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Deceased Organ Donation Consent Rates among Racial and Ethnic Minorities and Older Potential Donors

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Abstract

Objectives—We sought to assess consent rates for organ donation from potential brain-dead donors, and to identify factors associated with variation in consent for donation that could guide the development of targeted interventions to increase organ consent rates.

Design, Setting, and Subjects—We used data provided by the Organ Procurement and Transplantation Network (OPTN) to analyze the 35,823 OPO-reported eligible deaths (potential brain-dead donors 70 years of age) from January 1st, 2008 to October 31st, 2011.

Measurements and Main Results—Excluding cases where donation authorization was based on prior patient documentation (e.g. donor registry), consent was obtained on 21,601 (68.9%), not obtained on 8,727 (27.8%), and not requested on 1,080 (3.4%) eligible deaths. There were substantial differences in consent rates among racial/ethnic groups (77.0% in whites, 67.5% in Hispanics, 54.9% in blacks, and 48.1% in Asians) and OPOs (median (IQR): 72.4% (67.5 – 87.3)). In generalized estimating equation models, with whites and patients ages 18–39 years as the respective reference groups, consent for donation was less likely to be obtained among Hispanics (OR 0.54; 95% CI: 0.44–0.65), blacks (OR 0.35; 95% CI: 0.31–0.39), Asians (OR 0.31; 95% CI: 0.25–0.37), and eligible donors ages 55–64 (OR 0.72; 95% CI: 0.67–0.77), and 65 (OR 0.58; 95% CI: 0.52–0.64) years.

Conclusions—In presenting the first published analyses of consent rates among all eligible deaths, this study confirms smaller and regional studies that showed significant differences in consent rates between whites and racial/ethnic minorities (blacks, Hispanics, and Asians). The study also identifies considerable variation in consent rates between age groups and between OPOs. Critical care physicians are usually the front-line providers for potential brain-dead donors

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and their next-of-kin, and these data highlight the need for further research to identify the causes of variation in consent rates and mechanisms to increase rates where appropriate.

Keywords

organ consent; organ donation; eligible death; consent rates; organ procurement organization; brain-dead donors

Introduction

The current number of donated organs is insufficient to meet the demand for organ transplantation.(1) Diverse efforts have addressed this organ shortfall, including using organs from non-heartbeating, but not brain dead donors [donors after circulatory determination of death (DCDD)] whose organs are at higher risk of graft failure post-transplantation (2). Another important strategy for expanding the organ pool is to improve donation consent rates.(1, 3–6)

The majority of brain-dead organ donors, and nearly all DCDD organ donors are cared for in an intensive care unit (ICU) prior to donation.(7) As a result, the first contact with family members and next-of-kin regarding organ donation originate from ICU staff. Appropriate and effective contact with next-of-kin is critical in the chain of the organ consent process.(8) Prior studies have identified black race, Hispanic ethnicity, and older donor age, as factors associated with lower rates of consent for donation, though these studies were based on single organ procurement organization (OPO) or multi-center data.(9–11) One potential explanation for these differences in consent rates is the differences in actual or perceived treatment of family members by hospital staff and the interactions between family members and health care providers.(9, 11, 12) This underscores the importance of the interaction between ICU staff and decision-makers of potential organ donors, and the need to identify factors associated with variation in consent that could guide the development of targeted interventions to increase rates of consent for potential deceased organ donors

As part of the Hospital Conditions of Participation in the Medicare program, the Health Care Financing Administration mandates that hospitals participating in Medicare contact their OPO (the local organization in charge of organ procurement) in a “timely” manner about individuals whose death is imminent or who die in the hospital.(13) The OPO then determines which of these individuals is an “eligible death,” defined as a patient 70 years who was: a) declared brain dead according to hospital policy and b) lacked exclusionary medical conditions to organ donation, as enumerated by the OPTN (Table 1).(1, 3–6, 14)

Although eligible deaths represent a fraction of in-hospital deaths(15), and exclude potential DCDDs, the vast majority of organ donors derive from this patient pool.(6, 15, 16) On January 1st, 2008, the OPTN/United Network for Organ Sharing (UNOS; the organization that manages the nation’s organ transplant system) mandated that OPOs submit patient-level data on eligible deaths.(3) In this study, we analyze eligible deaths reported to the OPTN to assess overall consent rates and identify factors associated with variation in consent that could guide the development of targeted interventions by ICU staff to increase consent rates for potential deceased organ donors.

Methods

Study population

All analyses were based on OPTN/UNOS data from 1/1/08–10/31/11.(3) Eligible deaths were categorized into 6 clinically relevant age strata with sufficient sample sizes for

statistical testing. Racial/ethnic categories were based on UNOS definitions, and were defined by the individual OPO reporting the data to OPTN/UNOS: white, black, Hispanic, Asian, and other (includes Native American, Pacific Islander, and multiracial). UNOS does not distinguish between white vs. black Hispanics.

Outcomes

The primary outcome was whether consent for organ donation was obtained. In the dataset, the variable “consent” was coded as, “Consent-No,” “Consent-Yes,” “Consent not requested,” or “Registry-Yes.” “Consent-Yes” refers to authorization for donation obtained through the next of kin. For the primary analysis, we excluded “Registry-Yes” patients – those who authorized donation through a registry or a legal document – for two reasons. First, the data do not allow determination of whether assent was obtained from next of kin. Second, because the authorization process for “Registry-Yes” individuals is different than among those where consent was obtained from next of kin, it is difficult to determine whether the process was “effective” in such cases. Nonetheless, to confirm our results, we included the entire cohort of eligible deaths in secondary analyses.

In the primary cohort, we evaluated the secondary outcome of whether the consent request was deemed “effective” by the OPO. UNOS does not provide specific guidance on how to define an effective request, however, prior studies of effective requesting have emphasized the importance of timely referrals to the OPO, consent requests performed by skilled and experienced staff, and ensuring that next-of-kin understood the meaning of brain death.(8, 17)

Statistical analysis

We analyzed all available attributes among eligible deaths, including age, race/ethnicity, gender, cause of death, OPO and UNOS region (there are 11 regions which are aggregates of the OPOs, used for broader organ sharing) were evaluated. The zip code of each eligible death was an optional field for submission to the OPTN, and was missing in 6,776 (18.9%) cases. This missingness was differential (87.4% of eligible deaths with zip code data consented to donation, compared with 9.3% of those without, $P < 0.001$), thus these data were not suitable for analysis.

Wilcoxon rank-sum and Kruskal-Wallis tests were used to analyze continuous variables, and chi-square tests for categorical variables. We fit generalized estimating equation (GEE) models using a logit link with an exchangeable correlation structure and robust variance estimates to identify factors associated with consent for donation. Such models adjust standard errors to account for the correlation of individuals within an OPO (59 OPOs reported data).(18) Potential factors associated with donation were examined in univariable analyses; variables significantly associated with the outcome ($p < 0.05$) were entered into the multivariable model.

In secondary analyses, GEE models were fit to identify attributes associated with having an organ consent process meet OPO specifications of an “effective request,” among those for whom consent was requested. Candidate variables were included as specified above.

We performed a non-parametric test of trends to determine if the number of eligible deaths, consented deaths, and actual donors changed over time. We extrapolated data from 1/1/2011–10/31/2011 for the entire year of 2011 under the assumption that the number of deaths, rate of consent, and proportion of eligible deaths donating at least one organ remained consistent during the last two months of the year. Year was tested as a variable in GEE models, but was not significant ($P > 0.90$), and not included in the final models.

Estimation of potential increase in organ donors with increased consent rates

—Under the assumption that differing consent rates among older donors and racial/ethnic minorities (see results section) are in part due to modifiable factors, such as poor communication with family members, we sought to estimate the potential impact of future interventions to increase consent rates. We simulated the potential increase in transplantable organs were consent rates in the lowest consenting age groups (potential donors ages 55–64 and 65) similar to that of the highest consenting adult age group (18–39 years), but other characteristics held constant. To estimate the outcome of this hypothetical scenario, we recoded the age group of eligible donors 55 as if they were in the 18–39 age group. We then applied our GEE model, and summed the predicted probability of consent from 1/1/2008–10/31/2011 to estimate the number of consenting eligible deaths. To estimate the increased number of transplanted organs from these hypothetical donors, we calculated the observed mean number of organs transplanted per actual donor in the 55–64 and 65 year age groups, and multiplied the mean number of expected organs per donor by the number of increased consented donors based on our simulated data. We performed a second similar process to estimate the number of additional organs were the donors from ethnic/racial minority groups to consent at the same rates as white donors.

All analyses were performed using Stata 12.0 (College Station, TX). The study was approved by the Institutional Review Board at the University of Pennsylvania.

Results

Table 2 reports the characteristics of the 35,823 eligible deaths reported during the study period. The majority of eligible deaths were male (58.4%) and white (57.1%).

The percentage of eligible deaths from whom some form of consent was obtained increased from 2008 – 2011 ($P < 0.001$). However, the total number of eligible deaths ($p = 0.10$), consented eligible deaths ($p = 0.19$), and actual donors ($p = 0.22$) decreased (Figure 1).

Proportion of eligible deaths consented

Some form of consent was provided in 26,016 (72.6%) eligible deaths, of which 21,601 (83.0%) were obtained from family or other decision-makers, and 4,415 (17.0%) from authorization in a donor registry and/or prior documentation. Excluding cases of authorization through prior documentation, 21,601/31,408 (68.9%) eligible deaths were consented for donation (Table 3). Consent was not obtained on 8,727 (24.4%) and not requested from 1,080 (3.0%) eligible donors.

There was significant OPO variability in the proportion of consents obtained from prior donor documentation. The median percentage obtained from prior documentation was 14.0% (interquartile range (IQR), 2.7–32.9%). The consent rates across UNOS regions varied significantly ($p < 0.001$), with the lowest consent rates in regions 9 (58.9%), 6 (63.5%), and 11 (65.0%), and the highest rates in regions 7 (78.4%) and 8 (77.5%). This regional variation is multifactorial and dependent on differences in patient demographics (race/ethnicity and age), regional beliefs about the value of organ transplant, and the practices of OPO and hospital personnel when encountering donor families. Three potential factors associated with regional variation could be identified in this dataset. First, the regional differences in consent corresponded to the racial and ethnic distribution of UNOS regions, with regions 7 and 8 having the first and third highest proportion of white potential donors (data not shown). Second, the age distribution of UNOS regions was associated with differences in consent rates, with region 9 having the highest proportion of potential donors ages 55 and older. Third, there were large regional differences in donor designation in state

registries(19); we addressed this variation by limiting our main analyses to donor consent rates among eligible deaths that were not included in registries.

Differences in consent rates

Racial/Ethnic variability—Consent was significantly more likely to be obtained from white patients (77.0%), compared to Hispanics (67.5%) “other” races (59.0%), blacks (54.9%), and Asians (48.1%) ($P<0.001$; Table 3 compares consent rates across racial/ethnic categories). There was substantial variability in consent rates by race/ethnicity across UNOS regions (Figure 2).

In GEE models assessing the outcome of the consent process (consented yes/no), these differences across racial/ethnic groups remained significant (Table 4). Compared with whites, all other racial/ethnic groups were less likely to consent to donation. Consent was least likely to be obtained among Asian eligible deaths (OR=0.31), but “other” race (OR=0.33), black (OR=0.35) and Hispanic (OR=0.54) eligible deaths also had significantly lower odds of consent (all p-values <0.001).

Age categories—Table 4 displays the consent rates across the different age strata. The lowest rates were seen among patients aged 55–64 years (63.8%) and 65 years (59.3%). There was substantial variability in consent rates across all age categories, except those ages 0–5, across UNOS regions (Figure 3). Compared with patients ages 18–39 years old, in GEE models, consent was significantly less likely ($P<0.001$ for all three groups) to be obtained in patients ages 40–54 (OR=0.84), 55–64 (OR=0.72), and 65 years (OR=0.58).

OPO variability—There was significant variability in the consent rates among OPOs, with the median consent rate of 72.4% (IQR = 67.5–78.4%); table 3). The median rate of consent being denied was 30.4% (IQR = 21.4–34.1%), and the median rate of not requesting consent was 2.6% (IQR = 1.2–5.3%).

Other variables—In GEE models, deaths due to trauma were more likely to result in consent for donation (OR=1.20), while “other” causes of death were less likely (OR=0.64). Consent rates were higher when the OPO criteria for effective requesting were satisfied (OR=3.80).

Consent Process

Among those for whom consent was requested directly from decision-makers, the consent process was deemed effective in 24,973/30,332 (82.3%) cases. In GEE models, compared with eligible deaths ages 18–39, the consent process was deemed less effective for all other age categories, except the 6–17 years group (Table 5).

Secondary analyses of all eligible deaths

When the entire cohort of eligible deaths was analyzed, consent rates increased minimally (three to five percentage points), across all racial/ethnic and age groups (except age groups 0–5 and 6–17, since nearly all of these potential donors were too young to enroll in donor registries). However, differences across racial/ethnic and age groups remained essentially unchanged in unadjusted and adjusted analyses. The results are therefore not shown.

Estimates of increased transplantable organs

Using the GEE models to estimate the maximal impact of hypothetical interventions that increased consent rates among specific groups, we estimated an additional 1220 organs could be provided by donors 55 years if consent rates were similar to donors 18–34 years,

while an additional 4719 could be provided by black donors if consent rates were similar to white donors (table 6).

Discussion

In presenting the first published analyses of eligible deaths reported to the OPTN, this study confirms smaller and regional studies that showed significant differences in consent rates between whites and racial/ethnic minorities. Lower consent rates among racial and ethnic minorities may be due in part to personal, cultural, or religious beliefs. In these cases, lower rates do not represent problems to be fixed. However, we hypothesize that portions of these differences are due to disproportionate miscommunication, misinformation, or trust among racial and ethnic minorities. If so, then the ICU and transplant community should develop targeted interventions aimed at optimal communication regarding organ donation and trust-building. The study also identifies considerable variation in consent rates across age groups and OPOs. The data highlight the need for further research to determine the root causes of these differences, and to determine the specific role that interactions between ICU providers and next-of-kin have on the variation in consent rates. Importantly, if low consent rates in some patient populations or regions are attributable to misunderstanding or inadequate communication with next-of-kin by ICU staff, then important opportunities exist to increase the organ supply.

Organ consent from potential organ donors in ICUs has been recognized as a barrier to maximizing the organ supply since transplantation became a readily available procedure. The largest prior study, by Sheehy et al, estimated the number of potential donors in the U.S. based on medical record review of deaths occurring in ICUs from 1997–1999 .(6) The authors estimated that the potential national pool of brain-dead donors in ICUs ranged from 10,500–13,800, with a consent rate of 54% among families of potential donors who had been approached for consent.(6) The estimated number of potential organ donors in that study is significantly greater than the 8,995 (estimated available in 2011) to 9,833 (in 2008) potential donors reported to the OPTN. Rather than reflecting a true decline in the number of eligible deaths since 1999, we suspect the differences in these estimates may be attributable in part to the fact that Sheehy et al extrapolated their data to the national experience, causing an overestimate of eligible deaths, or to the possibility of under-reporting of eligible deaths to the OPTN, leading to an underestimate in our dataset.

Our study confirms that lower consent rates are obtained from black and Hispanic potential donors, even after adjustment for available patient characteristics and the quality of the consent process. These results also demonstrate lower consent rates among Asians.(9–11) Given this variation in consent, targeted interventions aimed at optimal communication about organ donation could be effective. For instance, it has been shown that using an ethnicity-matched requestor for donation has the potential to increase consent rates among racial and ethnic minorities.(20) Availability of such ethnicity-matched requestors for ICU staff could potentially lead to increased organ consent rates among racial/ethnic minorities. In addition to ethnicity-matched requestors, ICU staff should ensure appropriate use of medical interpreters when working with individuals for whom English is not the primary language. Discussions surrounding organ donation are complex and likely to be weighted with emotion. In those cases where the initial refusal of consent is based on miscommunication due to language barriers, discussions in the patient's families' native language may serve to improve consent rates. However, prospectively collected data are needed to determine why consent rates in certain populations remain low, and what aspects of the consent process, specifically care of the patient and/or next-of-kin in the ICU can be modified to increase consent rates.

Prior work has shown that specific interactions and discussions between healthcare providers and decision-makers of potential organ donors have a direct impact on the decision to consent for organ donation. Specifically, provision of accurate and sufficient information regarding the organ donation process, the definition of brain death, the potential for donation to help others, and the impact of donation on funeral arrangements have been shown to be associated with increased rates of organ donation. (8) As a result, discussions with next-of-kin racial and ethnic minorities should focus on these specific areas of the organ consent and donation process that have been shown to be misinterpreted or communicated improperly. It is also worth assessing whether checklists or other standardized interventions might help ensure that all aspects of the organ donation process are discussed with next-of-kin of all potential brain-dead donors. Among next-of-kin of potential organ donors who are black, it has been demonstrated that differences in treatment or perceived treatment by hospital staff towards family members leads to lower consent rates. Thus targeted interventions may be needed to improve consent rates among racial/ethnic minorities.(11, 12) In doing so, ICU physicians may serve to help bridge the organ supply-demand gap.

We also found significantly lower consent rates among families of older potential donors, notably those ≥ 55 years. These findings complement two recent studies demonstrating lower consent rates among older potential donors in a single U.S. OPO, and among potential donors in the Netherlands.(9, 21) Our data do not allow us to determine if lower consent rates are related to differences in how providers and/or OPO staff view these patients' potential eligibility versus family misperceptions about the likelihood that older donor organs would be acceptable for transplantation. However, per the OPTN data: a) consent was not requested in 3.9% of eligible deaths ages ≥ 65 , similar to other age groups; and b) the odds of the consent process being deemed not "effective," was significantly more common among older eligible donors (table 5). These results suggest that lower consent rates in this group are related to provider/OPO practices, as opposed to families not being approached for donation. In order to increase consent rates among potential older donors, it would be important to know if treatment by ICU vs. OPO staff result in lower consent rates. If the lower consent rates are a result of biases of ICU staff, targeted interventions focusing on educating providers on the potential of older patients to become successful organ donors may be helpful. Alternatively, families may not view these organs to be of sufficiently "good quality" for donation, and thus they refuse to consent. Further investigation is needed, as increasing consent among this population of patients may serve as a means to substantially increase the number of organs; specifically, our simulations suggest that nearly 1,200 organs would be available over an almost four-year period if consent rates among older donors improved.

These data confirm prior suggestions that although the demand for transplantable organs continues to grow, the supply of organs from brain-dead donors is both insufficient and relatively fixed. Thus, even optimal consent practices in the ICU, while valuable, will be insufficient to completely solve the problem of organ scarcity. Potential ways to narrow this gap include: a) increased utilization of non-standard organs, such as from DCDDs (22–26); b) paying living donors to increase the number of living donor transplants(27); or c) using simulation and Markov models to examine the efficiency and societal implications of different allocation strategies.(28–30) Despite recent laudable efforts in the social media arena to increase the number of people - especially the 18–39 year cohort - enrolling in donor registries, these OPTN/UNOS data demonstrate that such efforts alone will not bridge the organ supply-demand gap, given that over 30,000 patients are added to the kidney transplant waitlist each year.(31, 32)

This study has limitations. The only patients included in this dataset are “eligible deaths,” reported by OPOs. OPOs receive a significantly greater number of referrals about in-hospital deaths, with a limited number of these qualifying as eligible deaths.(15) While the overwhelming majority of these referrals are not potential donors due to characteristics such as medical co-morbidities, a subset are patients with neurologic injury not meeting brain death criteria at the time of reporting.(15) Such patients may eventually become brain-dead donors, or be potential DCDD donors. Secondly, it is unknown whether there is under-reporting of eligible deaths. If such under-reporting exists, it would falsely lower the denominator of eligible deaths, resulting in artificially higher reported consent rates. Additionally, if such under-reporting were more likely to occur among racial/ethnic minorities, then even greater differences in consent rates may exist between whites and other groups. The dataset did not provide data on the whether eligible deaths came from ICUs versus emergency departments, and among those in an ICU, the characteristics of the ICU (e.g. medical vs. surgical, small vs. large). While such data would help to further characterize and identify causes of variation in consent rates, the data still identify groups to target for future research and potential interventions to increase consent rates.

The differing consent rates across OPOs may be due to many factors that cannot be accounted for using these registry data. In practice, OPOs may differ in their definition or reporting of eligible deaths. There may be other unmeasured confounders across OPOs, such as: socioeconomic status of eligible deaths; language barriers between next-of-kin and medical staff; composition, size, and availability of trained personnel to discuss organ donation in ICUs within different OPOs; variation in whether consent was requested by OPO or hospital personnel; or the timeliness of hospital reporting of deaths. Lastly, there are substantial differences in donor authorization through registries across the country, thus the “pool” of donors from whom direct consent could be obtained from next-of-kin differs widely between OPOs.(19, 33) Though these factors prevent us from making definitive conclusions on OPO performance, the primary findings of lower consent rates among racial/ethnic minorities, and older potential donors, are unlikely to be explained solely by underreporting of potential donors.

We provide estimates of the number of increased consented donors in the event of a targeted intervention that improved donation rates among older donors or racial/ethnic minorities. These estimates were under the assumption that differing consent rates are due to modifiable factors, such as optimal education or communication with next of kin, and not due to fixed preferences about donation among certain groups. We acknowledge these estimates may reflect the maximal impact of hypothetical interventions, since consent to donation does not lead to organ procurement in all donors, and not all recovered organs are transplanted. These data, however, may provide a useful best-case scenario that could be used by policymakers and researchers exploring the potential efficacy of an intervention. They also demonstrate the potential societal benefit to improving the organ consent process within ICUs.

Despite these limitations, this study provides the most robust data to date regarding variation in consent rates between different types of patients, and perhaps, between different OPOs. Less clear is whether these data provide accurate absolute estimates of consent rates, and indeed, there are several reasons to believe that the rates reported here are optimistic. Whereas these data highlight differences in consent rates among racial and ethnic minorities, older donors, and across OPOs, they are not sufficient to judge individual OPO performance, or to make inferences about why certain populations may opt for donation at lower rates. Instead, these data help to identify important areas for future research focusing on identifying the causes of differences in consent rates, and developing interventions that may help to bridge the gap between the number of donated organs and the need for organs. As ICU and OPO staff are both essential to the organ consent and donation process, new

strategies to improve consent rates may be best achieved by future partnerships between these two groups.

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List of Abbreviations

DCDD	Donors after circulatory determination of death
ICU	Intensive care unit
OPO	Organ Procurement Organization
OPTN	Organ Procurement and Transplantation Network
UNOS	United Network for Organ Sharing
GEE	Generalized estimating equation
IQR	Interquartile range
CVA	Cerebrovascular accident

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Figure 1.
Temporal trends in eligible deaths, consent rates, and organ donation in the United States

Figure 2.
Distributions of donation consent rates across UNOS regions, by race/ethnicity category

Figure 3.
Distributions of donation consent rates across UNOS regions, by age category

Table 1

OPTN-defined medical conditions that exclude a brain-dead patient for deceased organ donation

Exclusionary diagnosis groups
Active infection (bacterial, viral, fungal, parasitic, or prion)
Aplastic anemia, agranulocytosis
Extreme immaturity (<500 grams gestational age or <32 weeks)
Current malignant neoplasm exception non-melanomatous skin cancer
Previous malignant neoplasm with current metastatic disease
History of melanoma
Hematologic malignancies (e.g. leukemia)
Multi-system organ failure due (3 or more systems in simultaneous failure for 24 hours) without response to treatment
Active meningitis or encephalitis

* As per OPTN policy 7.1.7, published online at http://optn.transplant.hrsa.gov/PoliciesandBylaws2/policies/pdfs/policy_23.pdf¹

Table 2

Demographics of all eligible deaths in the United States from 1/1/08 – 10/31/11

Variable	Total N=35,823
Eligible donor age in years, median (IQR)	43 (25–54)
Age category, N (%)	
0–5	1,839 (5.1)
6–17	2,422 (6.8)
18–39	11,548 (32.2)
40–54	11,209 (31.3)
55–64	6,538 (18.3)
65+	2,267 (6.3)
Race/Ethnicity, N (%)	
White	20,442 (57.1)
Black	7,914 (22.1)
Hispanic	5,580 (15.6)
Asian	1,309 (3.7)
Other	476 (1.6)
Male gender, N (%)	20,931 (58.4)
UNOS Region, N (%)	
1	1,017 (2.8)
2	3,961 (11.1)
3	5,893 (16.5)
4	3,577 (10.0)
5	5,674 (15.8)
6	1,274 (3.6)
7	2,519 (7.0)
8	2,341 (6.5)
9	2,003 (5.6)
10	3,043 (8.5)
11	4,521 (12.6)
Cause of death, N (%)	
Anoxia	8,126 (22.7)
CVA	14,827 (41.4)
Trauma	11,748 (32.8)
CNS tumors	202 (0.6)
Other	920 (2.6)
Consent process met OPO definition of an effective request, N (%)	29,160 (83.9)

IQR: Interquartile range

CVA: cerebrovascular accident

CNS: Central nervous system

OPO: Organ procurement organization

Table 3

Proportion of eligible deaths for which direct consent for organ donation was obtained, N=31,408 *

Category	Consented	Did not consent	Consent not requested
Race/Ethnicity [†]			
Whites, N=17,002	13,980 (77.0)	3,418 (20.1)	495 (2.9)
Blacks, N=7,394	4,060 (54.9)	3,009 (40.8)	325 (4.4)
Hispanics, N=5,262	3,553 (67.5)	1,528 (29.0)	181 (3.4)
Asians, N=1,226	490 (48.1)	585 (47.7)	51 (4.2)
Other, N=524	309 (59.0)	187 (35.7)	28 (5.3)
Age category [†]			
0–5, N=1,839	1,278 (69.5)	443 (24.1)	0 (0.0)
6–17, N=2,358	1,774 (75.2)	532 (22.6)	52 (2.2)
18–39, N=9,715	7,146 (73.6)	2,294 (23.6)	275 (2.8)
40–54, N=9,709	6,525 (67.2)	2,875 (29.6)	309 (3.2)
55–64, N=5,753	3,671 (63.8)	1,845 (32.1)	237 (4.1)
65+, N=2,034	1,207 (59.3)	738 (36.3)	89 (4.4)
OPO, % [‡]			
25 th percentile	67.5%	21.4%	1.2%
Median	72.4%	30.4%	2.6%
75 th percentile	78.4%	34.1%	5.3%
Cause of brain death [†]			
Anoxia, N=7,136	4,958 (69.5)	1,899 (26.6)	279 (3.9)
CVA, N=13,062	8,350 (63.9)	4,271 (32.7)	441 (3.4)
Trauma, N=10,216	7,713 (75.5)	2,213 (21.7)	290 (2.8)
CNS Tumor, N=177	117 (66.1)	55 (31.1)	5 (2.8)
Other, N=817	463 (56.7)	289 (35.4)	65 (8.0)
Consent process met OPO definition of effective requesting [†]			
Yes, N=24,973	18,970 (76.0)	5,997 (24.0)	N/A
No, N=5,359	2,630 (49.1)	2,727 (50.9)	N/A
Gender [†]			
Males, N=18,546	12,987 (70.0)	4,900 (26.4)	659 (3.6)
Females, N=12,862	8,614 (67.0)	3,827 (29.8)	421 (3.3)
Overall	21,601 (68.9)	8,727 (27.8)	1,080 (3.4)

* Excluded consent obtained based on prior documentation (e.g. donor registry)

[†] P<0.001 for comparisons across categories in the proportion of eligible deaths who consented vs. not consented vs. consent not requested[‡] P<0.001 for comparisons of the consent rate across OPOs using Wilcoxon rank-sum test

Table 4

Results of univariable and multivariable analyses of exposures associated with consent for organ donation *

Category	Univariable OR	Multivariable OR	P-value [†]
Race/Ethnicity			
Whites	Reference	Reference	
Blacks	0.36 (0.34–0.39)	0.35 (0.31–0.39)	<0.001
Hispanics	0.62 (0.58–0.67)	0.54 (0.44–0.65)	<0.001
Asians	0.28 (0.25–0.31)	0.31 (0.25–0.37)	<0.001
Other	0.43 (0.36–0.51)	0.33 (0.20–0.55)	<0.001
Age category in years			
0–5	0.82 (0.73–0.91)	1.09 (0.95–1.14)	0.21
6–17	1.09 (0.98–1.21)	1.14 (1.02–1.28)	0.02
18–39	Reference	Reference	
40–54	0.74 (0.69–0.78)	0.84 (0.78–0.90)	<0.001
55–64	0.63 (0.59–0.68)	0.72 (0.67–0.77)	<0.001
65+	0.52 (0.48–0.58)	0.58 (0.52–0.64)	<0.001
Cause of death			
Anoxia	Reference	Reference	
CVA	0.78 (0.73–0.83)	0.95 (0.88–1.04)	0.22
Trauma	1.35 (1.27–1.45)	1.20 (1.11–1.29)	<0.001
CNS Tumor	0.86 (0.62–1.18)	0.85 (0.61–1.18)	0.32
Other	0.57 (0.50–0.67)	0.64 (0.46–0.88)	0.006
Consent request met DSA definition	3.28 (3.08–3.48)	3.80 (3.08–4.68)	<0.001
Male gender	1.15 (1.10–1.21)	1.08 (1.01–1.15)	0.02

* The analysis excluded eligible deaths among whom consent was obtained based on prior documentation (e.g. donor registry) and eligible deaths for whom consent was not requested

[†] Multivariable p-value

Table 5

Multivariable model assessing odds of consent process meeting specifications of an “effective request,” among those for whom consent was requested^{*}

Variable	Odds Ratio	P-value
Race/Ethnicity		
White	Reference	
Black	0.92 (0.82–1.03)	0.14
Hispanic	1.03 (0.82–1.30)	0.80
Asian	0.76 (0.65–0.88)	<0.001
Other	0.80 (0.58–1.10)	0.17
Age category		
0–5	0.80 (0.67–0.95)	0.01
6–17	0.92 (0.77–1.09)	0.34
18–39	Reference	
40–54	0.86 (0.78–0.94)	0.001
55–64	0.78 (0.67–0.90)	0.001
65+	0.73 (0.61–0.86)	0.001
Cause of death		
Anoxia	Reference	
CVA	1.16 (1.02–1.32)	0.02
Trauma	1.46 (1.26–1.68)	<0.001
CNS tumor	1.62 (0.93–2.85)	0.09
Other	0.90 (0.66–1.22)	0.50
Male gender	0.98 (0.92–1.06)	0.65

^{*} Effective request criteria defined by each organ procurement organization. Excluded consent obtained based on prior documentation (e.g. donor registry)

Table 6

Estimates of increased number of transplantable organs if consent rates in eligible deaths 55–64 and 65 similar to consent rates in patients ages 18–39, and consent rates in racial/ethnic minorities similar to whites^{*}

Category of potential donors	Additional number of consented eligible deaths	Increased number of transplantable organs				
		Kidney	Liver	Lung	Heart	Total
Potential donors 55–64	409	487	270	74	20	851
Potential donors 65	276	173	193	3	0.4	369
Black potential donors	1637	2169	1332	709	508	4719
Hispanic potential donors	630	982	461	267	235	1945
Asian potential donors	318	457	236	118	66	878
Potential donors of other races	123	191	92	46	30	358

^{*} Estimates obtained based on data from GEE model