Performance Monitoring and Decertification Threats: Evidence from Organ Transplantation*

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Abstract

Performance monitoring is often used to shape how organizations search for and allocate scarce resources. We study this in the context of organ procurement organizations (OPOs), which coordinate deceased organ donation and face performance standards tied to decertification. We examine how OPOs respond to decertification risk revealed by the first performance report and how the resulting increase in organ supply is used. Following the release of the performance report, donor identification and organ recovery increased, particularly among lower-performing OPOs. We find that 73% of the increase in organs recovered translated into additional transplants, while the remainder were discarded. The increase in organ supply appears to operate through two margins: greater recovery of organs from higher-risk donors and broader outreach to expand the donor pool. We further explore transplant center acceptance decisions and find that a one standard deviation increase in the offer rate reduces the acceptance probability by 50%. This demonstrates that transplant centers' dynamic incentives to turn down offers limit the potential increase in transplant rates following increased offers from OPOs. Finally, OPO performance rankings are sensitive to the choice of metric, particularly whether the measure incorporates transplantation rates and characteristics of the underlying population.

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1 Introduction

Regulators often monitor performance and enforce minimum standards when market competition alone is insufficient (Dranove and Jin 2010). Organizations that fail to meet these standards may lose access to public reimbursement or authorization to operate. Health care facilities can lose participation in public insurance programs (Chen and Dillender 2025; Stith and Hirth 2016; Li et al. 2010), charter schools can have their charters revoked (Harris and Martinez-Pabon 2024; Bross, Harris, and Liu 2023), and banks can be closed by federal or state authorities (Correia, Luck, and Verner 2025; Agarwal et al. 2014). The threat of removal may induce low-performing organizations to improve, but removal itself can disrupt markets. Whether these policies improve outcomes therefore depends on how organizations respond to the threat of removal and how those responses affect downstream users.

This paper studies whether decertification threats under federal oversight can increase organ supply and improve transplant outcomes. We study the responsiveness of Organ Procurement Organizations (OPOs), asking whether decertification threats change their behavior and downstream transplant outcomes. OPOs are federally certified nonprofit organizations designated by the Centers for Medicare & Medicaid Services (CMS) to serve distinct geographic service areas, where they coordinate donor authorization, organ recovery, and organ placement. OPOs reported $20 billion in revenue in 2022, and Medicare reimburses organ acquisition costs (CMS 2026). Access to transplant remains limited, with about 13 people dying each day while waiting for an organ transplant, making OPO decisions over deceased donor organ recovery an important margin for expanding organ supply. Historically, however, OPOs have faced relatively limited performance-based risk to their certification since the US deceased donor organ allocation system was established in the 1980s.

The introduction of performance monitoring changed these incentives by linking OPO performance more directly to the risk of losing responsibility for their service area. Beginning

in 2021, CMS publicly reported OPO donation and transplant rates and used them to assign OPOs to three performance tiers. CMS plans to use these measures in the 2026 recertification process, although the exact timing has not yet been set. OPOs that fail to meet the relevant standards may face decertification, with their service areas opened to competition from higher-performing OPOs, generating substantial variation in decertification risk. The first performance report, released on September 30, 2021, has two features that are useful for identification. First, both tier assignments and the underlying performance cutoffs are based on data from more than two years earlier. This lag makes measured decertification risk largely predetermined with respect to behavioral responses and keeps tier assignments relatively stable across the first three annual reports. Any behavioral changes induced by the report would affect measured performance only with a substantial delay. Second, because the report's release date was not announced in advance, OPOs learned their position relative to the performance thresholds at a time that was difficult to anticipate.

We use two complementary empirical strategies to study the supply- and demand-side responses to performance monitoring. First, we estimate how OPOs respond to greater decertification risk using a difference-in-differences design that exploits differences across OPOs in their exposure to decertification following the release of the initial performance report. We proxy for treatment intensity using each OPO's distance from the thresholds required to reach the highest-performing tier, which is not subject to decertification, and estimate effects on donor authorization, organ recovery, use of donated organs using a quarterly OPO panel.

OPOs facing greater decertification risk increased donor identification and organ recovery following the release of the 2021 performance report. A 10 percentage point larger shortfall from the Tier 1 cutoff increased the number of donors by 7.3 percent and organs recovered for transplant by 7.5 percent relative to the pre-period means. We provide evidence that this increase reflected greater efforts to expand the donor pool. OPOs recovered more organs

from higher-risk donors, engaged a broader set of donor hospitals and pursued donation for a larger number of potential deaths. The findings suggest that performance monitoring induced OPOs to expand donor recovery along margins that had previously been used less intensively. The increase in recovery, however, did not translate proportionally into transplant. About 65 percent of the additional organs recovered were ultimately transplanted, while the number of discarded organs increased by 15.5 percent. Because recovery generates costs even when an organ is ultimately discarded, these findings point to a potential unintended consequence of the policy: greater recovery activity without a commensurate increase in the use of donated organs.

Second, we examine the demand-side response by estimating how transplant centers adjust their acceptance decisions as organ offers increase. We focus on kidneys because they account for the largest share of deceased donor organ offers and transplants. We estimate a linear probability model of the decision to accept an offer as a function of patient, donor, and patient-donor characteristics, as well as the offer rate. Because the offer rate is endogenous to offer acceptance decisions, since an offer reaches a candidate only after higher-ranked candidates decline it, we use donor scarcity as an instrumental variable, following an approach similar to Agarwal, Hodgson, and Somaini (2025).

We find that a one standard deviation increase in offer rate cuts the acceptance probability in half, pointing to strong demand-side responses to an increase in offers. Together with the reduced quality of the newly recovered organs, this suggests that the lack of downstream improvements in transplant volume associated with the OPO performance report release is driven by the non-responsiveness of transplant centers. Our findings suggest that improving OPO performance alone may be insufficient to increase transplant volume when transplant centers face incentives to decline additional offers. Consistent with Agarwal, Hodgson, and Somaini (2025) who show that lower quality organs can still generate substantial life-year gains, our findings highlight the potential importance of complementary incentives on the

transplant center side (Chan and Roth 2026; Rentas et al. 2026).

Our findings contribute to the literature examining approaches to increase the availability and use of donated organs.[1] A growing strand of this literature focuses specifically on organ procurement and the incentives facing OPOs (Chan and Roth 2024; Bae et al. 2026; Adam, Agarwal, and Ghassemi 2026). Most closely related, Chan and Roth (2024) use a market-design laboratory experiment to study the joint incentives facing OPOs and transplant centers, while Bae et al. (2026) document changes in organ donation and transplant rates across the three performance tiers following the release of the 2021 OPO performance report. We build on these studies by examining how decertification risk changes OPO behavior, identifying the margins through which OPOs expand organ supply in the short run, and studying how transplant centers respond to the resulting increase in organ offers. Contemporaneous work by Ozbay et al. (2026) uses cost report data from non-hospital based OPOs to study changes in OPO costs and the evolution of the utilization gap between kidney and non-kidney organs.

Our findings also contribute to the literature on organizational responses to performance measurement and regulatory oversight. Prior work shows that public report cards can change provider behavior in health care (Dranove et al. 2003; Cutler, Huckman, and Landrum 2004; Wang et al. 2011; Bundorf et al. 2009; Pope 2009; Epstein 2010; Singh and Zureich 2025; Ng 2024), while a growing recent literature examines responses to regulatory audits (Shi 2024; Chen and Dillender 2025; Gandhi, Olenski, and Shi 2025). A related literature studies performance standards in public programs and regulated organizations when measured

1. Prior work studies how organ supply responds to seat-belt policies (Dickert-Conlin, Elder, and Moore 2011), waitlist priority rules (Kessler and Roth 2014a), the opioid crisis (Dickert-Conlin et al. 2024), incentives for living donation (Kessler and Roth 2012; Schnier et al. 2018; Elías, Lacetera, and Macis 2019; Kessler and Roth 2014b), kidney exchange (Roth, Sönmez, and Ünver 2004; Ashlagi and Roth 2014; Roth, Sönmez, and Ünver 2007), and donor registration policies (Chan, Gupta, and Xu 2026; Kessler and Roth 2025; Li, Hawley, and Schnier 2013; Sönmez, Ünver, and Yenmez 2020). Related work examines organ use and patient outcomes under alternative waitlist and allocation policies (Agarwal et al. 2018; Agarwal et al. 2021; Sweat 2024; Agarwal et al. 2019; Agarwal, Hodgson, and Somaini 2025; Bae 2023; Bae and Clemens 2026).

performance does not fully capture the underlying objective (Heckman, Heinrich, and Smith 1997; Barnow and Smith 2004; Holmstrom and Milgrom 1991; Baker 1992). The OPO setting links these literatures because measured performance determines exposure to decertification, while donation and transplant depend on different decision makers. Donation depends largely on OPO decisions over donor identification, authorization, and recovery, whereas transplantation also depends on transplant center acceptance decisions. Our findings suggest that this distinction matters for both behavioral responses and performance classification: stronger incentives generate larger responses on margins more directly controlled by OPOs, while OPO rankings are sensitive to how performance is measured.

The remainder of the paper is organized as follows. Section 2 provides institutional background on the deceased donor organ procurement process and the OPO recertification process. Section 3 describes the data used in the analysis. Section 4 presents the empirical strategy. Section 5 presents the main findings, explores potential mechanisms, and examines tier assignments under alternative performance measures.

2 Institutional Background

2.1 Deceased Donor Identification, Authorization, and Organ Recovery

Organ Procurement Organizations (OPOs) are federally designated nonprofit organizations responsible for coordinating deceased organ donation within defined geographic service areas. They serve as intermediaries between donor hospitals and transplant centers. Hospitals notify the designated OPO when a death may be eligible for organ donation, after which the OPO evaluates medical suitability, determines authorization status, coordinates organ recovery, and communicates organ offers through the national allocation system. OPOs are also required to report eligible deaths and imminent neurological deaths through the OPTN Death Notification Registration (DNR), including cases reported by donor hospitals and

those identified through retrospective review of death records.[2]

Potential donors need not meet the reporting definitions of either an eligible death or an imminent neurological death to be identified and pursued by an OPO.[3] After a referral, the OPO evaluates medical suitability and verifies or seeks authorization for donation. For donation after neurologic determination of death, hospital physicians first pronounce death using neurologic criteria, after which circulation may be maintained until organ recovery. For donation after circulatory death (DCD), the decision to withdraw life-sustaining treatment is made independently of donation, and recovery may begin only after treatment is withdrawn, circulation and respiration cease, and death is pronounced. Conditional on authorization and medical suitability, the OPO coordinates donor management, medical testing, organ recovery, and communication with transplant centers.

A single deceased donor may provide multiple transplantable organs, including the kidneys, liver, heart, lungs, pancreas, and intestine. For each donated organ, the allocation system generates an ordered list of potential recipients according to organ-specific rules, called the 'match run'. These rules may account for blood type compatibility, medical urgency, waiting time, tissue compatibility, candidate characteristics, and logistical considerations. Transplant centers then decide whether to accept or decline each offer on behalf of their candidates. Donor organ quality is also measured differently across organ types. For kidneys, the Kidney Donor Profile Index (KDPI) is constructed from donor characteristics and used in the allocation process as a proxy for organ quality, with lower values indicating kidneys expected to yield better post-transplant outcomes (Bae and Clemens 2026).

2. OPOs are required to submit two forms related to organ donation each month. The Death Notification Form (DNF) records imminent and eligible deaths, while the Monthly Donation Data Report records deaths reported to the OPO and the corresponding donation outcomes. See OPTN Policy 18: Data Submission Requirements.

3. OPTN guidance also clarifies that these reporting definitions do not preclude an OPO from pursuing a donor candidate who is not classified as an eligible death. See OPTN (2013)

2.2 Performance Metrics and Decertification

CMS announced the final OPO accountability rule on November 20, 2020, and formally published it on December 2, 2020 (85 FR 77898). OPOs are assigned to three performance tiers based on two measures: the donation rate and the age-adjusted transplant rate. Both measures use inpatient deaths among individuals aged 75 or younger within an OPO's geographic service area as the denominator, calculated from the CDC Multiple Cause of Death files.[4] The donation rate equals the number of deceased donors from whom at least one vascularized organ was transplanted per 100 potential deaths over 12 months. The transplant rate equals the number of organs transplanted per 100 potential deaths and is adjusted for differences in the age distribution of the OPO's donor potential.[5][6]

For each measure, CMS compares the upper limit of the one-sided 95% confidence interval with the median and top quartile of the metric distributions. Tier 1 OPOs have upper 95% confidence limits at or above the top quartile for both the donation and age-adjusted transplant rates. Tier 2 OPOs have upper 95% confidence limits at or above the median for both measures but fall below the top quartile for at least one measure. Tier 3 OPOs have

4. Each OPO serves a designated group of counties, although a small number of counties are served by multiple OPOs. For each performance year, CMS specifies how deaths in these counties are assigned across OPOs. We define potential deaths following CMS performance reporting guidance as inpatient deaths among individuals aged 75 or younger whose primary cause of death corresponds to ICD-10 codes I20–I25, I60–I69, or V01–Y89.

5. CMS uses the following age categories for the adjustment: younger than 1 year, 1–5, 6–11, 12–17, 18–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, and 70–75. d_{ao} denote the number of potential deaths in age category (a) within OPO (o), and R_a denote the national transplant rate per 100 potential deaths for age category (a). CMS calculates the expected transplant rate as $E_o = \frac{\sum_a R_a d_{ao}}{\sum_a d_{ao}}$. The observed transplant rate for OPO o is $O_o = 100 * \frac{T_o}{\sum_a d_{ao}}$ where T_o denotes the number of organs transplanted from donors in OPO (o). The age-adjusted transplant rate is $A_o = \frac{O_o}{E_o} P$ where P denotes the national unadjusted transplant rate per 100 potential deaths. E_o captures the transplant rate expected given the age composition of OPO o's donor potential, while O_o incorporates the OPO's realized transplantation performance.

6. Because a deceased donor may provide multiple organs and some organs may be recovered in whole or in part, CMS applies organ-specific counting rules. One transplant is counted for each right or left kidney, heart, intestine, intestinal segment, whole pancreas, or pancreas segment. Two transplants are counted for a double-kidney transplant, an en bloc kidney transplant, or a double-lung transplant. CMS revised these counting rules following the release of the 2021 report. Under the revised rules, a pancreas recovered for islet cell research is counted as one transplant when the associated reason code is 525 or 518.

an upper 95% confidence limit below the median cutoff for at least one of the two measures.

The 2026 decertification cycle spans August 1, 2022, through July 31, 2026, with three interim assessments and one final assessment. Each assessment uses one year of recovery, transplant, and mortality data to compute performance metrics with a two year lag between the data collection period and the assessment report. For instance, tier assignments in the 2021 report were based on 2019 performance data, while the median and top quartile cutoffs used to evaluate OPO performance were based on OPO rates from 2018.

CMS released the first performance report on September 30, 2021 (CMS 2021). This report was not tied to certification decisions for the 2026 cycle but provided OPOs with early information about their performance under the new metrics. In that report, 16 OPOs were classified as Tier 3 (Appendix Figure A.1).

2.2.1 Annual Reports

The annual CMS reports provide descriptive evidence on how OPO performance evolved after the 2021 baseline report. For each OPO, we measure subsequent performance changes relative to its own 2021 value, separately for the donation and transplantation rates. These changes are expressed in percentage points, so positive values indicate higher measured performance than in 2021 and negative values indicate lower measured performance. Appendix Figure A.2 shows how the distribution of OPO level donation and transplant rates evolved across annual performance reports relative to the 2021 report. Because annual reports are constructed using lagged 12-month performance periods, the distributions of donation and transplant rates remain similar in the 2022 and 2023 reports and begin to shift substantially in the 2024 and 2025 reports.

We also examine how OPOs moved across CMS performance tiers after the 2021 report. Appendix Figure A.3 compares each OPO's tier in the 2021 report with its tier in each subsequent report year. Each dot represents an OPO. Tier assignments were highly persistent

in the 2022 and 2023 reports. Among OPOs classified as Tier 3 in the 2021 report, only three were assigned to a higher tier in either of the subsequent two reports, with one reaching Tier 1 and two reaching Tier 2. However, by the 2024 report, six of the OPOs originally classified as Tier 3 had moved to Tier 2 and five had moved to Tier 1. Movement in the opposite direction was less common: only 3 of the 25 OPOs classified as Tier 1 in the 2021 report were assigned to Tier 3 at least once in the 2022 or 2023 reports. The persistence of tier assignments in the earlier reports is consistent with the use of lagged data windows in constructing the annual performance measures, which may delay the extent to which post 2021 changes in OPO performance are reflected in reported tiers.

3 Data

We combine several data sources to construct the analysis sample. Measures of the population of potential organ donors are derived from mortality records, while information on attempted and successful organ donation, donor characteristics, transplantation, and organ allocation is drawn from national transplant registry data.

First, we use restricted-use vital statistics data from the Centers for Disease Control and Prevention to measure potential deceased donors at the county-by-quarter level from 2017 through 2023. Following the methodology used by the Centers for Medicare & Medicaid Services (CMS), we construct these measures from the National Center for Health Statistics Multiple Cause of Death files. Potential donor deaths are defined using the underlying cause-of-death ICD codes specified by CMS and are restricted to inpatient deaths among individuals aged 75 or younger. We also construct age-adjusted transplant rates using the donor age categories and adjustment procedure specified by CMS.

Second, we use data from the Scientific Registry of Transplant Recipients (SRTR), which contain records on deceased donors and kidney transplant candidates and recipients in the United States over the same period. These data include geographic information on donor

hospitals and transplant centers, detailed donor and recipient characteristics, the timing of death and organ recovery, and records of organ offers and their disposition, including whether an offer was accepted, declined, or bypassed.

Third, we use the UNOS Standard Transplant Analysis and Research (STAR) and Potential Transplant Recipient (PTR) datasets, which contains information on eligible deaths, imminent neurological deaths, recovered and and non-recovered donor cases, and offers made for kidney transplants. These nonrecovered cases may or may not have met the eligible death or imminent neurological death definitions, but they were assigned a donor ID and ultimately had no organs recovered for transplant during the study period. The kidney offer data was used to study how transplant centers respond to an increase in offers.[7]

Our sample includes 53 OPOs that remained in operation without any merger events during the sample period.[8] The primary offer-level analysis includes 4.9 million offers for deceased donor kidneys from 2019-2025 and restricts attention to the top-100 offers because most donor kidneys offered more than this are eventually not used. Tables 1 and 2 report summary statistics for the OPO-quarter panel and the offer-level sample, respectively.

3.1 Treatment Intensity

We construct a continuous measure of treatment intensity based on each OPO's distance from the top-quartile performance thresholds in the 2021 CMS performance report. The purpose of this measure is to capture the extent to which an OPO was exposed to performance pressure under the new evaluation system. OPOs further below the relevant performance thresholds faced stronger incentives to improve their measured performance to avoid being at risk of decertification.

7. The data reported here have been supplied by the United Network for Organ Sharing as the contractor for the Organ Procurement and Transplantation Network. The interpretation and reporting of these data are the responsibility of the author and in no way should be seen as an official policy or interpretation by the OPTN or the US Government. Based on data as of December 31, 2025.

8. HIOP is dropped from the analysis because it is evaluated using an unadjusted kidney transplant rate rather than the age-adjusted transplant rate used for all other OPOs.

$$g_o^{\mathrm{D}} = \max\left\{0, \frac{c^{\mathrm{D}} - R_o^{\mathrm{D}}}{c^{\mathrm{D}}}\right\}, \qquad g_o^{\mathrm{T}} = \max\left\{0, \frac{c^{\mathrm{T}} - R_o^{\mathrm{T}}}{c^{\mathrm{T}}}\right\} \tag{1}$$

where R_o^{D} and R_o^{T} denote the one-sided 95 percent upper confidence bounds for OPO o's donation and transplant rates, respectively. c^{D} and c^{T} denote the corresponding top-quartile thresholds in the 2021 report. Thus, g_o^{D} measures the percentage shortfall of the donation rate from its threshold, with the distance set to zero for OPOs that meet or exceed the threshold. Similarly, g_o^{T} measures the percentage shortfall of the age-adjusted transplant rate from its threshold.

To incorporate both performance measures in a single composite treatment intensity, we construct Decertification.Risk$_o$ for OPO o as the average of these required percentage improvements:

$$\text{Decertification.Risk}_o = 100 \times \frac{g_o^{\mathrm{D}} + g_o^{\mathrm{T}}}{2}. \tag{2}$$

The measure captures the average percentage improvement required for an OPO to reach the top quartiles. It equals zero for OPOs that meet or exceed both thresholds and increases with the improvement required to reach them. A one-unit increase in Decertification.Risk$_o$ represents a one percentage point increase in the average required improvement across the two CMS performance measures.[9]

4 Empirical Strategies

We use two empirical strategies to examine the effects of decertification threats on OPO behavior and transplant outcomes. First, we implement a difference-in-differences design to estimate effects on donor authorization, organ recovery, organ utilization, and patient

9. For example, consider an OPO's donation and transplantation measures are each 10 percent below the relevant top-quartile threshold, so that $R_o^{\mathrm{D}} = 0.90 \times c^D$ and $R_o^{\mathrm{T}} = 0.90 \times c^T$, resulting in $g_o^{\mathrm{D}} = g_o^{\mathrm{T}} = (1 - 0.90)/0.90 = 0.111$. Then the treatment intensity is calculated as Decertification.Risk$_o = 100 \times (0.111 + 0.111)/2 = 11.1$, implying that OPO would need to improve its measured performance by 11.1 percent on average to reach the tier 1 thresholds across the two CMS performance measures.

health outcomes. Second, we use an instrumental variables design to study organ acceptance decisions. This approach allows us to separate changes in transplant rates attributable to increased organ supply from changes attributable to the composition and quality of recovered organs.[10]

4.1 Difference-in-Differences Design

First, we employ a difference-in-differences design to examine whether OPOs with higher decertification risk experienced changes in outcomes after the report release. We use the treatment intensity in Eq. 2 to run a difference-in-differences design in Eq. 3. To examine anticipatory effects of the policy announcement and the impact of the release of the performance report, we divide the post-reform period into two parts: the period after the December 2020 announcement but before the release of the 2021 performance report and the period after the 2021 report release.

$$Y_{oq} = \beta_1 \text{Decertification.Risk}_o \times 1[\text{PreReport}_q] + \beta_2 \text{Decertification.Risk}_o \times 1[\text{PostReport}_q] + \alpha_o + \lambda_q + \varepsilon_{oq} \tag{3}$$

where Y_{oq} denotes an outcome for OPO o in quarter q. α_o are OPO fixed effects and λ_q are quarter fixed effects. $1[\text{PreReport}_q]$ is an indicator for quarters after the December 2020 announcement but before the 2021 CMS report release. $1[\text{PostReport}_q]$ is an indicator for quarters after the 2021 report release date. $\text{Decertification.Risk}_o$ denotes the OPO's treatment intensity based on the 2021 CMS report, defined in Eq. 2 as the distance from the Tier 1 performance threshold in the initial performance report. Standard errors are clustered at the OPO level. According to the 2021 report OPOs outside Tier 1 have an average

10. This study used data from the Scientific Registry of Transplant Recipients (SRTR). The SRTR data system includes data on all donor, wait-listed candidates, and transplant recipients in the US, submitted by the members of the Organ Procurement and Transplantation Network (OPTN). The Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services provides oversight to the activities of the OPTN and SRTR contractors.

treatment intensity of 12.1% meaning that they would need to improve their donation and transplant measures by this amount on average to reach the Tier 1 thresholds (Table 1). For ease of interpretation we scale the estimated two way fixed effects coefficients to represent a 10 percentage point increase in treatment intensity. We describe the two way fixed effects specification in the following section.

The identifying assumption is that OPOs with high and low treatment intensity would have followed similar trajectories in the outcome of interest in the absence of treatment. Under this assumption, β_1 and β_2 capture the causal effect of the reform in the pre-report and post-report periods, respectively. We assess this assumption by plotting the event study estimates from Eq. 4.

$$Y_{oq} = \alpha + \sum_{\tau=-13(\tau\neq-1)}^{12} \delta_\tau Decertification.Risk_o \times 1(t=\tau) + \lambda_q + \nu_o + \epsilon_{oq} \tag{4}$$

where Y_{oq} denotes the outcome of interest for OPO o in quarter q, and event time τ is measured relative to the announcement of the new OPO performance and decertification policy in Q4 2020. δ_τ is the coefficient of interest. Our main outcomes capture OPO performance, organ recovery, and organ utilization. Appendix Table A.1 lists the dependent variables and their definitions. We begin with the two measures CMS uses to evaluate OPOs: the donation rate and the transplant rate. Both use inpatient deaths with eligible health conditions ("potential deaths") as the denominator. The donation rate is the number of donors with at least one organ transplanted per potential death, consistent with the CMS definition. We also examine the number of organs recovered for transplant and the organ discard rate. These outcome measures capture both the number of organs entering the allocation system and the extent to which recovered organs are ultimately transplanted.

We also estimate the difference-in-differences design at the donor level in Eq.5 to examine (1) whether the composition of donors shifts differentially across OPOs in response to the

initial report release, and (2) whether the effects on the use of donated organs persist after controlling for these compositional shifts.

$$Y_{ioq} = \gamma_1 \textit{Decertification.Risk}_o \times 1[\text{PreReport}_q] + \gamma_2 \textit{Decertification.Risk}_o \times 1[\text{PostReport}_q] + X_{ioq}\theta + \alpha_o + \lambda_q + \varepsilon_{ioq} \tag{5}$$

where Y_{ioq} is an outcome for deceased donor i with organ recovery in quarter q at donor hospital located in OPO o. Covariates include donor characteristics, including gender, race and ethnicity, blood type, and donation after circulatory death (DCD) status. Standard errors are clustered at the donor hospital's OPO.[11]

4.2 Instrumental Variable Approach: Demand-Side Response to Increased Offers

We also study how transplant centers respond to changes in offer rates to determine how their incentives limit the ability of OPO performance monitoring to increase transplant rates. This analysis focuses on kidney transplants as these comprise the bulk of organs for transplantation. A key demand-side force arises from the dynamic incentives to decline organ offers. Patients who remain on dialysis longer receive greater priority on the waitlist. If surgeons place more weight on post-transplant survival than on waitlist survival, they may have incentives to decline a current offer in anticipation of receiving a higher-quality offer for the same patient in the future. As offer rates increase, the probability of accepting any given offer may therefore decline.

11. The corresponding event study specification is

$$Y_{ioq} = \alpha + \sum_{\tau=-13(\tau\neq-1)}^{12} \delta_\tau \text{Decertification.Risk}_o \times 1(t=\tau) + \lambda_q + \nu_o + \epsilon_{ioq} \tag{6}$$

where event time τ denotes the number of quarters relative to Q4 2020.

To evaluate the magnitude of these incentives, we relate the decision to accept a particular offer to the offer rate. However, offer rates are themselves determined by aggregate acceptance decisions, raising concerns about endogeneity. To address this issue, we use an instrumental variables approach in which the deceased donor arrival rate serves as an instrument for the offer rate. The exclusion restriction is that the donor arrival rate affects acceptance decisions only through its effect on offers, so donor arrivals can be interpreted as a "supply-side" shifter (Agarwal, Hodgson, and Somaini 2025). We estimate the following linear probability model in Equation 7:

$$A_{ij} = \zeta_W \text{Offer rate}_{ij} + \beta' x_{ij} + \text{TC}_{c(i)} + \text{month}_{t(j)} + \epsilon_{ij}. \tag{7}$$

where A_{ij} indicates whether patient i accepts an offer from donor j. The first stage is

$$\text{Offer rate}_{ij} = \tau \log\left(1 + \text{donor arrival rate}\right)_{ij} + \gamma' x_{ij} + \text{TC}_{c(i)} + \text{month}_{t(j)} + \nu_{ij}. \tag{8}$$

The offer rate is a summary measure of the option value of turning down an offer in order to wait for a better offer than from donor j in the future. This is constructed based on historical offer rates by a donor quality index as described below.[12] This is an extension to the 'reduced-form' acceptance equation estimated in Agarwal, Hodgson, and Somaini 2025 in lieu of estimating the complete dynamic discrete choice model as in Agarwal et al. 2021.

We construct a lagged offer rate for each patient-donor group and month. Patient groups are defined by the candidate's listing OPO/DSA, blood type, years since listing, and calculated panel reactive antibody (CPRA) category. Waiting time is calculated as years since the candidate first joined the waitlist divided into categories (0, 1, 2, 3, 4, 5, or >5 years). CPRA is a measure of predicted immune system compatibility and is categorized by whether the

12. Although we reference the patient here for convenience, the decision to accept an offer lies with the patient's care team.

patient is highly sensitized (CPRA$\geq$ 0.8) or not. Donors are grouped by kidney donor risk index (KDRI) where lower KDRI is associated with lower post-transplant risk or a higher quality donor. A donor in KDRI decile d is grouped with donors in deciles $1, \ldots, d$ so that the offer rate measures offers from donors at least as good as the donor under consideration.

Let O_{pds} denote the number of offers made to candidates in group p in month s by donors in KDRI deciles $1, \ldots, d$. Let P_{ps} denote the number of patient-days observed for patients in group p in month s. Then the offer rate is constructed based on the offers per patient-day over the previous six months:

$$R_{pdt} = \frac{\sum_{s=t-6}^{t-1} O_{pds}}{\sum_{s=t-6}^{t-1} P_{ps}}. \tag{9}$$

We construct the donor arrival rate over the same rolling window. Let A_{ids} denote the number of blood-type compatible donors who arrive within 250 nautical miles of patient i in KDRI deciles $1, \ldots, d$ and month s. We use 250 nautical miles as this donors are first offered to candidates within this distance. Let D_s denote the number of days in month s. The donor arrival instrument in month-year is

$$Z_{idt} = \frac{\sum_{s=t-6}^{t-1} A_{ids}}{\sum_{s=t-6}^{t-1} D_s}. \tag{10}$$

5 Results

We employ two complementary approaches to examine how decertification threats affect OPOs and transplant centers. First, using a difference-in-differences design, we study whether public performance ratings changed OPO behavior, as reflected in organ recovery and transplantation. Second, using an instrumental-variables approach, we examine whether transplant centers respond to receiving more organ offers by performing more transplants or by becoming more selective.

5.1 Impact on Organ Donation

We start the analysis by examining the effect of increased decertification risk on organ supply. Figures 1a and 1b report event study estimates for organ donors and organs recovered for transplant per 100 potential deaths, respectively. Columns 1 and 2 of Table 3 report the corresponding two way fixed effects estimates.

Greater decertification risk increased organ supply following the release of the initial performance report. Neither outcome exhibits differential pretrends, providing support for the identifying assumption. The shaded region in each event study marks the period from the policy announcement in November 2020 through the release of the first performance report on September 30, 2021. During this period, the estimates remain close to their pre-period levels, and the corresponding two way fixed effects estimates are also close to zero for both the number of donors and organs recovered for transplant (Columns 1 and 2). The absence of a detectable response before the report release suggests limited anticipation and indicates that OPO behavior changed primarily after their position relative to the tier thresholds became known.

Following the report release, however, the number of organ donors increases by 0.70 per 100 potential deaths among OPOs with a 10 percentage point larger shortfall from the Tier 1 cutoff (7.3 percent increase relative to the pre-period mean; Column 1). We find a similar response for organ recovery. The number of organs recovered for transplant increases by 2.6 per 100 potential deaths for a 10 percentage point larger shortfall (7.5 percent; Column 2). These findings suggest that greater decertification risk increases both donor recovery and the number of organs entering the transplant allocation system.

5.2 Impact on Use of Donated Organs

We next examine the effect of decertification risk on the use of recovered organs. We consider two measures of the transplant rate. The first is the unadjusted transplant rate, defined as

the number of deceased donor organs transplanted per 100 potential deaths. The second is the age adjusted transplant rate used by CMS in its annual OPO performance reports. Figures 2a and 2b present the corresponding event study estimates.

Consistent with the findings on organ recovery, the event study coefficients remain close to zero before the policy announcement and during the period between the announcement and the release of the 2021 performance report. The corresponding two way fixed effects estimates are also small and statistically insignificant for both transplant measures, providing little evidence of differential pretrends or anticipatory responses during the interim period (Columns 2 and 3 of Table 3).

Following the report release, however, both transplant measures increase more among OPOs facing greater decertification risk. The number of organs transplanted increases by 1.89 per 100 potential deaths for OPOs with a 10 percentage point larger shortfall from the Tier 1 cutoff, a 6.2 percent increase relative to the preperiod mean. Compared with the 2.92 additional organs recovered for transplant in Column 2, this implies that about 65 percent of the increase in recovery translates into additional transplants. The CMS age adjusted transplant rate shows a similar increase of 2.04 per 100 potential deaths, or 5.9 percent (Column 3).

The increase in recovery is also accompanied by greater organ discard (Figure 2c). Column 5 of Table 3 shows that, following the report release, the number of discarded organs increases by 0.71 per 100 potential deaths for a 10 percentage point increase in treatment intensity (15.5%). This increase is equivalent to about 24 percent of the corresponding increase in organs recovered for transplant, indicating that roughly one quarter of the additional recovery does not result in transplantation. Because OPOs incur recovery related costs even when an organ is ultimately discarded, these results suggest that stronger performance incentives may also increase expenditures on organs that are not ultimately transplanted.

5.2.1 Donor-level analysis

We next examine whether decertification risk affected the number and quality of organs recovered and utilized at the donor level. Figure 3 reports event study estimates for the number of organs recovered per donor, the number of organs transplanted per donor, the share of recovered organs ultimately transplanted, and the donor kidney donor profile index (KDPI). We estimate Poisson regressions for count outcomes (number of organs recovered and transplanted per donor) and OLS regressions for the other outcomes (KDPI and the share of recovered organs transplanted). Across these outcomes, the estimates are close to zero before the report release, with little evidence of anticipatory responses, and begin to change primarily after the release of the 2021 performance report. Table 4 reports the corresponding estimates.

Consistent with the OPO level analysis, the donor level outcomes show little evidence of differential pretrends or anticipatory responses, but begin to diverge after the report release according to the decertification risk of the OPO serving the donor hospital. First, we find little change in the number of organs recovered per donor for OPOs with a 10 percentage point increase in treatment intensity (Column 1). In contrast, the number of organs transplanted per donor decreases by 0.024 (0.8%; Column 2), and the share of recovered organs ultimately transplanted declines by 1.98 percentage points (2.4%; Column 3). We also find evidence of a shift toward higher risk donors, with average KDPI increasing by 1.54 points for a 10 percentage point increase in treatment intensity (3.0%; Column 4). These donor level estimates are consistent with the OPO level results. Greater decertification risk leaves the number of organs recovered per donor largely unchanged, while reducing the share ultimately transplanted and shifting recovery toward higher risk donors.

5.2.2 Margins of Increased Organ Recovery

We next examine the margins through which OPOs facing greater decertification risk expanded organ supply. We focus on four dimensions: engagement with donor hospitals, donor quality, the source of donation authorization, and donation pathway.

First, OPOs facing greater decertification risk engaged with a broader set of donor hospitals. Column 1 of Table 5 shows that the number of donor hospitals increases by 0.19 per 100 potential deaths for a 10 percentage point increase in treatment intensity (5.8%). The corresponding event study estimates in Panel (b) of Figure 6 show little evidence of differential pretrends or anticipatory responses, with the increase emerging after the report release. These results are consistent with OPOs broadening their engagement with donor hospitals after learning their position relative to the performance thresholds.

Second, the increase in donors is concentrated among donors with higher KDPI. Columns 2 and 3 separate donors according to whether KDPI is below 50 or at least 50. The number of donors with KDPI below 50 increases by 0.19 per 100 potential deaths for a 10 percentage point increase in treatment intensity, but the estimate is not statistically significant (Column 2). In contrast, the number of donors with KDPI of 50 or higher increases by 0.69 per 100 potential deaths (12.8%; Column 3). The corresponding event study estimates are reported in Figure 4. These estimates are consistent with the donor level results showing an increase in average KDPI and indicate that much of the additional donor recovery came from higher KDPI donors.

Third, the increase in donors occurs through both family authorization and prior donor authorization. The number of donors authorized by next of kin increases by 0.41 per 100 potential deaths for a 10 percentage point increase in treatment intensity (9.6%; Column 4), while the number of donors with prior authorization increases by 0.47 per 100 potential deaths (7.8%; Column 5). The corresponding event study estimates in Figure 5 show

little evidence of anticipatory changes and increases after the report release. Next of kin authorization therefore accounts for nearly half of the increase across these two authorization categories.

Finally, Columns 6 and 7 examine whether the increase in donors differs between donation after brain death and donation after circulatory death (DCD). The number of donors following brain death increases by 0.61 per 100 potential deaths for a 10 percentage point increase in treatment intensity (8.0%; Column 6). The estimate for DCD donors is also positive but smaller and statistically indistinguishable from zero (Column 7). The corresponding event study estimates are reported in Figure 7. These results point more clearly to an increase in donors following brain death, with less evidence of a change in DCD donation, suggesting that the increase in donation among lower performing OPOs was not primarily driven by a shift toward DCD cases.[13]

5.3 Impact on Offer Acceptance Decision

Motivated by the increase in organ supply but the more limited improvement in the utilization of donated organs, we next use an instrumental variables approach to examine the role of transplant centers. Because the increase in the number of organ donors was accompanied by increases in donor age and health risk, transplant rates may not rise proportionally if transplant centers are more reluctant to accept higher risk organs. In addition, transplant centers located in regions served by OPOs facing greater recertification threats may expect more organs to become available nearby. This expectation may give them greater flexibility to decline current offers. To assess why transplant rates improved less than overall organ supply, we estimate an instrumental variables model.

Table 6 shows that the acceptance behavior is highly responsive to an increase in offer

13. Recent investigations, including a 2025 federal investigation of DCD cases in Kentucky (Rosenthal 2025), have raised concerns about safeguards surrounding DCD procurement amid the growing use of DCD as a source of donated organs (Husain et al. 2026). While DCD donation has risen, our results demonstrate this has not occurred differently across OPO performance tiers.

rates. Figure 8 depicts results graphically using an IV binscatter plot of residualized predicted offer rates against residualized acceptance decisions. The 2SLS estimate implies that a one standard deviation increase in the offer rate, about 21 additional offers per patient-year, reduces the probability of accepting an offer by 0.8 percentage points. This is a large reduction relative to the small overall acceptance probability of 1.6%. Panel B of 6 demonstrates that donor scarcity is a powerful instrument for shifting the offer rate. Appendix Table A.2 shows that this is not sensitive to our offer sample construction.

5.4 Alternative Performance Measures

Our findings suggest that the donation and transplant rates capture different margins of OPO performance. The donation rate depends more directly on OPO decisions, whereas the transplant rate also reflects acceptance decisions by transplant centers. Measured performance may also vary with characteristics of the underlying potential donor population across service areas. We therefore examine how OPO tier assignments change under alternative performance measures.

Table 7 and Figure **??** compare tier assignments under the 2021 report with four alternative specifications. Case 1 uses only the unadjusted donation rate. Case 2 uses an age-adjusted donation rate that accounts for differences in the age composition of potential deaths across service areas. Case 3 uses only the age-adjusted transplant rate. Case 4 uses both the age-adjusted donation and transplant rates. These comparisons show how tier assignments vary with the choice and adjustment of the underlying performance measures.

Tier assignments differ materially across the four specifications. Using only the unadjusted donation rate assigns 32 OPOs to Tier 1, compared with 24 under the 2021 report. Age adjustment reduces this number to 26 in Case 2. Using only the age-adjusted transplant rate assigns 27 OPOs to Tier 1 in Case 3, whereas requiring OPOs to meet both the age-adjusted donation and transplant thresholds assigns 25 OPOs to Tier 1 in Case 4. All four

alternative specifications also assign fewer OPOs to Tier 3 than the 2021 report. Because OPOs at the bottom of the performance distribution face the greatest risk of decertification, these results show that exposure to decertification depends, in part, on how performance is measured.

6 Conclusion

This paper examines whether being publicly rated changed OPO behavior and its implications for the use of donated organs and transplant outcomes. To answer this question, we employ two complementary designs that draw on registry organ transplant data as well as data on deaths considered in the donor authorization process. Using a difference-in-differences design, we study changes in organ recovery and transplantation following the release of the 2021 performance report. We then turn to transplant centers and ask whether receiving more organ offers leads them to transplant more organs or instead to become more selective.

We find that performance oversight moved OPOs along the margins they control most directly, namely donor identification and recovery, while the associated gains in completed transplants were smaller. OPOs facing greater decertification risk increased organ recovery, expanded hospital outreach, obtained more family authorizations, and recovered organs from somewhat higher risk donors. About 73% of the additional organs recovered were ultimately transplanted, while the remainder were discarded. Our offer level analysis also indicates that transplant centers became somewhat more selective as offer rates increased. These findings are consistent with OPOs responding more strongly on the supply margin rewarded by the performance metric than on the downstream transplant outcome, although other mechanisms may also contribute.

Our findings show that regulatory oversight tied to performance can generate strong responses on margins controlled by the regulated organization, even when downstream outcomes depend on other decision makers. In the OPO setting, stronger incentives increase

organ recovery, but transplant also requires acceptance by transplant centers. Performance metrics that reward recovery may increase organ supply while yielding smaller gains in transplantation and higher discard related costs, as Medicare includes the costs of procuring organs ultimately determined unusable in organ acquisition costs (Intent to Transplant, Intent for Research, Counting En Bloc, and Unusable Organs 2024). This consideration is relevant when the marginal organs recovered are higher risk but may nevertheless generate substantial life-year gains (Agarwal, Hodgson, and Somaini 2025). Complementary incentives on the transplant-center side may help align these margins. The recently implemented Increasing Organ Transplant Access (IOTA) model (Chan and Roth 2026; Rentas et al. 2026), which introduces performance incentives for kidney transplant centers, provides one such approach. More generally, our findings suggest that policies designed to increase organ transplantation should jointly account for the incentives facing both the organizations that supply organs and those that decide whether to use them.

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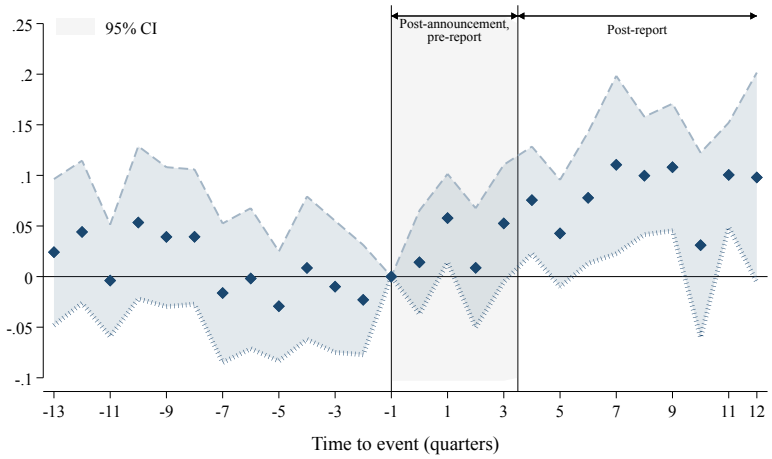
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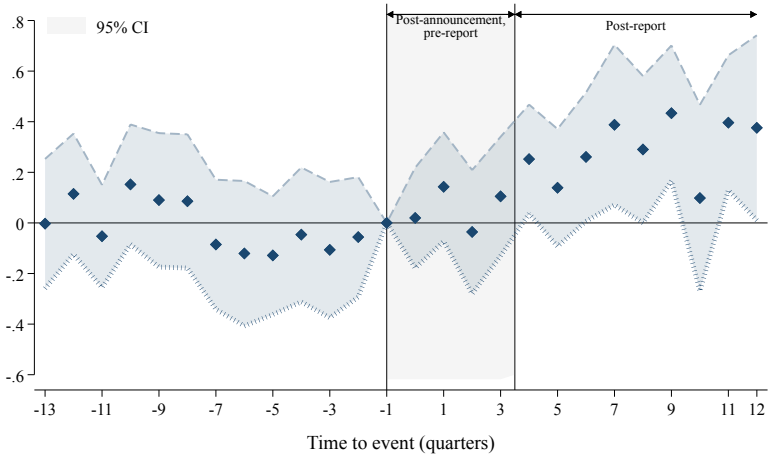
Figures and Tables

Figure 1: Impact on Organ Donation

(a) Number of donors per 100 deaths



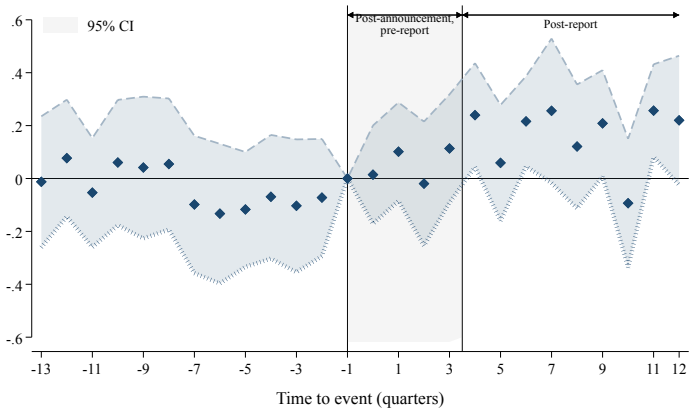
(b) Number of recovered organs per 100 deaths



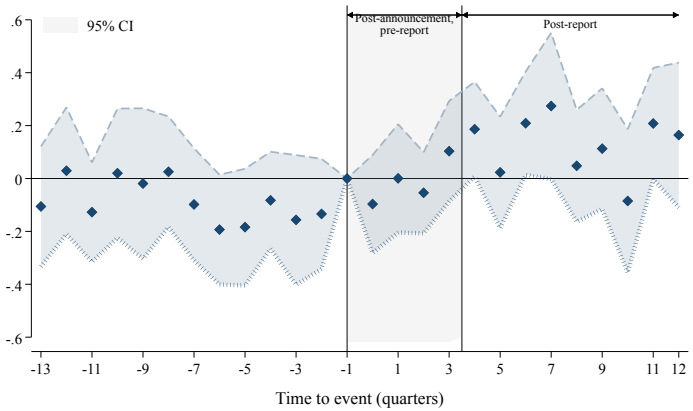
Notes: This figure reports event study estimates for donor and organ recovery. Panel (a) reports the number of recovered donors per 100 potential deaths, and panel (b) reports the number of recovered organs per 100 potential deaths. The preceding quarter is omitted as the reference period. The shaded area denotes the post-announcement period before the release of the 2021 CMS performance report, when OPOs were subject to the new evaluation system but had not yet observed their initial CMS tier classifications. Estimates are from OPO-level regressions that interact event-time indicators with the 2021 treatment-intensity measure and include OPO and quarter fixed effects. Standard errors are clustered at the OPO level.

Figure 2: Impact on organ usage

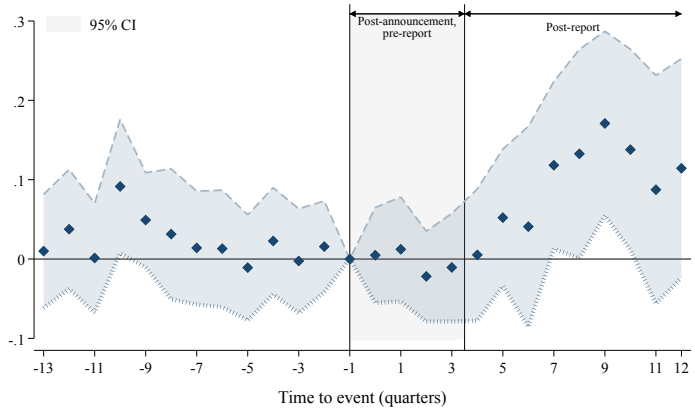
(a) Transplanted organs per 100 potential deaths



(b) Age-adjusted transplant rate



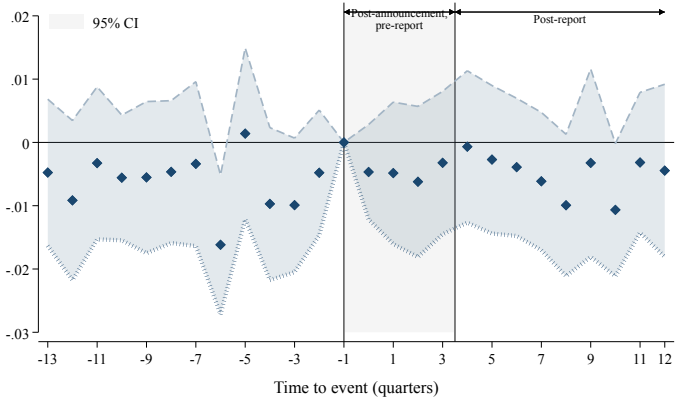
(c) Discarded organs per 100 potential deaths



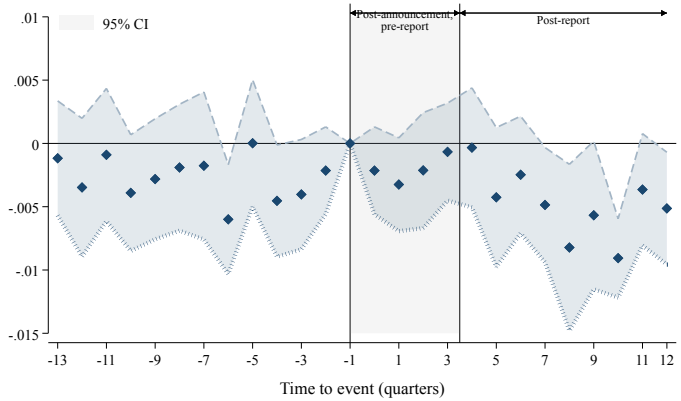
Notes: This figure presents event study estimates from Equation 4. Panel A reports the number of transplanted organs per 100 potential deaths, Panel B reports the age adjusted transplant rate used by CMS in the annual OPO performance reports, and Panel C reports the number of discarded organs per 100 potential deaths. Treatment intensity is the OPO's distance from the Tier 1 performance threshold in the 2021 CMS performance report. The shaded region marks the period between the policy announcement in Q4 2020 and the release of the first performance report in Q3 2021.The preceding quarter is omitted as the reference period. The analysis combines SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023 with CDC Multiple Cause of Death data used to construct potential deaths. See the notes to Table 1 for further details on the analysis sample.

Figure 3: Impact on donor-level outcomes

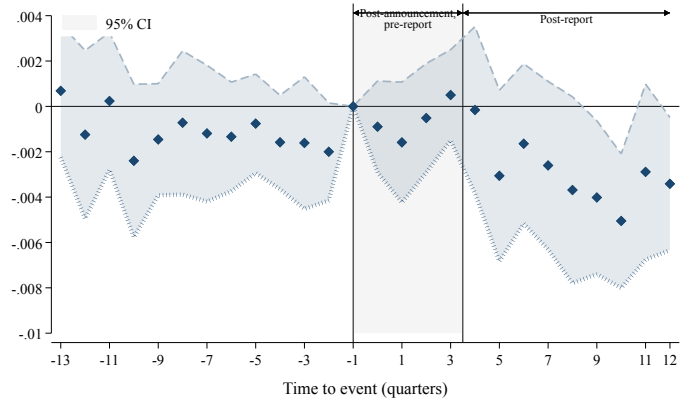
(a) Number of organs recovered per donor



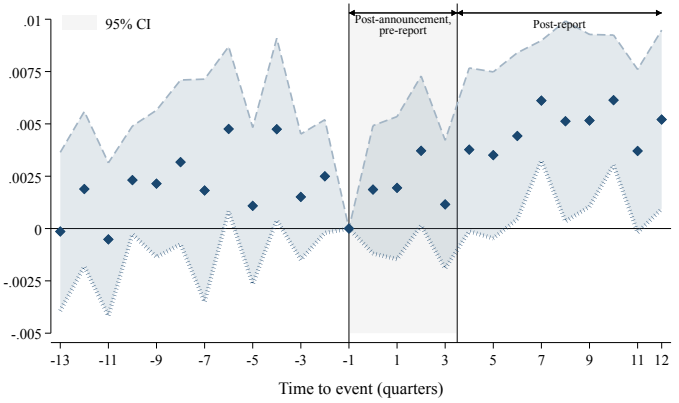
(b) Number of organs transplanted per donor



(c) Share of transplanted organs per donor



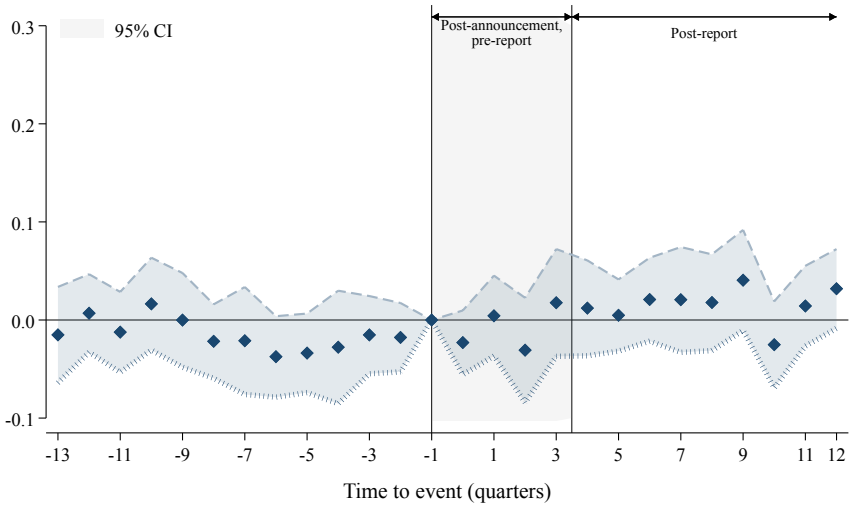
(d) Kidney Donor Profile Index (KDPI)



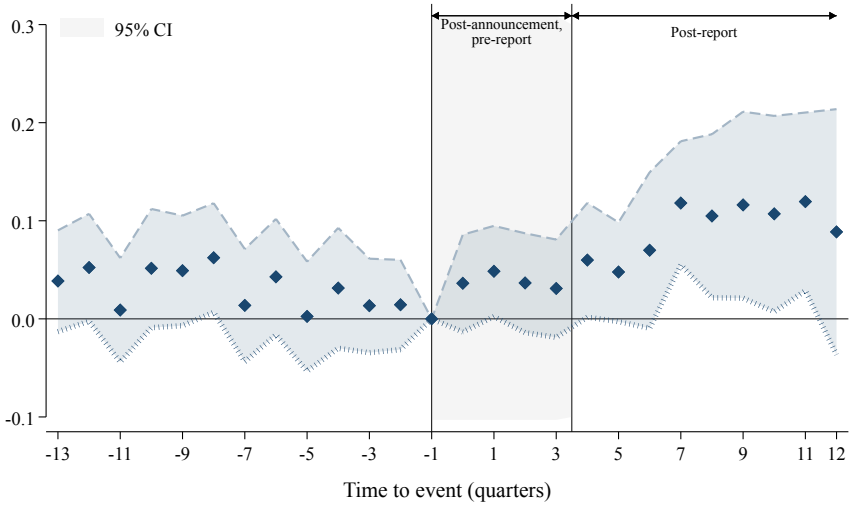
Notes: This figure plots event study estimates from Equation 6. Panel (a) uses the number of organs recovered per donor as the outcome, Panel (b) uses the number of organs transplanted per donor, Panel (c) uses the share of recovered organs ultimately transplanted per donor, and Panel (d) uses Kidney Donor Profile Index (KDPI). The preceding quarter is omitted as the reference period. The shaded area denotes the period after the announcement but before the release of the 2021 CMS performance report, when OPOs were subject to the new evaluation system but had not yet observed their initial tier classifications.

Figure 4: Impact on Organ Donation by Donor Health Risk

(a) Donors with low health risk (KDPI<50%)



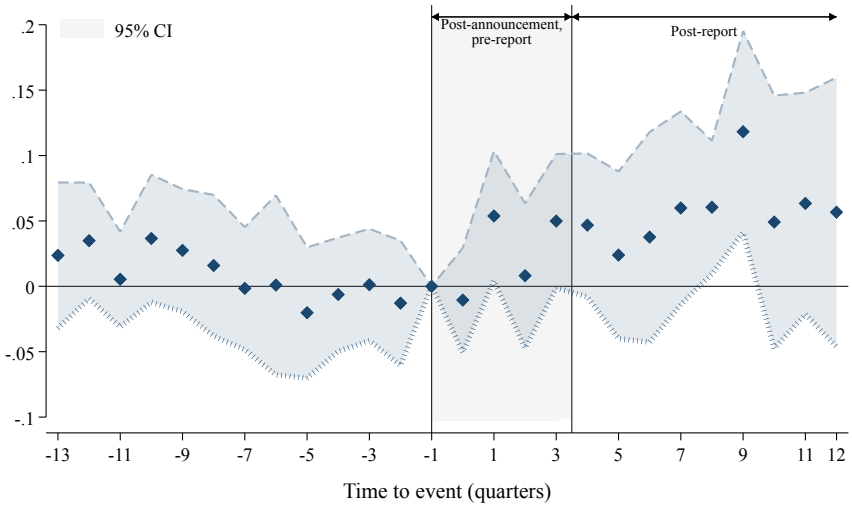
(b) Donors with high health risk (KDPI≥50%)



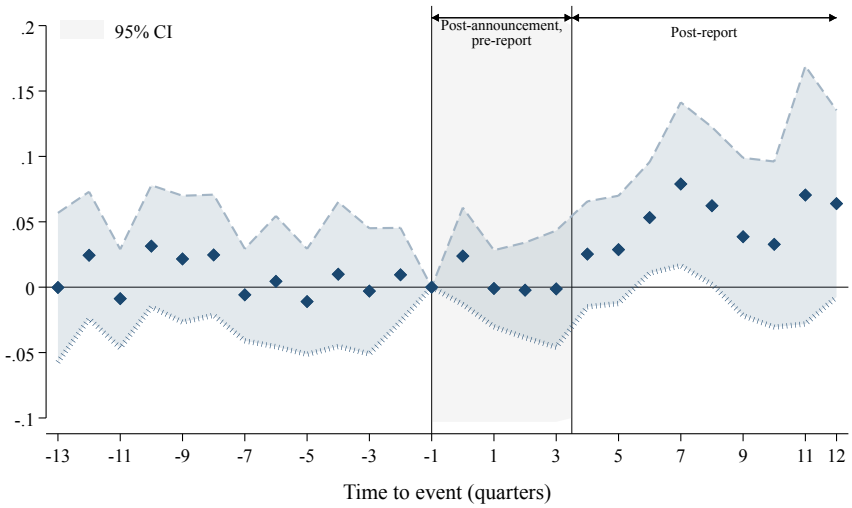
Notes: This figure presents the event study estimates from Equation 4. The dependent variable is the number of donors per 100 potential deaths with KDPI below 50% in Panel (a) and KDPI of 50% or higher in Panel (b). The preceding quarter is omitted as the reference period. The shaded area denotes the period after the policy announcement and before the report release. Treatment intensity is measured using the OPO's distance from the Tier 1 performance threshold in the 2021 report. Standard errors are clustered at the OPO level. The analysis combines SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023 with CDC Multiple Cause of Death data used to construct potential deaths.

Figure 5: Impact on Organ Donation by Source of Authorization

(a) Prior donor authorization



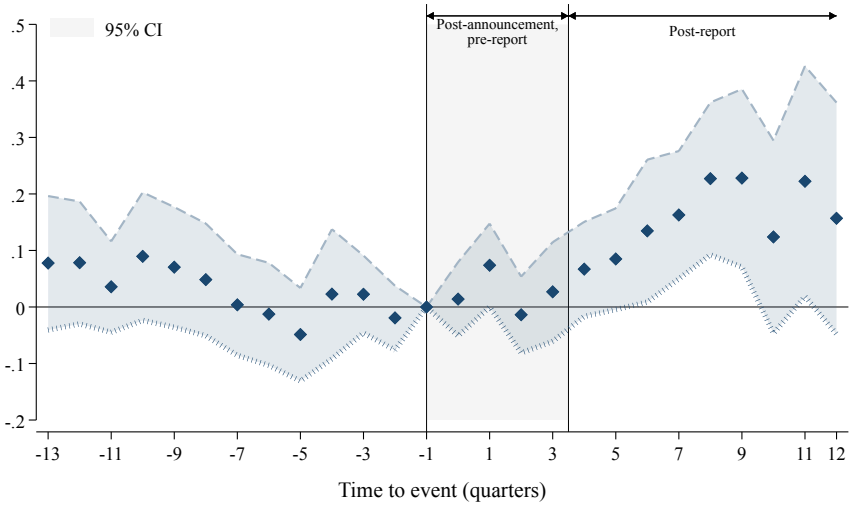
(b) Authorization by next of kin



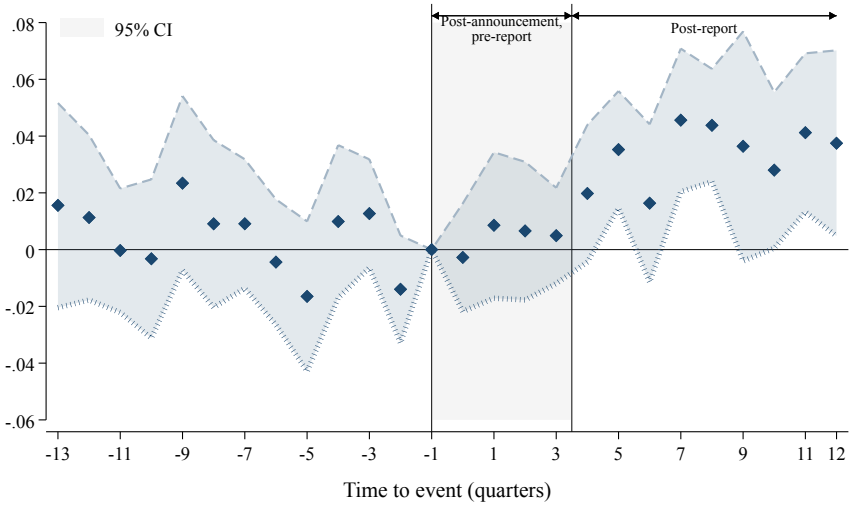
Notes: This figure plots event study estimates from Equation 4. The dependent variable is the number of donors per 100 potential deaths with prior donor authorization in Panel (a) and next of kin authorization in Panel (b). The preceding quarter is omitted as the reference period. The shaded area denotes the period after the policy announcement and before the report release. Treatment intensity is measured using the OPO's distance from the Tier 1 performance threshold in the 2021 report. Standard errors are clustered at the OPO level.

Figure 6: OPO Operational Responses to the 2021 Performance Report

(a) Deaths with donation authorization per 100 deaths



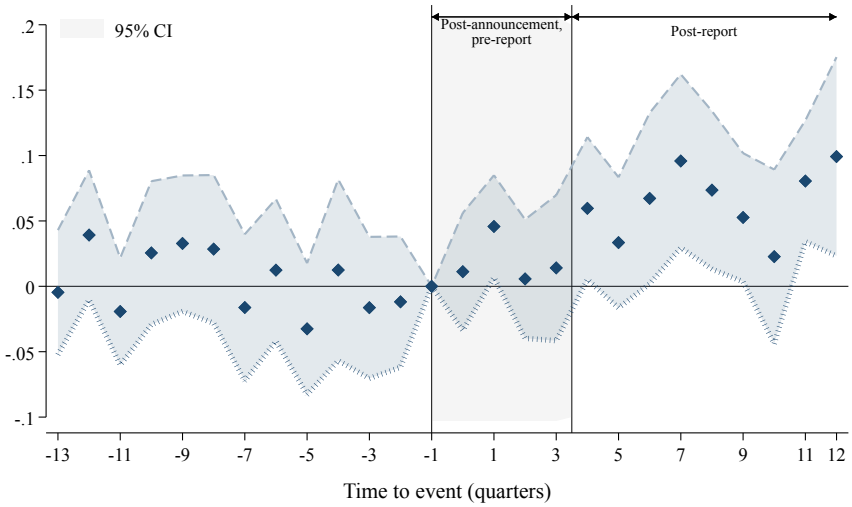
(b) Hospitals with donation authorization per 100 potential deaths



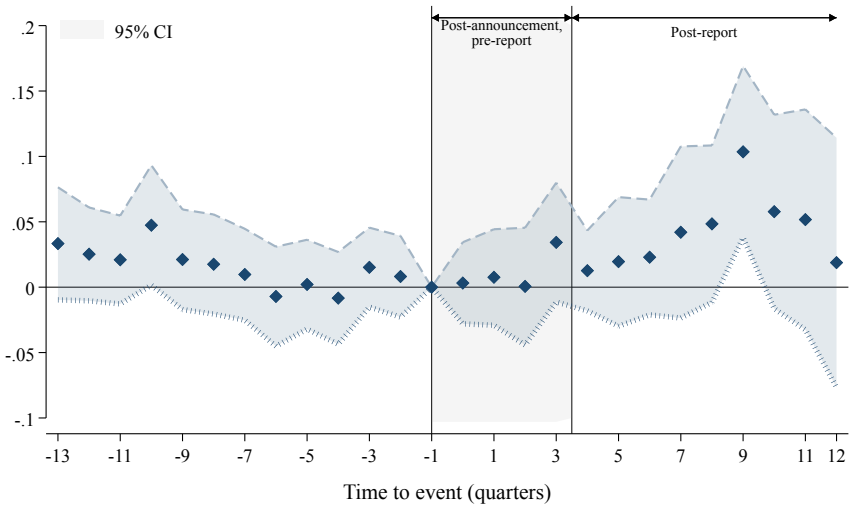
Notes: This figure plots event study estimates from Equation 4. Panel (a) uses deaths with donation authorization per 100 potential deaths as the outcome, while Panel (b) uses donor hospitals involved in at least one such case per 100 potential deaths. The shaded area denotes the period after the policy announcement and before the report release. Treatment intensity is measured by the OPO's distance from the Tier 1 performance threshold in the 2021 report. All regressions include OPO and quarter fixed effects, with standard errors clustered at the OPO level. Deaths with donation authorization are identified using UNOS data on potential donor deaths assigned a donor identifier, including both recovered and nonrecovered donors.

Figure 7: Impact on Organ Donation by Donation Pathway

(a) Donation after brain death

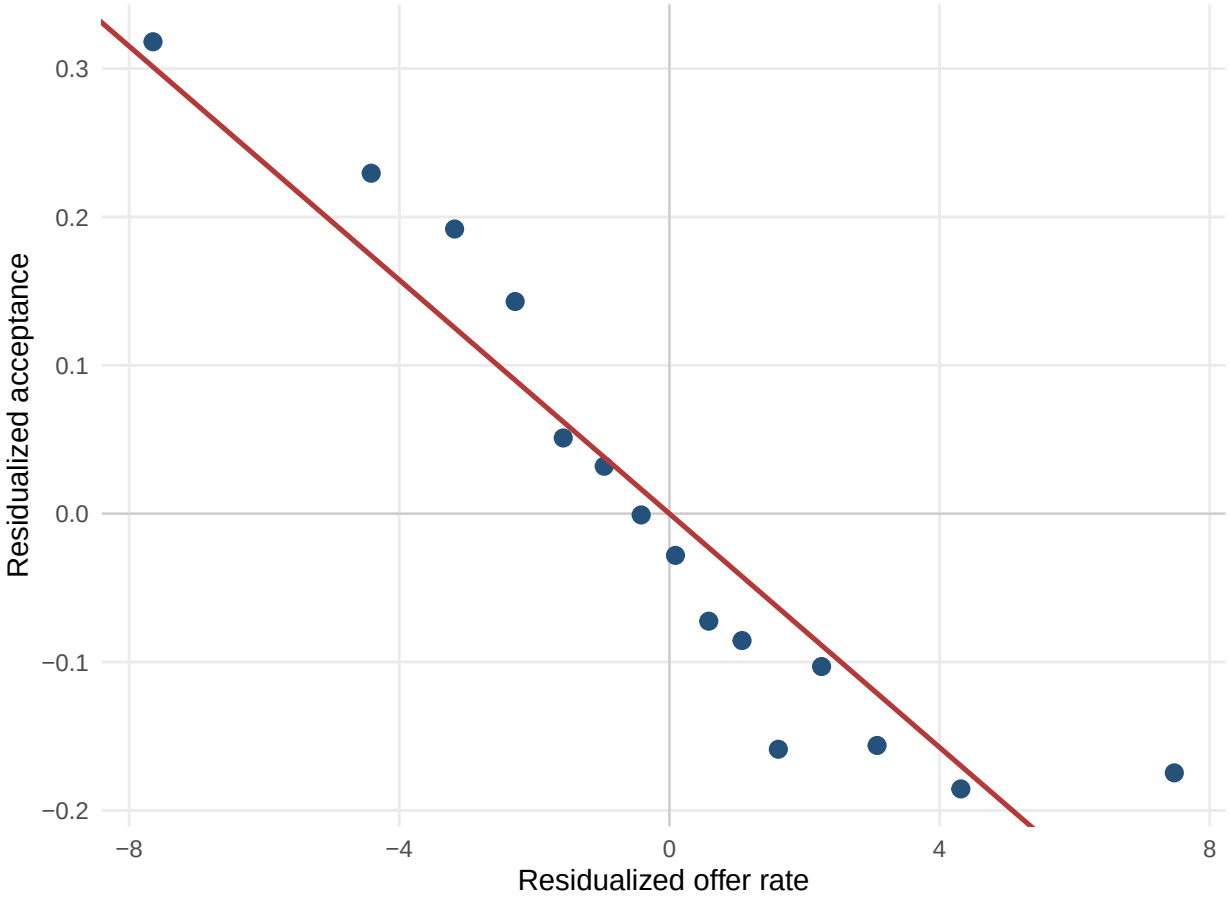


(b) Donation after circulatory death (DCD)



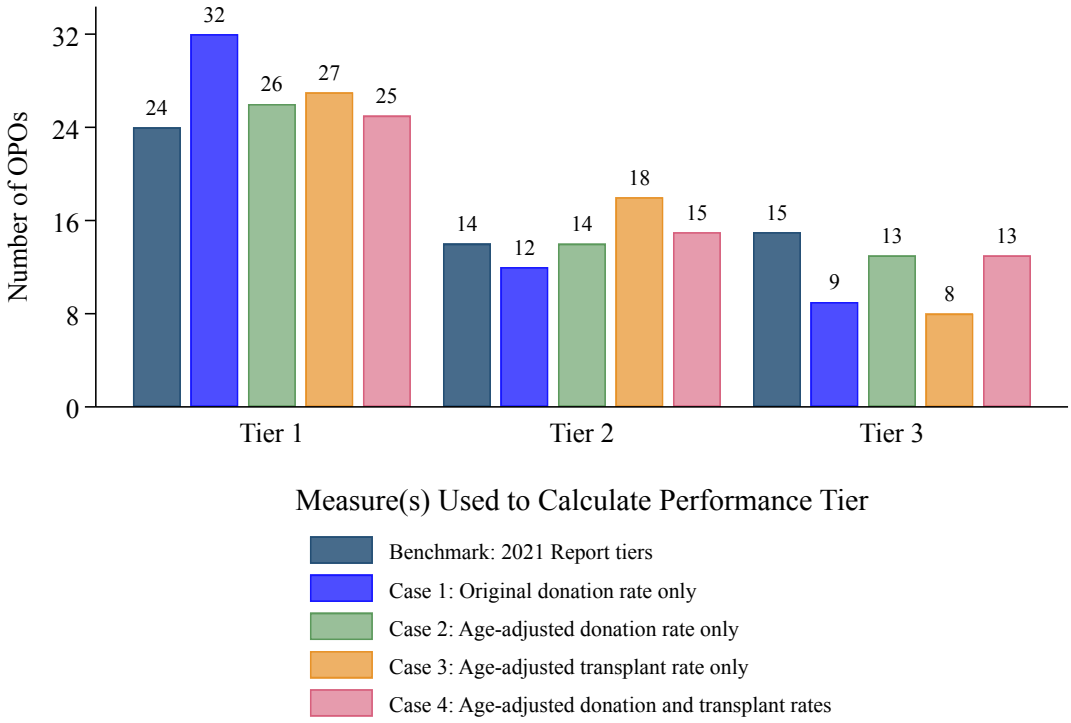
Notes: This figure plots event study estimates from Equation 4. Panel (a) uses the number of donors following brain death per 100 potential deaths as the outcome, while Panel (b) uses the number of DCD donors per 100 potential deaths. The shaded area denotes the period after the policy announcement and before the report release. The preceding quarter is omitted as the reference period. The shaded area denotes the period after the policy announcement and before the report release. Treatment intensity is measured using the OPO's distance from the Tier 1 performance threshold in the 2021 report. Standard errors are clustered at the OPO level.

Figure 8: Impact of Offer Rate on Acceptance



Notes: This figure plots IV binscatter estimates of the residualized acceptance decision against the residualized predicted offer rate estimated using the donor arrival instrument.

Figure 9: Distribution of OPO Tiers under Alternative Performance Measures



Notes: This figure shows the number of OPOs assigned to each performance tier under the 2021 OPO Annual Public Aggregated Performance Report (Benchmark) and four alternative performance measures. The sample consists of 53 OPOs for which no changes to OPO composition occurred from 2019–2025. HIOP is dropped from the analysis because it is evaluated on an unadjusted kidney transplant rate rather than the age-adjusted transplant rate used for all other OPOs. The Benchmark uses the tier assignment reported in 2021. Case 1 uses the unadjusted donation rate. Case 2 uses the age-adjusted donation rate. Case 3 uses the age-adjusted transplant rate. Case 4 uses both the age-adjusted donation and transplant rates. Tiers are constructed by ranking OPOs on each measure, with Tier 1 corresponding to the top 25% threshold, as used in the 2021 report. The analysis combines SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023 with CDC Multiple Cause of Death data used to construct potential deaths.

Table 1: Descriptive statistics

	(1)	(2)	(3)	(4)
	Full sample	2021 Performance Tier		
		Tier 1	Tier 2	Tier 3
Treatment intensity	6.619	0.000	4.057	19.602
OPO performance measures				
(a) Donation rate (organ donors per 100 potential deaths)	10.771	12.538	9.649	8.991
(b) Age-adjusted transplant rate	36.855	42.349	33.885	30.837
Organ recovery and utilization				
(a) Organs recovered for transplant per 100 potential deaths	40.445	47.331	35.528	34.016
(b) Organs transplanted per 100 potential deaths	33.146	39.044	29.272	27.325
(c) Organs discarded per 100 potential deaths	6.802	7.718	6.100	5.990
(d) Number of donor hospitals per 100 potential deaths	3.716	4.215	3.328	3.280
Number of OPOs	53	24	14	15
Observations (OPO × quarter)	1378	624	364	390

Notes: This table reports descriptive statistics for the full sample and by OPO performance tier in the initial 2021 report. Column 1 reports means for the full sample. Columns 2–4 report means for OPOs assigned to Tiers 1, 2, and 3, respectively. Treatment intensity measures the average percentage improvement in the donation and transplant measures required to reach the Tier 1 thresholds. The sample consists of 53 OPOs that remained in operation without any merger events during the sample period. HIOP is excluded because it is evaluated using an unadjusted kidney transplant rate rather than the age-adjusted transplant rate used for all other OPOs. The analysis combines SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023 with CDC Multiple Cause of Death data used to construct potential deaths. Following CMS performance reporting guidance, we define potential deaths as inpatient deaths among individuals aged 75 or younger whose primary cause of death corresponds to ICD codes I20–I25, I60–I69, or V01–Y89.

Table 2: Offer-level descriptive statistics

	(1)	(2)	(3)	(4)
	Full sample	2021 Performance Tier		
		Tier 1	Tier 2	Tier 3
Offer accepted (%)	1.236 (11.049)	1.267 (11.184)	1.479 (12.069)	1.005 (9.976)
Compatible offers per patient-day	0.0761 (0.0303)	0.0774 (0.0300)	0.0720 (0.0259)	0.0810 (0.0337)
Compatible recovered donors per day	0.4656 (0.2762)	0.5143 (0.2671)	0.4530 (0.2288)	0.4186 (0.3161)
Number of offers	4,817,691	2,259,256	1,099,872	1,458,563
DSA-month observations	4,290	1,950	1,170	1,092
Unique donors	109,095	90,116	64,994	68,437
Unique candidates	234,409	111,712	61,657	61,040
Listing centers	243	121	68	55

Notes: Entries in the first three rows are means, with standard deviations in parentheses. Offer acceptance is summarized across offer-level observations in the preferred top-100 estimation sample. The offer-rate and donor-arrival statistics are summarized across DSA-month observations. Within each DSA-month, candidate blood type cells are aggregated using patient-day weights, and the offer rate also aggregates across waiting-time categories. Both availability measures are six-month rolling averages constructed from the six complete calendar months preceding the observation month. Donor arrivals count blood type-compatible recovered donors per calendar day. Tiers refer to the OPO whose DSA contains the candidate's listing center and are taken from the 2021 performance report. The analysis uses Potential Transplant Recipient (PTR) data on deceased donor kidney offers from 2019-2025.

Table 3: Impact on organ donation and transplant rates

	(1)	(2)	(3)	(4)	(5)
	Organ donors per 100 deaths	Organs recovered for transplant per 100 deaths	Age-adjusted transplant rate (per 100 deaths)	Transplanted Organs per 100 deaths	Discarded Organs per 100 deaths
Recertification.Risk$_o$ × 1[PreReport$_q$]	0.022	0.055	0.067	0.081	-0.026
	(0.020)	(0.075)	(0.063)	(0.072)	(0.024)
Recertification.Risk$_o$ × 1[PostReport$_q$]	0.070**	0.260**	0.204**	0.189**	0.071*
	(0.032)	(0.116)	(0.093)	(0.085)	(0.039)
Mean Dep. Var (Pre-period)	9.544	34.915	34.584	30.326	4.589
Observations	1,378	1,378	1,378	1,378	1,378

Notes: This table reports estimates of β_1 and β_2 from Equation 3. Each observation corresponds to an OPO quarter. 1[PreReport$_q$] equals one for quarters from Q4 2020 through Q3 2021, after the policy announcement and before the release of the initial performance report. 1[PostReport$_q$] equals one for quarters following the release of the 2021 performance report. Column 1 reports the number of deceased donors with at least one organ transplanted per 100 potential deaths, corresponding to the donation rate used by CMS to evaluate OPO performance. Column 2 reports the number of organs recovered for transplant per 100 potential deaths. Column 3 reports the age adjusted transplant rate used by CMS to evaluate OPO performance. Column 4 reports the number of transplanted organs per 100 potential deaths, and Column 5 reports the number of discarded organs per 100 potential deaths. "Mean Dep. Var." denotes the mean of the dependent variable in Q3 2020, the quarter preceding the November 2020 policy announcement, among OPOs assigned to Tiers 2 and 3 in the 2021 performance report and therefore exposed to decertification risk. The analysis combines SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023 with CDC Multiple Cause of Death data used to construct potential deaths according to the CMS definition described in Section 2. See the notes to Table 1 for further details on the analysis sample. Standard errors, clustered at the OPO level, are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Impact of Decertification Risk on Donor Outcomes

	Number of Recovered Organs for Transplant	Number of Transplanted Organs	Share of Transplanted Organs	Kidney Donor Profile Index (KDPI)
Recertification.Risk$_o$ × 1[PreReport$_q$]	0.00029	0.00049	0.00044	0.02658
	(0.00081)	(0.00116)	(0.00076)	(0.05678)
Recertification.Risk$_o$ × 1[PostReport$_q$]	0.00018	-0.00240**	-0.00198**	0.15412***
	(0.00128)	(0.00100)	(0.00083)	(0.04806)
Mean of Dep. Var (Pre)	3.432	2.980	0.835	51.530
Observation	78,168	78,168	78,168	78,148
Controls	Yes	Yes	Yes	Yes
specification	poisson	poisson	OLS	OLS

Notes: This table reports the difference in differences estimates of γ_1 and γ_2 from Equation 5. Each observation corresponds to a deceased organ donor. Column 1 reports the number of organs transplanted per donor, Column 2 the number of organs recovered for transplant per donor, and Column 3 the share of recovered organs that are ultimately transplanted. Column 4 reports the Kidney Donor Profile Index (KDPI), a percentile measure based on donor characteristics, with higher values indicating donors whose kidneys have higher expected risk of graft failure. 1[PreReport$_q$] equals one for quarters from Q4 2020 through Q3 2021, after the policy announcement and before the release of the initial performance report. 1[PostReport$_q$] equals one for quarters following the release of the 2021 performance report. Controls include donor blood type, sex, race and ethnicity, and donation after circulatory death (DCD) status. The analysis uses SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023. See the notes to Table 1 for further details on the analysis sample. Standard errors, clustered at the OPO level, are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Heterogeneity Analysis: Impact on Organ Donation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Number of	Number of donors per 100 deaths					
	donor hospitals	By Donor's KDPI		Donor consent mechanism		Donor type	
	per 100 deaths	0-49%	50-100%	Next of kin	Self	Brain Death	DCD donor
Recertification.Risk$_o$ × 1[PreReport$_q$]	0.009	-0.003	0.016	-0.003	0.016	0.016	-0.003
	(0.006)	(0.012)	(0.015)	(0.012)	(0.014)	(0.015)	(0.013)
Recertification.Risk$_o$ × 1[PostReport$_q$]	0.019***	0.019	0.069**	0.041**	0.047*	0.061***	0.027
	(0.007)	(0.014)	(0.029)	(0.019)	(0.027)	(0.021)	(0.025)
Mean Dep. Var (Pre-period)	3.298	4.911	5.391	4.256	6.046	7.582	2.720
Observations	1,378	1,378	1,378	1,378	1,378	1,378	1,378

Notes: This table reports estimates of β_1 and β_2 from Equation 3. Each observation corresponds to an OPO quarter. Column 1 reports the number of donor hospitals per 100 potential deaths. Columns 2 and 3 report the number of donors per 100 potential deaths by donor KDPI, separately for KDPI below 50 and KDPI of 50 or higher. Columns 4 and 5 report donors by authorization mechanism, distinguishing authorization by next of kin from prior donor authorization. Columns 6 and 7 report donors by donor type, distinguishing donation after brain death from donation after circulatory death (DCD). The analysis combines SRTR data covering the universe of deceased organ donors in the United States from 2017 to 2023 with CDC Multiple Cause of Death data used to construct potential deaths according to the CMS definition described in Section 2. "Mean Dep. Var (Pre-period)" reports the mean of each outcome in Q3 2020 among OPOs assigned to Tiers 2 and 3 in the 2021 report. Standard errors, clustered at the OPO level, are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Offer Acceptance and Offer Rates

	Offer accepted		Offer rate
	OLS	2SLS	First stage
	(1)	(2)	(3)
Panel A. Acceptance equation			
Offer rate	0.0081***	−0.0394*	
	(0.0016)	(0.0164)	
Panel B. First stage			
Log(1 + compatible donors/day)			29.9900***
			(3.0055)
First-stage F-statistic			99.566
Mean dependent variable	1.5873	1.5873	
Observations	2,807,777	2,807,777	2,807,777

Notes: This table reports estimates from Eqs. 7 and 8. Acceptance is expressed in percentage points. The offer rate is the annualized six-month as-good ABO-compatible offer rate; the instrument is log(1 + as-good compatible donors/day) within 250 nautical miles. The sample retains each match's first 100 non-bypass PTR offers, truncated at placement and deduplicated by donor-candidate pair, from 2019–2023. All specifications include the prespecified controls and listing-center, month-year, and candidate-ABO fixed effects. Standard errors are two-way clustered by listing OPO and donor. $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

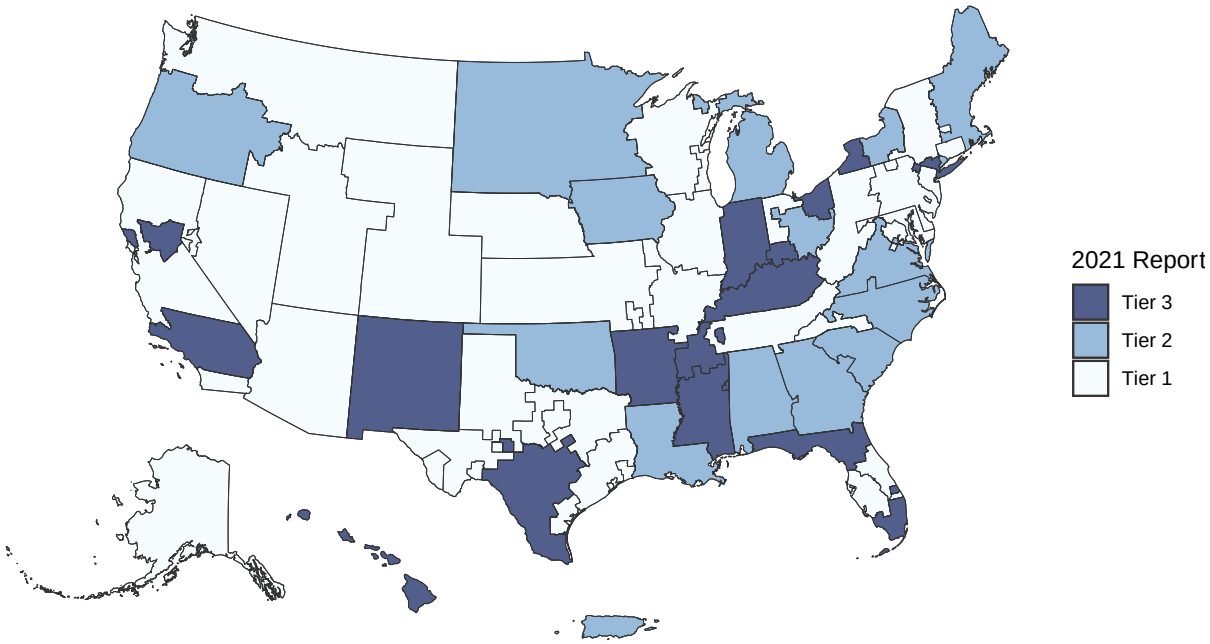
Table 7: Distribution of Tiers under Alternative Performance Measures

	2021 Report Tier			
	1	2	3	Total
Case 1: *Donation rate only*				
Tier 1	24	6	2	32
Tier 2	0	8	4	12
Tier 3	0	0	9	9
Case 2: *Age-adjusted donation rate only*				
Tier 1	24	2	0	26
Tier 2	0	11	2	14
Tier 3	0	0	13	13
Case 3: *Age-adjusted transplant rate only*				
Tier 1	24	3	0	27
Tier 2	0	11	7	18
Tier 3	0	0	8	8
Case 4: *Age-adjusted donation and transplant rates*				
Tier 1	24	1	0	25
Tier 2	0	13	2	15
Tier 3	0	0	13	13
Total	24	14	15	53

Notes: This table cross-tabulates OPO tier assignments under four alternative performance measures against their tier in the 2021 report. The sample consists of 53 OPOs for which no changes to OPO composition occurred from 2019–2025. HIOP is dropped from the analysis because it is evaluated on an unadjusted kidney transplant rate rather than the age-adjusted transplant rate used for all other OPOs. Columns denote each OPO's tier in the 2021 report, and rows denote the tier assigned under the alternative measure. Each cell reports the number of OPOs in the corresponding pair of tiers. Tiers are constructed by ranking OPOs on each measure, with Tier 1 corresponding to the top 25% threshold, as used in the 2021 report. Case 1 uses the unadjusted donation rate. Case 2 uses the age-adjusted donation rate. Case 3 uses the age-adjusted transplant rate. Case 4 uses both the age-adjusted donation and transplant rates. Cells on the diagonal correspond to OPOs whose tier is unchanged relative to the 2021 report.

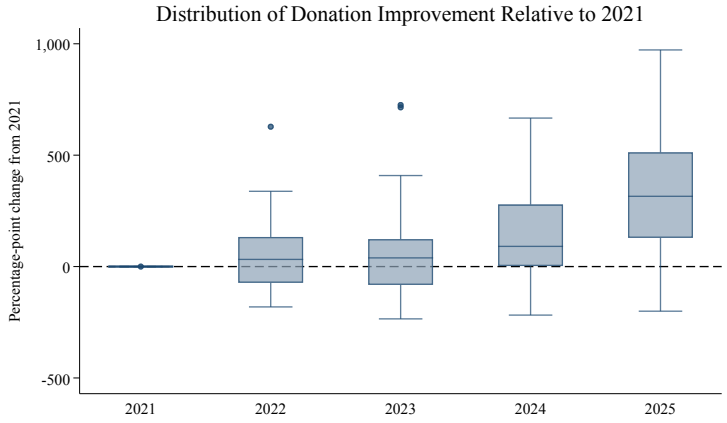
Appendix Figures and Tables

Figure A.1: 2021 Report Tiers by OPO

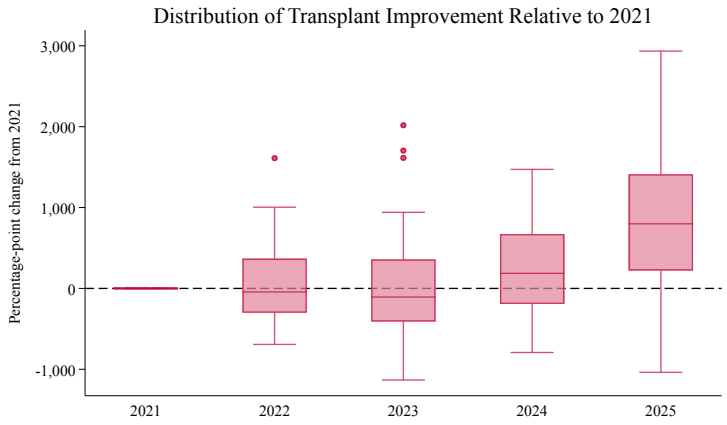


Notes: This figure presents OPO service areas in the United States. Each area consists of the counties served by a given OPO and is shaded according to the OPO's tier assignment in the 2021 CMS performance report. Data are from the 2021 CMS performance report.

Figure A.2: Distribution of OPO-Level Performance Changes Relative to 2021 Report



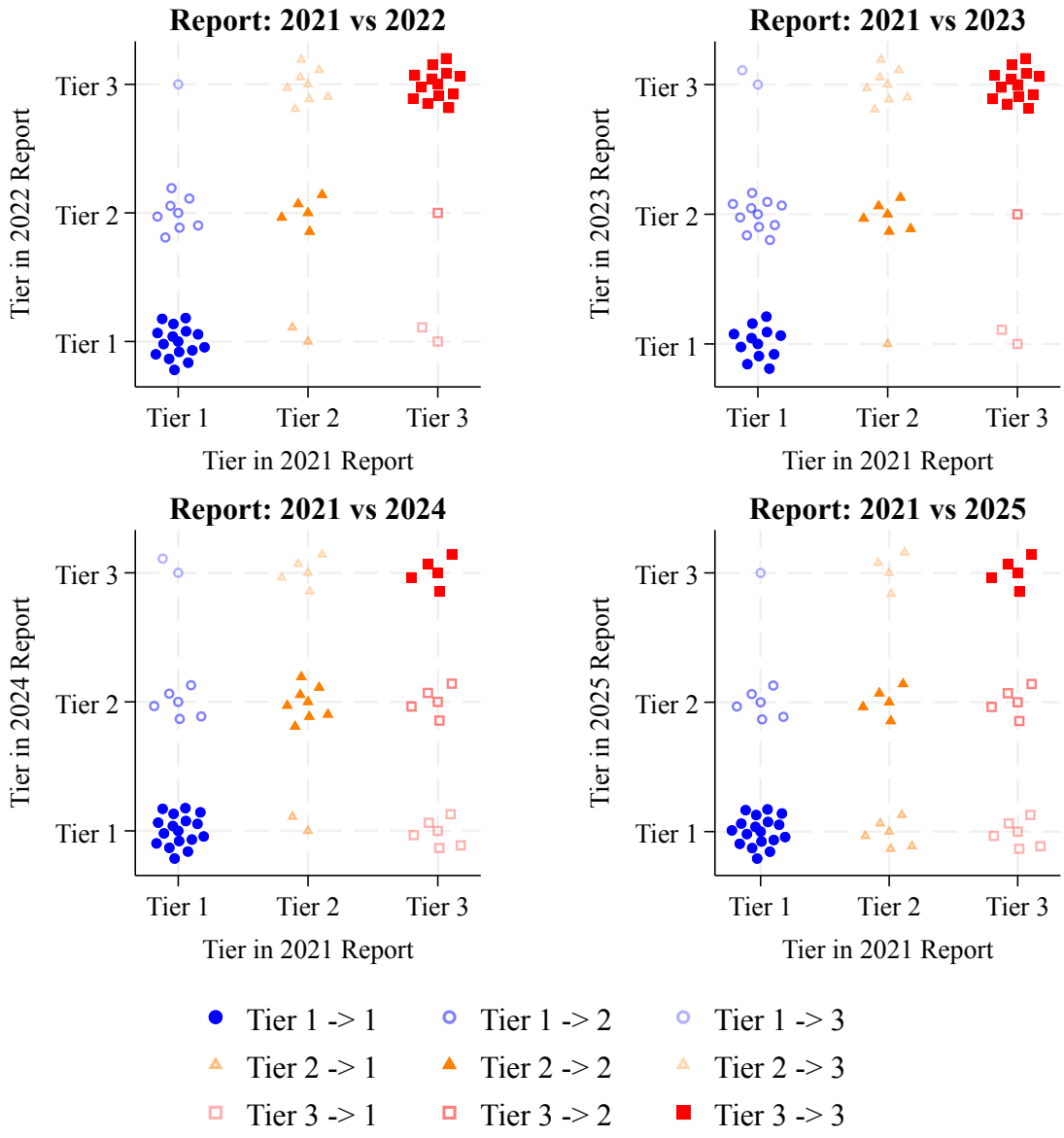
(a) Donation rate



(b) transplant rate

Notes: This figure shows the distribution of OPO-level performance changes relative to each OPO's 2021 value. Panel A reports percentage-point changes in the donation performance measure, and Panel B reports percentage-point changes in the transplantation performance measure. Positive values indicate improvement relative to 2021, while negative values indicate lower measured performance than in 2021. The horizontal dashed line at zero denotes no change from 2021 performance. Boxes show the interquartile range, horizontal lines inside the boxes show medians, whiskers show adjacent values, and dots indicate outliers. Data are from the 2021–2025 OPO performance reports from CMS.

Figure A.3: OPO Tier Transitions Relative to the 2021 CMS Performance Report



Notes: This figure shows OPO tier transitions from the 2021 CMS performance report to each subsequent report year. Panel A compares 2021 with 2022, Panel B compares 2021 with 2023, Panel C compares 2021 with 2024, and Panel D compares 2021 with 2025. The x-axis reports each OPO's tier in the 2021 report, and the y-axis reports its tier in the later report year. Each point represents one OPO. Points are randomly jittered within tier cells to make overlapping observations visible.

Table A.1: Outcome and Mechanism Measures

Category	**Measure**	**Definition for OPO o in quarter q**
Organ supply	Donation rate	Donors with at least one transplanted organ per 100 potential deaths
	Organs recovered	Organs recovered for transplantation per 100 potential deaths
Organ utilization	Transplant rate	Organs transplanted per 100 potential deaths
	Organ discard rate	Organs recovered but not transplanted per 100 potential deaths
Reporting intensity	Donor initiation rate	Cases assigned a donor ID per 100 potential deaths
	Hospital surveillance intensity	Donor hospitals reporting at least one case per 100 potential deaths

Notes: This table presents the main dependent variables of interest, all of which are constructed at the OPO-quarter level. Potential deaths are constructed using CDC Multiple Cause of Death data from 2017–2023 according to the CMS definition. The numbers of donors, organs recovered, organs transplanted, and organs discarded are obtained from SRTR data. The number of deaths assigned a deceased donor identifier, including both eventual donors and non-recovered donors, and the number of hospitals involved in at least one such case are obtained from UNOS data.

Table A.2: Offer Acceptance and Compatible Offer Rates: Preferred top 250 Specification

	Offer accepted		Any compatible offer rate
	OLS	2SLS	First stage
	(1)	(2)	(3)
Panel A. Acceptance equation			
Any compatible offer rate	−0.0100***	−0.0398**	
	(0.0020)	(0.0173)	
Panel B. First stage			
Log(1 + compatible recovered donors/day)			0.1035***
			(0.0331)
First-stage F-statistic			9.751
Mean dependent variable	0.0069	0.0069	
Observations	8,968,202	8,968,202	8,968,202

Notes: This table reports estimates from Equations 7 and 8. Columns (1) and (2) report the coefficient on the offer rate from Equation 7, where the dependent variable equals one if an offer is accepted and zero otherwise. Column (3) reports the coefficient on the donor arrival rate from the first stage in Equation 8, where the dependent variable is the offer rate. The sample includes the first 250 offers for each deceased donor kidney in the UNOS PTR data from 2019 to 2025. All specifications include patient, donor, and patient-donor match characteristics, as well as month-year and transplant center fixed effects. Standard errors in parentheses are two-way clustered by listing center and month-year. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.