Procedures at the End of Life Among Patients Treated With Maintenance Dialysis

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Background: Many dialysis patients receive intensive procedures intended to prolong life at the very end of life. However, little is known about trends over time in the use of these procedures. We describe temporal trends in receipt of inpatient intensive procedures during the last 6 months of life among patients treated with maintenance dialysis.

Study Design: Mortality follow-back study.

Setting & Participants: 649,607 adult Medicare beneficiaries on maintenance dialysis therapy who died in 2000 to 2012.

Predictors: Period of death (2000-2003, 2004-2008, or 2009-2012), age at time of death (18-59, 60-64, 65-69, 70-74, 75-79, 80-84, and ≥ 85 years), and race/ethnicity (Hispanic, non-Hispanic black, or non-Hispanic white).

Outcome: Receipt of an inpatient intensive procedure (defined as invasive mechanical ventilation/intubation, tracheostomy, gastrostomy/jejunostomy tube insertion, enteral or parenteral nutrition, or cardiopulmonary resuscitation) during the last 6 months of life.

Results: Overall, 34% of cohort patients received an intensive procedure in the last 6 months of life, increasing from 29% in 2000 to 36% in 2012 (with 2000-2003 as the referent category; adjusted risk ratios [RRs] were 1.06 [95% CI, 1.05-1.07] and 1.10 [95% CI, 1.09-1.12] for 2004-2008 and 2009-2012, respectively). Use of intensive procedures increased more markedly over time in younger versus older patients (comparing 2009-2012 to 2000-2003, adjusted RR was 1.18 [95% CI, 1.15-1.20] for the youngest age group as opposed to 1.00 [95% CI, 0.96-1.04] for the oldest group). Comparing 2009 to 2012 to 2000 to 2003, the use of intensive procedures increased more dramatically for Hispanic patients than for non-Hispanic black or non-Hispanic white patients (adjusted RRs of 1.18 [95% CI, 1.14-1.22], 1.09 [95% CI, 1.07-1.11], and 1.10 [95% CI, 1.08-1.12], respectively).

Limitations: Data sources do not provide insight into reasons for observed trends in the use of intensive procedures.

Conclusions: Among patients treated with maintenance dialysis, there is a trend toward more frequent use of intensive procedures at the end of life, especially in younger patients and those of Hispanic ethnicity.

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INDEX WORDS: End-of-life; dialysis; intensive procedures; end-stage renal disease (ESRD); Hispanic; elderly; age differences; ethnic disparities; Medicare spending; health care costs; hospitalization; mortality follow-back.

A disproportionately high percentage of Medicare spending is directed at beneficiaries approaching the end of life.¹ For example, in 2011, Medicare spent ~\$170 billion, or 28% of its total budget, caring for beneficiaries in their last 6 months of life.² These high levels of health care spending at the end of life largely reflect intensive inpatient-oriented patterns of care directed at treating

underlying disease complications and lengthening survival.³⁻⁶ Despite increasing pressure to curb hospital length of stay and reduce readmission, rates of intensive care unit admission and use of intensive procedures (eg, cardiopulmonary resuscitation and mechanical ventilation) are becoming increasingly common among Medicare beneficiaries approaching the end of life.⁷⁻¹⁰

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The Medicare End-Stage Renal Disease (ESRD) Program provides comprehensive health insurance coverage for most patients receiving maintenance dialysis in the United States.¹¹ Available data suggest that patterns of inpatient use at the end of life for Medicare beneficiaries with ESRD are even more intensive than for those with cancer and some other chronic conditions.¹²⁻¹⁵ However, there is scant information about temporal trends in patterns of end-of-life care in this population and the extent to which these might parallel those described for the overall Medicare population. To address this knowledge gap, we examined temporal trends in the use of inpatient intensive procedures during the last 6 months of life among Medicare beneficiaries treated with maintenance dialysis.

METHODS

Study Population and Data Sources

We identified all patients in the US Renal Data System (USRDS) with a first ESRD service date for maintenance dialysis in 1995 or later who died during January 1, 2000, to December 31, 2012, and had not received a kidney transplant ($n = 1,024,990$). We excluded patients for whom Medicare Parts A and B were not the primary payer for dialysis throughout the last 6 months of life ($n = 316,858$) and those who were younger than 18 years or older than 100 years at the time of death ($n = 31,581$). To support race/ethnicity-stratified analyses, we limited the cohort to the subset of the remaining patients who were black, white, or Hispanic ($n = 649,607$; Fig 1).

We used information from the USRDS Patients file to ascertain age at time of death (categorized as 18-59, 60-64, 65-69, 70-74, 75-79, 80-84, and ≥ 85 years), sex, and race/ethnicity. We used Medicare Institutional and Physician Supplier inpatient and outpatient claims to ascertain comorbid conditions (diabetes

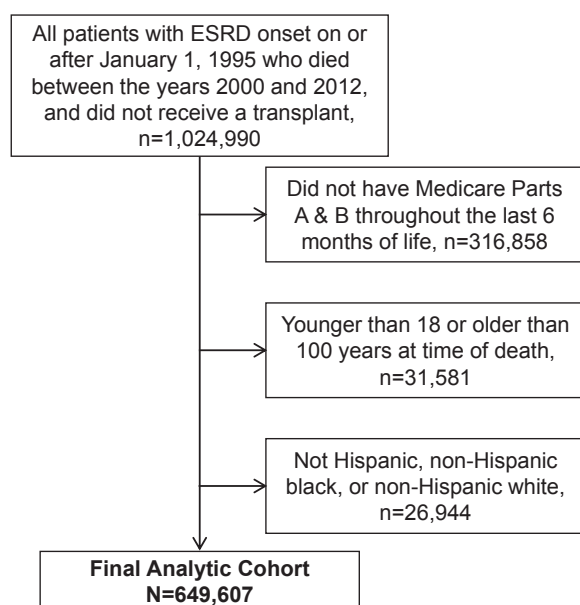


Figure 1. Study flow chart. Abbreviation: ESRD, end-stage renal disease.

mellitus, hypertension, dyslipidemia, emphysema, cirrhosis, dementia, cancer, coronary artery disease, stroke, peripheral arterial disease, and congestive heart failure) and Charlson Comorbidity Index score (Quan score) at a time point 6 months before death based on claims during the preceding 1-year period.¹⁶ We used the USRDS Payer History file to identify patients with dual Medicare-Medicaid eligibility 6 months before death. We calculated the time between dialysis therapy initiation and death (dialysis vintage) based on dates of death and first ESRD service for dialysis recorded in the USRDS Patients file. We used the USRDS Treatment History file to ascertain each patient's most recent dialysis modality before death. We also included information from the Dartmouth Atlas of Healthcare on age, sex, race, and price-adjusted health care costs for 2012 in each patient's hospital referral region of residence at the time of death.¹⁷

Outcomes

The primary outcome for this study was receipt of an inpatient intensive procedure, defined using an adaptation of a previously published approach.¹⁸ Intensive procedures were identified using *International Classification of Diseases, Ninth Revision* procedure codes for invasive mechanical ventilation/intubation (96.04, 96.05, and 96.7x), tracheostomy (31.1, 31.21, and 31.29), artificial nutrition including gastrostomy (43.2, 43.11, 43.19, and 44.32) and jejunostomy (46.32) tube insertion, enteral or parenteral nutrition (96.6 and 99.15), and cardiopulmonary resuscitation (99.60 and 99.63). We only considered procedures that were performed while the patient was in the hospital and within the last 6 months of life based on Medicare Institutional claims.¹⁸

Statistical Analysis

We described patient characteristics and use of intensive procedures during the last 6 months of life among patients who died in 1 of 3 sequential time periods (2000-2003, 2004-2008, and 2009-2012) using mean \pm standard deviation or median (interquartile range [IQR]) for continuous variables and percentage for categorical variables. We examined associations of age, race/ethnicity, and time period of death with receipt of an intensive procedure during the last 6 months of life using multivariable generalized linear models to estimate risk ratios (RRs). These analyses were adjusted for demographic characteristics, comorbid conditions, Quan score, dual eligibility status, dialysis vintage, dialysis modality, and quintile of hospital referral region health care spending. To evaluate whether age differences in trends in receipt of intensive procedures might reflect differences in burden of comorbid conditions, we conducted a sensitivity analysis examining associations of age and time period of death with receipt of an intensive procedure stratified by quartile of Quan score. We tested for the following interactions by multiplying race/ethnicity \times time period of death, race/ethnicity \times age category, time period of death \times age category, and race/ethnicity \times age category \times time period of death. Product terms were tested for statistical significance in a full model that included the main effect terms. We chose to report adjusted RRs rather than odds ratios due to the high frequency of the outcome in some subgroups.¹⁹ All analyses were conducted using Stata SE, version 13.1 (StataCorp LP). The Institutional Review Board at the University of Washington approved the study protocol (Human Subjects Division no. 46936). We obtained a waiver of informed consent because data were deidentified and all cohort patients were deceased at the time of our analyses. The Partners Healthcare Human Research Committee declared this study exempt from institutional review board review.

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