




# End-of-Life Care among US Adults with ESKD Who Were Waitlisted or Received a Kidney Transplant, 2005–2014

Catherine R. Butler <sup>1</sup>, Peter P. Reese <sup>2,3</sup>, James D. Perkins,<sup>4</sup> Yoshio N. Hall,<sup>1</sup> J. Randall Curtis,<sup>5</sup> Manjula Kurella Tamura <sup>6</sup>, and Ann M. O'Hare<sup>1,7</sup>

Due to the number of contributing authors, the affiliations are listed at the end of this article.

## ABSTRACT

**Background** The care of patients in the United States who have ESKD is often shaped by their hopes and prognostic expectations related to kidney transplant. Little is known about how patients' engagement in the transplant process might relate to patterns of end-of-life care.

**Methods** We compared six measures of intensity of end-of-life care among adults in the United States with ESKD who died between 2005 and 2014 after experiencing differing exposure to the kidney transplant process.

**Results** Of 567,832 decedents with ESKD, 27,633 (5%) had a functioning kidney transplant at the time of death, 14,653 (3%) had a failed transplant, 16,490 (3%) had been removed from the deceased donor waitlist, 17,010 (3%) were inactive on the waitlist, 11,529 (2%) were active on the waitlist, and 480,517 (85%) had never been waitlisted for or received a transplant (reference group). In adjusted analyses, compared with the reference group, patients exposed to the transplant process were significantly more likely to have been admitted to an intensive care unit and to have received an intensive procedure in the last 30 days of life; they were also significantly more likely to have died in the hospital. Those who died on the transplant waitlist were also less likely than those in the reference group to have been enrolled in hospice and to have discontinued dialysis before death.

**Conclusions** Patients who had engaged in the kidney transplant process received more intensive patterns of end-of-life care than other patients with ESKD. These findings support the relevance of advance care planning, even for this relatively healthy segment of the ESKD population.

JASN 31: ●●●–●●●, 2020. doi: <https://doi.org/10.1681/ASN.2020030342>

Kidney transplant is the preferred form of RRT for many patients with ESKD because it offers the opportunity for longer survival and better quality of life compared with remaining on dialysis.<sup>1,2</sup> However, only a small and relatively healthy segment of the ESKD population will ultimately receive a kidney.<sup>3</sup> Available evidence suggests that for patients with advanced kidney disease, hopes and expectations around kidney transplant strongly shape their prognostic expectations<sup>4,5</sup> and may affect how they think about and plan for the future.

Little is currently known about how engagement in the kidney transplant process—whether this be in the form of evaluation, waitlisting, or receipt of a

kidney transplant—might shape the care that patients receive as they approach the end of life. Prior work among candidates for, and recipients of, other kinds of solid organ transplant (*i.e.*, heart, lung, or

Received March 24, 2020. Accepted June 22, 2020.

Published online ahead of print. Publication date available at [www.jasn.org](http://www.jasn.org).

**Correspondence:** Dr. Catherine R. Butler, Division of Nephrology and Kidney Research Institute, Department of Medicine, University of Washington, Seattle, WA. Email: [cathb@u.washington.edu](mailto:cathb@u.washington.edu)

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liver) describes their limited involvement in advance care planning (ACP)<sup>6–10</sup> and high burden of unmet palliative care needs.<sup>11–15</sup> Although results are mixed,<sup>10,16</sup> there is some evidence that patients preparing for these other types of solid organ transplant received more intensive patterns of end-of-life care than similar patients who had not been considered for transplant, even when their death was expected.<sup>8</sup> However, systematic differences in the selection process for kidney, as compared with other kinds of solid organ transplant,<sup>17</sup> and the availability of dialysis as an alternative form of organ replacement therapy for people with ESKD may contribute to distinctive patterns of end-of-life care for patients engaged in the kidney transplant process.

We are not aware of prior studies that have described patterns of end-of-life care for patients engaged in the kidney transplant process. We hypothesized that because of their younger age, lower burden of comorbidity, and engagement in a process intended to extend life, patients who had been waitlisted for, or received, a kidney would experience more intensive patterns of end-of-life care than other patients with ESKD. To test this hypothesis, we examined patterns of end-of-life care among a national cohort of decedents with ESKD with differing exposure to the kidney transplant process.

## METHODS

### Cohort Derivation

Using data from the United States Renal Data System (USRDS), a national registry of patients with ESKD, we identified all adults (ages 19–99 years) who had been treated with maintenance dialysis or received a kidney transplant; died between January 1, 2005 and December 31, 2014; and had Medicare Parts A and B coverage throughout their final year of life (Figure 1). We excluded patients who had been treated with maintenance dialysis but subsequently recovered kidney function and those who received a kidney transplant outside the United States. We also excluded patients for whom it was unclear from source data whether their allograft was functioning at the time of death (Supplemental Table 1).

### Exposure

Using USRDS Standard Analysis Files, we defined six mutually exclusive groups of patients with differing exposure to the transplant process at the time of death: (1) patients with a functioning kidney transplant; (2) patients who were active on the deceased donor waitlist; (3) patients who were inactive on the waitlist; (4) patients who had been removed from the waitlist without receiving a kidney; (5) patients with a failed kidney transplant; and (6) patients who had never been waitlisted for or received a kidney transplant.

We used the following stepwise hierarchical approach to assign each patient to one of these six exposure groups. First, we used the USRDS Treatment History and Death Files to identify patients with a functioning kidney transplant at the

### Significance Statement

For patients with ESKD, hoping for or receiving a kidney transplant can shape prognostic expectations and care processes. In this manuscript, the authors describe more intensive, inpatient-oriented patterns of end-of-life care for patients with ESKD who had been waitlisted for a kidney transplant or received a transplant, compared with other patients with ESKD. Patients who died while on the transplant waitlist were also less likely to have received hospice services and less likely to have discontinued dialysis before death. Because there are powerful defaults favoring use of aggressive interventions to prolong life in most health systems in the United States, these findings suggest that the broad relevance of advance care planning for patients with ESKD extends to the relatively healthy segment of this population that has engaged in the transplant process.

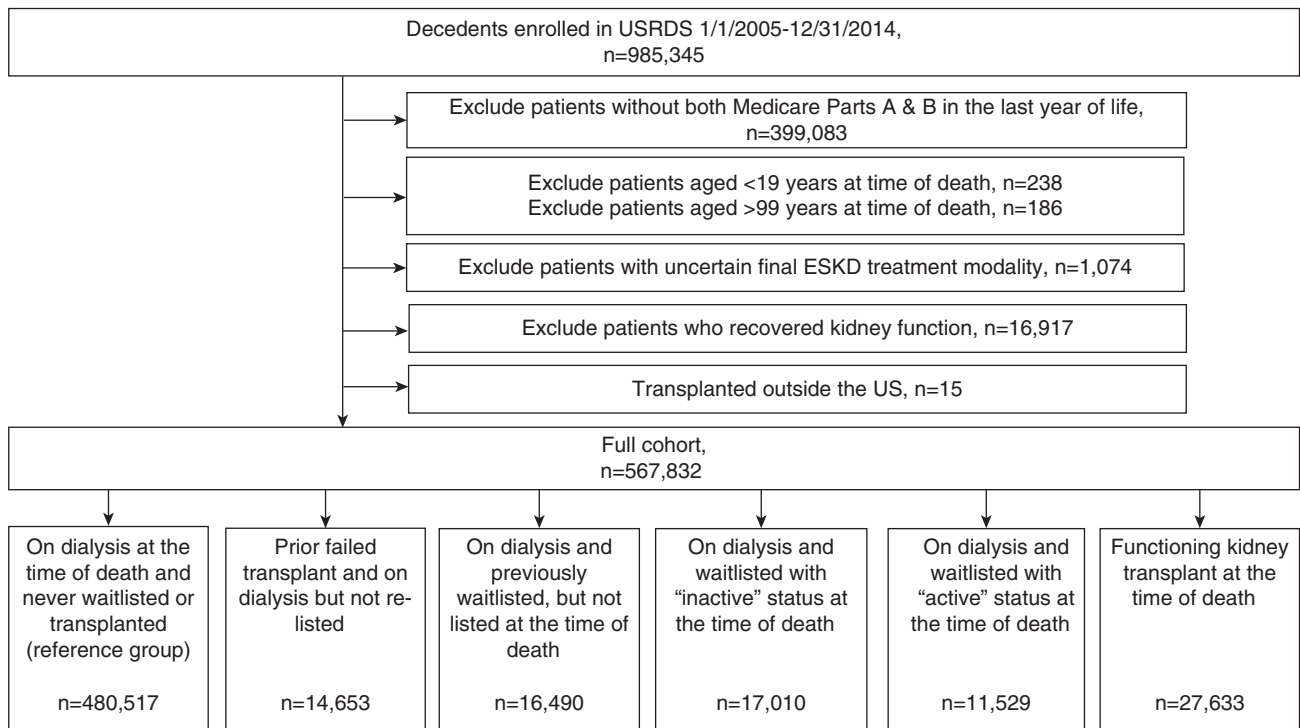
time of death. Second, among the remaining patients, we used waitlist removal codes in the USRDS Kidney and/or Kidney-Pancreas Transplant Files to identify patients who died while on the deceased donor waitlist. These patients were further classified as active or inactive on the waitlist at the time of death on the basis of their most recent United Network of Organ Sharing (UNOS) status codes. Patients were classified as being active on the waitlist at the time of death if they were listed as such by at least one transplant center. Third, patients were classified as having been removed from the waitlist at the time of death if they were not included in any of the preceding groups and their most recent UNOS removal code in the USRDS Kidney and/or Kidney-Pancreas Transplant Files indicated that they had been removed for reasons other than death (e.g., “condition deteriorated,” “medically unsuitable”). Fourth, patients were classified as having a failed transplant if they were not included in any of the preceding groups and had a record of at least one prior kidney transplant in the USRDS Patients File. The remaining cohort members, who were on maintenance dialysis but had never been waitlisted for or received a kidney transplant, were assigned to the reference group.

### Outcomes

We used Medicare fee-for-service institutional claims to define the following measures of intensity of end-of-life care during the last 30 days of life or at the time of death<sup>18</sup>: admission to a short- or long-stay hospital and admission to an intensive and/or coronary care unit in the last 30 days of life, receipt of one or more intensive procedures (cardiopulmonary resuscitation, mechanical ventilation, and/or artificial nutrition) in the last 30 days of life, and death in a hospital. We used the Centers for Medicare and Medicaid Services (CMS)-2746 form to ascertain whether patients were enrolled in hospice at the time of death and whether they had discontinued dialysis before death.

### Covariates

Using Medicare institutional claims, the Medicare Denominator File and the USRDS Patients and Medical Evidence Files



**Figure 1.** Cohort derivation.

(CMS-2728 form), we ascertained each cohort member's date of death, age at the time of death, sex, and race (Asian, American Indian or Alaska Native, Native Hawaiian or Pacific Islander, Black, White, or other or multiple races). We identified the following comorbid conditions on the basis of the International Classification of Diseases (ICD)-9 diagnostic codes for claims during the year before death: diabetes mellitus, coronary artery disease, congestive heart failure, stroke, emphysema, cirrhosis, and dementia. Because all of these characteristics could both differ across exposure groups and be associated with study outcomes, these were treated as potential confounding variables in the relationship between the exposure of interest (exposure to the transplant process) and study outcomes (measures of intensity of end-of-life care).

### Statistical Analyses

We described cohort member characteristics using percentages for categorical variables and mean (SD) or median (interquartile range [IQR]) values for continuous variables. We used logistic regression to measure the association between exposure to the transplant process and each study outcome. Results of logistic regression analyses were adjusted for the following measured patient characteristics: age, sex, race, individual comorbid conditions, and date of death. Results are presented as adjusted proportions and risk differences with 95% confidence intervals on the basis of the distribution of covariates in the overall cohort. We used a  $P$  value of  $<0.002$  as a threshold defining statistical significance for individual tests to achieve an overall false-positive error rate ( $\alpha$ -level) of 0.05

for all comparisons on the basis of the Bonferroni correction.<sup>19</sup>

### Supplementary Analyses

We examined time between the most recent transplant procedure and death among patients who died with a functioning kidney transplant ( $\leq 1$  year,  $>1-5$  years,  $>5-10$  years,  $>10$  years versus the reference group of patients who were not transplanted or waitlisted). We also examined time between graft failure and death among patients with a failed transplant who had not been waitlisted after their most recent graft had failed ( $\leq 1$  year,  $>1-5$  years,  $>5-10$  years,  $>10$  years versus the same reference group). These analyses were adjusted for the same covariates as the primary analyses.

### Sensitivity Analyses

The mortality follow-back approach is often used to describe patterns of end-of-life care among decedents. A limitation of this approach is that it cannot capture patterns of end-of-life care for patients who survive the ascertainment period. For this reason, for studies that aim to comprehensively describe patterns of end-of-life care among a prospective cohort, the mortality follow-back approach can produce biased results if there are systematic differences between cohort members who die and those who survive beyond the ascertainment period. To evaluate the extent to which our results might be sensitive to this type of bias, we repeated the primary analysis among the subset of cohort members who developed ESKD early on in the ascertainment period between January 1, 2005 and

December 31, 2008. As compared with patients who developed ESKD later in the ascertainment period, patterns of end-of-life care for these patients would be expected to more closely resemble those of a denominator population of otherwise eligible patients who developed ESKD over the same time period.

The analytic approach was guided by the Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) criteria<sup>20</sup> and statistical tests were conducted using R studio (version 1.1.453, RStudio, Inc.)<sup>21</sup> and Stata SE, version 13.1 (Stata Corp, College Station, TX). The study was approved by the Institutional Review Board at the University of Washington in Seattle, WA.

## RESULTS

In this national cohort of 567,832 adults with ESKD who died between 2005 and 2014, 27,633 patients (5%) had a functioning kidney transplant at the time of death, 14,653 (3%) were on dialysis after a failed transplant and had not been relisted, 16,490 (3%) had been removed from the waitlist, 17,010 (3%) were inactive on the waitlist, 11,529 (2%) were active on the waitlist, and 480,517 (85%) had never been waitlisted for or received a kidney transplant (Table 1). For patients with a functioning transplant at the time of death, the median interval between their most recent transplant procedure and death was 6.7 (IQR 2.9–11.4) years. For those with a failed transplant, the median time since their most recent transplant failure was 2.5 (IQR 0.9–5.8) years. For those who had been removed from the waitlist, the median time since their most recent waitlist removal was 1.8 (IQR 0.7–3.6) years.

Patients exposed to the transplant process were much younger than the reference group of patients who had never been transplanted or waitlisted, with the mean age ranging from 56.9 (SD 12.1) years for patients who were active on the waitlist to 65.1 (SD 11.6) years for those with a functioning transplant at the time of death as compared with 72.5 (SD 12.3) years for the reference group (Table 1). The proportion of Black patients was higher for all except those with a functioning transplant (in whom the proportion of Black patients was lower) compared with the reference group. With the exceptions of cancer (which was more common in those with a functioning transplant) and cirrhosis (which was more common in those who had been waitlisted or had a failed transplant), the prevalence of comorbid conditions was highest among members of the reference group.

### Adjusted Association of Transplant Status with Study Outcomes

With the exception of patients who were active on the waitlist at the time of death, the adjusted proportion admitted to a hospital in the last 30 days of life was higher for those exposed to the transplant process than for the reference group (adjusted proportion 75% for those with a transplant, 77% for

those with a failed transplant, 75% for those removed from the waitlist, 76% for those who were inactive on the waitlist, and 72% for those who were active on the waitlist versus 73% for the reference group;  $P$  value for adjusted risk difference  $<0.002$  for all comparisons except for patients active on the waitlist) (Figure 2, Supplemental Table 2). Compared with the reference group, a higher adjusted proportion of all groups exposed to the transplant process was admitted to an intensive and/or coronary care unit (55%, 55%, 53%, 56%, and 54% versus 51%, respectively;  $P<0.002$  for all comparisons) and received an intensive procedure (35%, 31%, 30%, 33%, and 34% versus 28%, respectively;  $P<0.002$  for all comparisons) in the last 30 days of life and a higher adjusted proportion died in the hospital (49%, 45%, 44%, 46%, and 45% versus 40%, respectively;  $P<0.002$  for all comparisons). Compared with the reference group, a lower adjusted proportion of patients who were waitlisted at the time of death received hospice services (18% of patients inactive on the waitlist and 12% of those active on the waitlist versus 25% of those in the reference group;  $P<0.002$  for both comparisons) and discontinued dialysis before death (25% and 17% versus 28%, respectively;  $P<0.002$  for both comparisons).

### Supplementary Analyses

In adjusted analyses, intensity of care was higher than for the reference group for patients with a functioning transplant regardless of time since transplant and was especially high for those who had died within a year of transplant. These patients were also less likely than the reference group to have received hospice services (Figure 3, Supplemental Table 3).

Among patients with a failed transplant, adjusted measures of inpatient intensity of care were all higher than for the reference group regardless of time since transplant failure (Supplemental Table 4). Use of hospice and dialysis discontinuation followed a similar pattern to the reference group and did not vary as a function of time since transplant failure.

### Sensitivity Analyses

Results of a sensitivity analysis among cohort members who developed ESKD between 2005 and 2008 were similar to the primary analysis (Supplemental Table 5).

## DISCUSSION

Patients with ESKD who had been waitlisted for or received a kidney transplant received more intensive patterns of end-of-life care than other members of this population, even after adjusting for differences in measured patient characteristics. Those patients who died on the kidney transplant waitlist—regardless of whether they were active or inactive at the time of death—were also less likely to have received hospice services and to have discontinued dialysis. Patterns of end-of-life care were more intensive than for the reference group regardless of time since transplant or transplant failure.

Table 1. Cohort characteristics

Characteristic	Transplant (n=27,633)	Failed Transplant, Never Relisted <sup>a</sup> (n=14,653)	Removed from Waitlist <sup>b</sup> (n=16,490)	Inactive on the Waitlist (n=17,010)	Active on the Waitlist (n=11,529)	On Dialysis, Never Waitlisted or Transplanted (Reference Group) (n=480,517)	Full Cohort (n=567,832)
Age category (%)							
19–54	4710 (17.0)	4888 (33.4)	3479 (21.1)	5794 (34.1)	4169 (36.2)	40,476 (8.4)	63,516 (11.2)
55–64	6330 (22.9)	4014 (27.4)	4600 (27.9)	5556 (32.7)	3789 (32.9)	66,926 (13.9)	91,215 (16.1)
65–74	10,286 (37.2)	4017 (27.4)	5704 (34.6)	4727 (27.8)	3004 (26.1)	128,895 (26.8)	156,633 (27.6)
75–100	6307 (22.8)	1734 (11.8)	2707 (16.4)	933 (5.5)	567 (4.9)	244,220 (50.8)	256,468 (45.2)
Age, mean (SD)	65.1 (11.6)	58.9 (13.2)	62.9 (11.6)	57.8 (11.6)	56.9 (12.1)	72.5 (12.3)	70.7 (12.9)
Sex							
Women	10,152 (36.7)	5965 (40.7)	6718 (40.7)	6936 (40.8)	4599 (39.9)	221,858 (46.2)	256,228 (45.1)
Men	17,479 (63.3)	8687 (59.3)	9771 (59.3)	10,074 (59.2)	6929 (60.1)	258,566 (53.8)	311,506 (54.9)
Missing	<11	<11	<11	<11	<11	93 (0.0)	98 (0.0)
Race (%)							
Asian	771 (2.8)	324 (2.2)	599 (3.6)	528 (3.1)	570 (4.9)	10,548 (2.2)	13,340 (2.3)
American Indian or Alaska Native	400 (1.4)	186 (1.3)	281 (1.7)	224 (1.3)	146 (1.3)	5330 (1.1)	6567 (1.2)
Native Hawaiian or Pacific Islander	122 (0.4)	70 (0.5)	176 (1.1)	164 (1.0)	131 (1.1)	3220 (0.7)	3883 (0.7)
Black	5299 (19.2)	4777 (32.6)	5737 (34.8)	5909 (34.7)	3997 (34.7)	129,437 (26.9)	155,156 (27.3)
White	20,791 (75.2)	9189 (62.7)	9567 (58.0)	10,025 (58.9)	6571 (57.0)	329,187 (68.5)	385,330 (67.9)
Other or multiple races	221 (0.8)	105 (0.7)	123 (0.7)	152 (0.9)	107 (0.9)	2682 (0.6)	3390 (0.6)
Missing	29 (0.1)	<11	<11	<11	<11	113 (0.0)	166 (0.0)
Year of death category (%)							
2005–2006	4921 (17.8)	2918 (19.9)	2070 (12.6)	2821 (16.6)	2853 (24.7)	102,202 (21.3)	117,785 (20.7)
2007–2008	4992 (18.1)	2804 (19.1)	2552 (15.5)	3302 (19.4)	2501 (21.7)	97,379 (20.3)	113,530 (20.0)
2009–2010	5470 (19.8)	2912 (19.9)	3311 (20.1)	3595 (21.1)	2229 (19.3)	95,026 (19.8)	112,543 (19.8)
2011–2012	5884 (21.3)	2947 (20.1)	4008 (24.3)	3748 (22.0)	1940 (16.8)	93,339 (19.4)	111,866 (19.7)
2013–2014	6366 (23.0)	3072 (21.0)	4549 (27.6)	3544 (20.8)	2006 (17.4)	92,571 (19.3)	112,108 (19.7)
Comorbidities (%)							
Diabetes mellitus	19,873 (71.9)	10,708 (73.1)	12,555 (76.1)	13,065 (76.8)	8649 (75.0)	378,342 (78.7)	443,192 (78.0)
Coronary artery disease	16,855 (61.0)	10,367 (70.8)	12,677 (76.9)	12,605 (74.1)	7877 (68.3)	372,320 (77.5)	432,701 (76.2)
Congestive heart failure	15,934 (57.7)	11,089 (75.7)	12,555 (76.1)	12,490 (73.4)	7606 (66.0)	390,614 (81.3)	450,288 (79.3)
Stroke	7965 (28.8)	5023 (34.3)	5983 (36.3)	5933 (34.9)	3556 (30.8)	185,240 (38.6)	213,700 (37.6)
Cancer	10,378 (37.6)	3475 (23.7)	3777 (22.9)	3534 (20.8)	1761 (15.3)	127,755 (26.6)	150,680 (26.5)
Emphysema	9263 (33.5)	6112 (41.7)	7199 (43.7)	6475 (38.1)	3524 (30.6)	251,447 (52.3)	284,020 (50.0)
Cirrhosis	1611 (5.8)	1249 (8.5)	1706 (10.3)	1594 (9.4)	789 (6.8)	31,054 (6.5)	38,003 (6.7)
Dementia	2434 (8.8)	1290 (8.8)	1915 (11.6)	1191 (7.0)	503 (4.4)	89,084 (18.5)	96,417 (17.0)

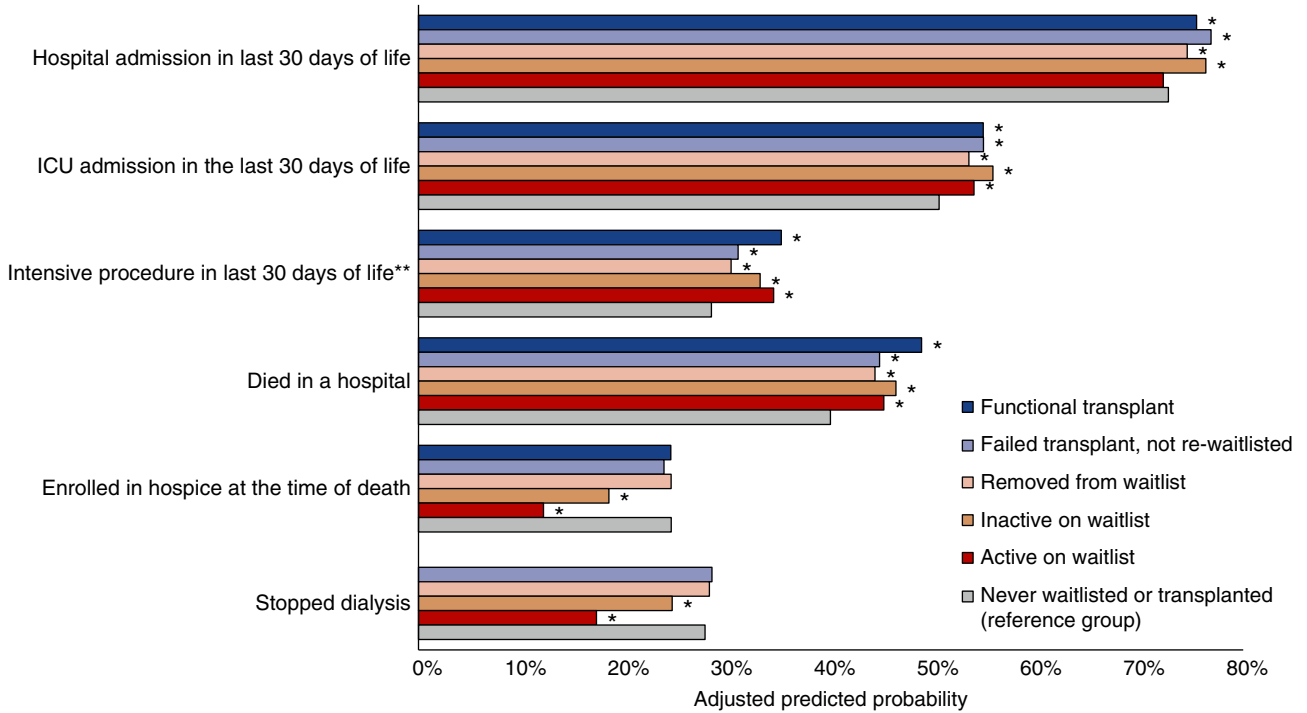
Chi-squared or ANOVA for difference between groups was <0.001 for all comparisons.

<sup>a</sup>This group includes patients with a prior transplant that failed and who were not subsequently relisted or retransplanted.

<sup>b</sup>This group includes patients on dialysis with a failed transplant who were subsequently waitlisted and then removed.

Prior studies in the wider population with ESKD have described intensive patterns of end-of-life care focused on life extension<sup>22,23</sup> that do not seem to reflect the kind of care many of these patients say they would want to receive if they were

seriously ill or dying.<sup>24,25</sup> Because there are strong defaults favoring use of aggressive interventions to prolong life in many US health systems,<sup>26,27</sup> our findings underline the importance of educating patients engaged in the transplant

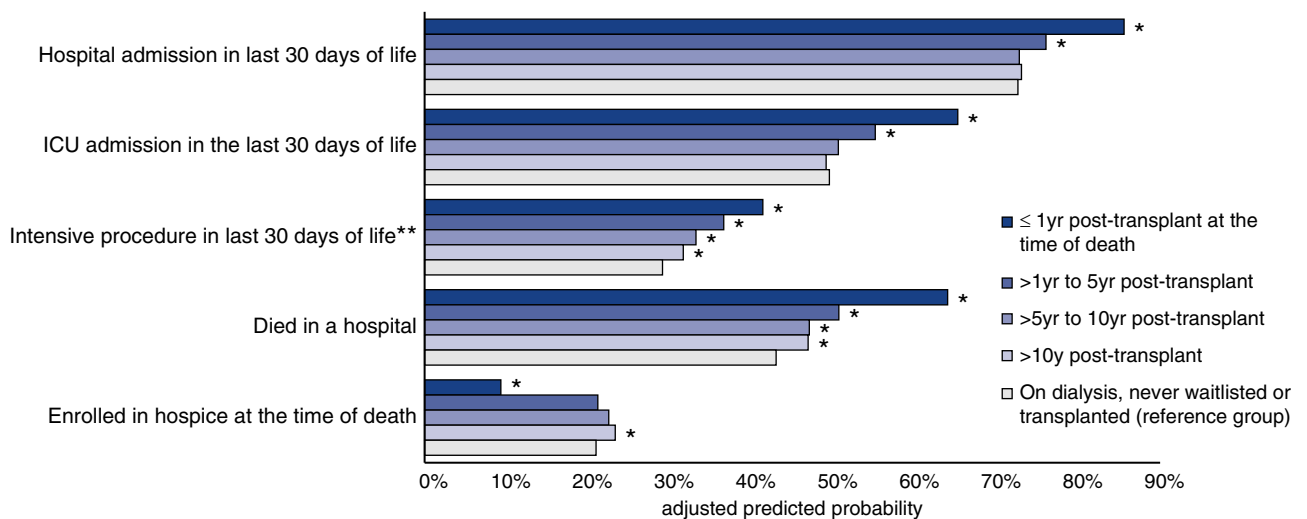


**Figure 2.** Measures of intensity of end-of-life care for adults with ESKD with exposure to the transplant process. Proportions adjusted for age, sex, race, date of death, and all measured individual comorbidities. \*P value for adjusted risk difference <0.002. \*\*Mechanical ventilation, cardiopulmonary resuscitation, and/or artificial nutrition. ICU, intensive or coronary care unit.

process about what to expect at the end of life and offering opportunities to engage in advance care planning (ACP).<sup>28,29</sup> High levels of end-of-life intensity of care among patients engaged in the kidney transplant process highlight the relevance of ACP even for this relatively healthy segment of the ESKD population. Our findings may also help to inform discussions

with patients and families about the kinds of situations and treatment decisions that might lie ahead were they to become seriously ill.

Existing models of ACP developed for patients undergoing other kinds of organ transplant<sup>30–33</sup> and for the overall ESKD population<sup>34–36</sup> may need to be adapted to accommodate the



**Figure 3.** Measures of intensity of end-of-life care among cohort members with a functioning kidney transplant at the time of death by time since transplant. Proportions adjusted for age, sex, race, date of death, and all measured individual comorbidities. \*P value for adjusted risk difference <0.002. \*\*Mechanical ventilation, cardiopulmonary resuscitation, and/or artificial nutrition. ICU, intensive or coronary care unit.

potentially dynamic and varied illness trajectories of patients engaged in the kidney transplant process. Unlike patients with other kinds of organ failure, where deteriorating health is anticipated (or even required) before they can receive a transplant, patients awaiting kidney transplant must remain relatively healthy in order to maintain their transplant candidacy.<sup>37–40</sup> Most patients are thus relatively young and healthy when they are first listed for kidney transplant. However, within 3 years of listing, approximately one in five patients die or are removed from the waitlist due to deteriorating health.<sup>41</sup> Although many of the deaths that occur among patients who are active on the waitlist or recently transplanted may be sudden and unexpected, even cohort members who had been inactivated or removed from the list received very intensive patterns of end-of-life care, as did those who had not been relisted after a failed kidney transplant.

Prior studies among candidates for other kinds of solid organ transplant suggest that patients generally welcome the opportunity to receive palliative care services and engage in ACP while planning for transplant.<sup>13,30–33,42</sup> However, there may be unique challenges to integrating ACP with care processes related to kidney transplant. Existing qualitative work suggests that an emphasis on preventative and curative interventions during the evaluation can sometimes undermine other care processes,<sup>43,44</sup> particularly if these seem inconsistent with the goal of receiving a transplant.<sup>45–49</sup> Further, hope for transplant—even for patients unlikely to receive a kidney—can foster overly optimistic expectations or uncertainty about the future that could limit the effectiveness of ACP.<sup>4,5</sup> Uncertainty about where patients stand in the transplant evaluation process and about whether they are likely to receive a kidney may also make it difficult for patients and families to formulate realistic plans for their future care.<sup>50,51</sup> This may perhaps explain why patterns of end-of-life care for patients who had been inactivated or removed from the transplant waitlist—events that may signal worsening health status<sup>52,53</sup>—largely mirrored those for patients who were actively listed at the time of death.

We suspect that conceptualizing of ACP as an ongoing and iterative “process”<sup>54</sup> rather than a one-time event may be particularly helpful in supporting patients engaged in the kidney transplant process. Early on, strategies to support patients and families in understanding prognostic uncertainty,<sup>55,56</sup> including “hoping for the best and preparing for the worst,”<sup>57</sup> may help to align ACP with the transplant evaluation process. Patients’ values, goals, and future expectations could then be revisited over time, particularly in the setting of deteriorating health and/or at critical junctures in the transplant process such as allograft failure or removal from the waitlist. More open communication and clear delineation of roles between the multiple clinicians who care for patients engaged in the transplant process may also help to support ACP in this population.

Our study has the following limitations. First, although the results of the sensitivity analysis provide some reassurance that patterns of end-of-life care would likely be similar for patients who did not die during the ascertainment period, it is possible

that our results may not be generalizable to patients who survive for long periods of time after ESKD onset. Second, our results do not speak to whether patterns of end-of-life care were aligned with the goals, preferences, and values of individual patients. Third, our cohort was restricted to fee-for-service Medicare beneficiaries, which may limit generalizability to patients with Medicare Advantage or other types of health insurance. Fourth, our analyses do not describe patterns of end-of-life care for the subgroup of patients who had been accepted for living donor transplant but had not yet received a kidney. Fifth, because selection for waitlisting and transplant relies on information ascertained during a detailed physical and psychosocial evaluation, there are almost certainly unmeasured differences between patients in the reference group and those exposed to the transplant process. Our analyses also do not account for other factors (*e.g.*, socioeconomic status) that can shape patterns of end-of-life care.<sup>58</sup> Finally, inaccurate or incomplete information on transplant status at the time of death in source data may have led to misclassification of the exposure, although this would likely have biased our results toward detecting no differences between groups.

In a national cohort of Medicare beneficiaries with ESKD who died between 2005 and 2014, those who had engaged in the transplant process—regardless of the nature of this engagement—received more intensive patterns of end-of-life care than other patients with ESKD. Because there are powerful defaults favoring aggressive intervention to prolong life in most US health systems, these findings highlight the broad relevance of ACP even for this relatively healthy segment of the ESKD population.

## DISCLOSURES

All authors have nothing to disclose.

## FUNDING

This work was supported by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (U01DK102150). The sponsor had no role in the design and conduct of the study; in collection, management, analysis, or interpretation of the data; in preparation, review, or approval of the manuscript; or in the decision to submit for publication. We are also grateful to the NIDDK for supporting C.R. Butler’s time through a training grant (5T32DK007467-33), and to the National Institute of Allergy and Infectious Disease for supporting P.P. Reese through a mentoring grant (K24AI146137-02).

## ACKNOWLEDGMENTS

We would like to thank William Kreuter in the Department of Pharmacy at the University of Washington for assistance with programming to extract information from Medicare claims.

Dr. Catherine R. Butler and Dr. Ann M. O’Hare designed the study and analyzed the data. Dr. Catherine R. Butler made the tables and figures, and drafted the initial manuscript. All authors contributed to the interpretation

and presentation of data, revised the manuscript, and approved the final version of the manuscript.

Ethics approval and consent to participate, consent for publication: The study was approved by the Institutional Review Board at the University of Washington in Seattle, Washington.

Dr. Catherine R. Butler reports personal fees from the Washington State Medical Association, outside the submitted work. Dr. Peter P. Reese reports National Institutes of Health (NIH) grant support; investigator-initiated grants from Merck and AbbVie to the University of Pennsylvania to support research on transplantation of Hepatitis C Virus infected organs into uninfected recipients, followed by antiviral treatment; investigator-initiated grants from CVS Caremark and Merck to the University of Pennsylvania to support research on medication adherence (focus: Statins); Associate Editor for the American Journal of Kidney Diseases; and COHRDATA (epidemiology analytics firm)—consultation on design of studies of therapies for patients on dialysis, outside the submitted work. Dr. Yoshio N. Hall reports other support from Northwest Kidney Centers, outside the submitted work. Dr. J. Randall Curtis reports grants from NIH, grants from the Cambia Health Foundation, and grants from the National Palliative Care Research Center, outside the submitted work. Dr. Ann M. O'Hare reports grants from NIDDK; grants from the Centers for Disease Control and Prevention; grants from the Department of Veterans Affairs Health Services Research & Development service; personal fees from Dialysis Clinics Inc.; personal fees from Fresenius Medical Care; personal fees from the Health and Aging Policy Fellows Program; personal fees from the University of Pennsylvania; personal fees from the University of Alabama, Birmingham; personal fees from Hammersmith Hospital; personal fees from Uptodate; personal fees from Devenir Foundation; personal fees from Japanese Society for Dialysis Therapy; personal fees from Chugai Pharmaceutical Co. Ltd.; other support from the Editorial Board of *JASN* and *CJASN*; and personal fees from ASN, outside the submitted work.

## DATA SHARING STATEMENT

The data reported here have been supplied by the United States Renal Data System and are available upon request. The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as official policy or interpretation of the US government.

## SUPPLEMENTAL MATERIAL

This article contains the following supplemental material online at <http://jasn.asnjournals.org/lookup/suppl/doi:10.1681/ASN.2020030342/-/DCSupplemental>.

Supplemental Table 1. USRDS registry codes used to define exposure groups.

Supplemental Table 2. Measures of intensity of end-of-life care by exposure to the transplant process.

Supplemental Table 3. Measures of intensity of end-of-life care among cohort members with a functioning kidney transplant at the time of death by time since transplant.

Supplemental Table 4. Measures of intensity of end-of-life care among cohort members with a failed transplant at the time of death by time since transplant failure.

Supplemental Table 5. Measures of intensity of end-of-life care by exposure to the transplant process for patients who developed ESKD from 2005 to 2008.

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## AFFILIATIONS

<sup>1</sup>Division of Nephrology, Department of Medicine and the Kidney Research Institute, University of Washington, Seattle, Washington

<sup>2</sup>Renal-Electrolyte and Hypertension Division, Department of Medicine and Department of Biostatistics and Epidemiology, University of Pennsylvania, Philadelphia, Pennsylvania

<sup>3</sup>Department of Biostatistics, Epidemiology, and Informatics, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, Pennsylvania

<sup>4</sup>Division of Transplant Surgery, Department of Surgery, University of Washington, Seattle, Washington

<sup>5</sup>Division of Pulmonary, Critical Care, and Sleep Medicine, Department of Medicine and the Cambia Palliative Care Center of Excellence, University of Washington, Seattle, Washington

<sup>6</sup>Division of Nephrology, Geriatric Research, Education, and Clinical Center, Veterans Affairs Palo Alto Health Care System, Palo Alto, California

<sup>7</sup>Division of Nephrology, Department of Medicine, Veterans Affairs Puget Sound Health Care System, Seattle, Washington