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Research Article

Impact of the COVID 19 Pandemic on Organ Donation from Deceased Donors in the United States

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Abstract

Aim: Deceased organ donors by death mechanisms in the United States of America have not been analyzed beyond the 2017 data. It was unclear how the deceased donor pool was impacted by the Coronavirus disease pandemic.

Methods: Using the metrics produced by Organ Procurement and Transplantation Network (OPTN)'s Scientific Registry of Transplant Recipients (SRTR) standard analytic files, we examined deceased donors between Jan 1st, 2010 to December 31st, 2020 in the US.

Result: Deceased organ donors increased from 11,870 in 2019 to 12,588 in 2020 (6.0% increase) despite the pandemic. Over the 11 year period, deceased donors from drug-intoxication death (drug death donor, or DDD) had the largest percentage increase from 4.3% of all deceased donors in 2010 to 16.1% in 2020, while deceased donors from intracranial hemorrhage/stroke (39.6% down to 25.35), blunt trauma (22.3% down to 17.2%) and gunshot wound deaths (10.0% down to 7.7%) all experienced decline. Between 2019 and 2020, DDD was the only major death mechanism category that showed significant increase (from 13.5% to 16.1% of all deceased donors in 2019 and 2020, respectively).

Conclusion: The increase of DDD was likely due to a sharp rise in national drug overdose death in the midst of economic and social disruption brought upon by the pandemic. OPTN's deceased donor data can be used as a surrogate of national drug death count, offering precious time for public health efforts to react.

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Introduction

The annual number of deceased donors in the United States increased 29.5% from 2010 to 2017, with deceased donors from drug-intoxication related death (DDD) being the category with highest increase [1]. Organ Procurement and Transplantation Network (OPTN) published its annual data report on deceased organ donors as recent as the 2019 data [2], yet no study has examined the trend of deceased organ donors by death mechanisms since 2017. With the unprecedented disruption of healthcare delivery in the United States and the acceleration in drug overdose death during the early phase of the Coronavirus Disease 2019 (COVID-19) pandemic [3], it is unknown how COVID-19 has impacted the organ transplantation operation and the makeup of the deceased donor pool.

In the United States, all organ procurement organizations and transplant centers report donor data to OPTN, including age, sex, race, mechanism of death, as well as donor risk type [4]. With the cause of death data from the Center for Disease Control and Prevention (CDC) not available until the end of 2021, OPTN's deceased donor categories offer insights into the US drug intoxication related deaths in 2020.

Methods

Using the metrics produced by OPTN's Scientific Registry of Transplant Recipients (SRTR) standard analytic files released on March 8th, 2021, we examined deceased donors between Jan 1st, 2010 to December 31st, 2020. Deceased donor counts include all donors for whom at least one organ was recovered for transplant. Mechanisms of death (asphyxiation, blunt injury, cardiovascular, drug intoxication, gunshot wound, intracranial hemorrhage (ICH)/stroke, natural causes, and seizure) were analyzed. Nationwide age-adjusted annual rates of drug intoxication-related deaths from 2010 to 2019 were obtained from the CDC's WONDER database [5].

Descriptive statistics and frequencies were calculated by year to assess trends. Trend analyses were performed using R version 3.3.3 software (R project, Vienna, Austria). Graphics were created by using STATA (Stata Statistical Software: Release 17. College Station, TX). The Institutional Review Board at Santa Clara Valley Medical Center granted an exemption to the requirement for ethics approval because the study subjects were deceased and the dataset used was completely de-identified.

The data reported here have been supplied by UNOS as the contractor for the Organ Procurement and Transplantation Network. The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as an official policy of or interpretation by the OPTN or the U.S. Government.

Results

The annual number of deceased organ donors steadily increased from 7,943 in 2010 to 10,286 in 2017, consistent with previous report by Abara et al., [1] The increase continued uninterrupted from 2019

(11,870) to 2020 (12,588 ,6.0% increase). Of the top 5 death mechanism categories: ICH/stroke remained the largest: from 3,143 (39.6% of total deceased donors) in 2010 to 3,181 (25.3%) in 2020, with trend slope for percentage of total deceased donors at -1.4% ($p<0.001$). Blunt trauma increased in counts from 1,770 in 2010 to 2,166 in 2020, but decreased in percentage of total from 22.3% to 17.2% (trend slope -0.6%, $p<0.001$). Gunshot wound similarly saw a small increase in counts from 795 to 963, while decreased in percentage from 10.0% to 7.7% of all deceased donors from 2010 to 2020 (trend slope -0.2%, $p<0.001$). Deceased donors from Cardiovascular disease rose from 1,047 (13.2%) to 2,465 (19.6%) during the study period (trend slope 0.6%, $p<0.001$). DDD led all death mechanism categories with the largest increase in both count (342 to 2,028) and percentage of total (4.3% to 16.1%) from 2010 to 2020 (trend slope 1.3%, $p<0.001$).

Between 2019 and 2020, DDD was the only death mechanism category that showed significant increase: from 1,604 (13.5%) in 2019 (Figure 2A) to 2,028 (16.1%) in 2020, $p<0.001$, while the other categories showed no statistically significant change.

% DDD of all deceased donors from 2010 to 2020 was plotted against CDC's age-adjusted national annual drug-intoxication related deaths. An exponential model predicted the % DDD/national drug intoxication-related death for 2020 at 2.40% and the drug intoxication-related death for 2020 to be 80,936 in the United States.

Discussion

Despite the unprecedented impact of the COVID-19 pandemic on the global healthcare delivery, OPTN data showed that deceased organ donors rose appropriately from 2019 to 2020, attesting to the resiliency of the organ donation and transplantation system.

Deceased organ donors remained largely unchanged with an average of 7,486 per year prior to 2010, after which the ongoing U.S. opioid crisis has resulted in an increase in eligible organ donors from drug overdose deaths [1-6]. The DDD increase accelerated after 2013 when universal donor testing for Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), and Human Immunodeficiency Virus (HIV) was mandated, and guidelines for categorizing increased risk donors established [7]. The passage of HOPE Act allowing organs from HIV infected donors to recipients also with HIV infection [8] as well as the FDA approval of direct acting antivirals to treat HCV in 2015 further boosted the usage of DDD donors. These milestone events led DDD increase by 125% between 2013 and 2016 (from 560 to 1,262, or 6.8% to 12.7% of total deceased donors). This trend, however, slowed and plateaued in 2017 (13.4%), 2018 (13.1%) and 2019 (13.5%), only to see a sharp rise in 2020 (16.1%). Given the close mirroring of DDD of the national drug intoxication death, the most plausible explanation for this significant increase was due to the increased mortality from drug intoxication in the year 2020, when the pandemic related economic hardship, disruption of healthcare, and loss of in-person social support resulted in increased anxiety, depression and social isolation [9]. Our model projected the national drug overdose deaths at 80,936 for 2020, as compared to 74,511 in 2019. This projection was very close to the reported 81,000 drug overdose death in the one year period ending May 2020 as reported by CDC, [3] a record breaking number that was believed to be related to COVID-19. While comprehensive prevention strategies are being adapted to address the drug overdose epidemic in the context and aftermath of the COVID-19 pandemic, it remains to be seen how the drug overdose death curve will respond to these interventions, with the DDD data from OPTN offering a precious 9 month-lead time for public health efforts to react prior to the CDC death data becoming available.

Another notable observation from our analysis is the continued decline in deceased donors from ICH/stroke over the preceding decade. This is consistent with the national decrease in stroke mortality, likely due to improved preventative strategies and acute stroke management [10]. Similarly, deceased donors from cardiovascular death also followed the national and global trend in cardiovascular mortality and showed a modest increase [11].

The findings in this report are subject to the following limitations: demographic and clinical data were detailed by the annual OPTN/SRTR data report: Deceased Organ Donors [2] and hence not included in this brief communication; second, data are limited to donors from whom at least one organ was recovered and do not include persons who might have been considered for donation but from whom no organs were recovered. Therefore, the mechanism of death tally might not fully reflect all persons considered for organ donation; Third, the association between DDD and increased national drug death mortality will need to wait until CDC releases the cause of death data by the end of 2021 for confirmation.

In summary, our analysis of OPTN's deceased donor data showed that number of organ donors with history of drug intoxication as the mechanism of death rose sharply from 2019 to 2020, reversing a trend of minimal change from 2016 to 2018, likely due to the profound impact of the COVID-19 pandemic on the national drug death crisis.

Author's contribution

AYZ: data acquisition, analysis, interpretation of data, drafting and revising

AD: study design, statistical analysis, interpretation of data, drafting and revising

AA: conceptualization, study design, data acquisition, revision and editing

Disclosure

The authors declare no conflicts of interest.

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