

BRIEF COMMUNICATION

Impact of COVID-19 pandemic on the size of US transplant waiting lists

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Abstract

Background: More patients are waitlisted for solid organs than transplants are performed each year. The COVID-19 pandemic immediately increased waitlist mortality and decreased transplants and listings.

Methods: To calculate the number of candidate listings after the pandemic began and short-term changes that may affect waiting time, we conducted a Scientific Registry of Transplant Recipients surveillance study from January 1, 2012 to February 28, 2021.

Results: The number of candidates on the liver waitlist continued a steady decline that began before the pandemic. Numbers of candidates on the kidney, heart, and lung waitlists decreased dramatically. More than 3000 fewer candidates were awaiting a kidney transplant on March 7, 2021, than on March 8, 2020. Listings and removals decreased for each solid organ beginning in March 2020. The number of heart and lung listings returned to equal or above that of removals. Listings for kidney transplant, which is often less urgent than heart and lung transplant, remain below numbers of removals. Removals due to transplant decreased for all organs, while removals due to death increased for only kidneys.

Conclusions: We found no evidence of the predicted surge in listings for solid organ transplant with a plateau or control of the pandemic.

KEYWORDS

COVID-19, solid organ transplant, waiting list

1 | INTRODUCTION

Since the COVID-19 pandemic began, the US organ transplant system has seen two undesirable trends. Waiting list mortality among transplant candidates has increased,¹⁻³ while new listings decreased, and more patients were inactivated on the list than ever before.^{2,4} Early in the pandemic, there was speculation that new listings may have been postponed and there would be a surge in listings, particularly for kid-

ney transplant, as the pandemic was controlled.⁵ More than a year into the pandemic, with vaccination efforts underway, attention needs to be given to long-term consequences of the pandemic on the solid organ transplant system, particularly because they affect patients' access to transplant.

One plausible scenario of the potential consequences of the COVID-19 pandemic on the length of waiting lists is that listing decisions have been deferred during the pandemic and will surge when the pandemic

is controlled.⁵ A competing scenario is that increased mortality rates during the pandemic have reduced the population on the waiting list or those eligible for listing. If the loss due to mortality is greater than the number of patients postponing listing, the waiting list could continue to decline in the near term rather than surge as had been predicted.

The length and composition of waiting lists are key determinants of access to transplant once a patient is listed and how long a patient waits. For example, in 2019, there were more than 100 000 prevalent listings for kidney transplant and only 24 273 kidney transplants performed, with a median waiting time longer than 5 years.⁶ We describe key trends that will influence patients' access to transplant once listed as a result of the onset of the pandemic in 2020, including:

1. How the length of solid organ transplant waiting lists in the United States changed in the last year.
2. Whether changes in waiting list size were due to decreases in new listings, increases in removals, or some combination.
3. Changes in reason for removal from the waiting list during the past year.

2 | METHODS

This study used Scientific Registry of Transplant Recipients (SRTR) data, which includes data on all US donors, waitlisted candidates, and transplant recipients submitted by members of the Organ Procurement and Transplantation Network (OPTN). The Health Resources and Services Administration, US Department of Health and Human Services, oversees the activities of OPTN and SRTR contractors.

This analysis used SRTR standard analysis file (SAF) candidate datasets from April 2021, which represent all US patients who are or have been registered on the waiting list for a solid organ transplant since October 1, 1987. SRTR SAFs have been described previously.⁷

The point prevalent number of unique candidates on the kidney, liver, lung, and heart transplant waiting lists were counted weekly from January 1, 2012, to March 28, 2021. Candidates listed at multiple centers were counted once. For each week, numbers of new listings and candidates removed were calculated. To smooth week-to-week variation in listings and removals, a moving average for the 13 weeks before the week of interest was calculated. The number removed due to transplant, death, or deteriorating condition each week was counted and a moving average for the 13 weeks before the week of interest calculated for each reason. The percentage of new listings and rates of waitlist removal for death and removal for transplant were calculated stratified separately on age, sex, race, and diagnosis for each week from March 10, 2019 to April 3, 2021, for kidney transplant candidates.

3 | RESULTS

The US organ transplant waiting list shrank for all solid organs in early 2020, correlating with the onset of the COVID-19 pandemic (Figure 1).

For heart and liver, declines in 2020 were a continuation of ongoing declines in the length of their waiting lists. In contrast, the kidney and lung transplant waiting lists maintained relatively constant sizes from 2018 to 2020, when they showed marked drops. For example, on March 8, 2020, 94 161 unique patients were on the kidney waiting list, and 1281 were on the lung waiting list; on March 7, 2021, 91 095 unique patients were waiting for kidneys, and 1020 were waiting for lungs.

When listings are equal to removal, the waiting list length remains the same. The 13-week moving average of listings and removals for all solid organs decreased substantially in spring 2020 after the onset of the pandemic, generally by 15–30% (Figure 2). Listings and removals for all organs also declined during the winter pandemic surge at the end of 2020 and beginning of 2021. Consistent with the pre-pandemic decline in the length of the liver waiting list, the number of listings was below the number of removals and remained so after the emergence of the pandemic. Both heart and lung listings returned to above the number of removals early in 2021. In contrast, listings for kidney candidates remained below the number of removals. For example, the ratio of listings to removal for kidney candidates ranged from .97 to .99 in the weeks of March 2019 and from .93 to .97 in the weeks of February 2020, indicating that new candidates were being listed at almost the rate that candidates were being removed. By contrast, in July 2020, the ratio of listings to removals in a week ranged from .74 to .77, indicating that substantially more candidates were being removed from the list than added to the list. By December 2020, the ratio of weekly kidney listings to removals was back at .94–.97, but not above the threshold of 1 that would indicate new listings were greater than removals.

All organs saw notable decreases in the number of patients removed due to transplant during the spring 2020 and winter 2020/2021 pandemic surges (Figure 3). Over those periods, the number of patients removed due to death remained constant for liver, lung, and heart but surged for kidneys. Considering the ratio of removals for transplant to removals for death among kidney candidates, in the weeks of March 2019 and February 2020, before the pandemic, the ratio of transplants to death ranged from 6.3 to 6.5, meaning that there were about 6 candidates who underwent transplant for every candidate who died. By contrast, during the weeks of June 2020 and February 2021, during peaks in the waves of the pandemic, the ratio of transplants to death ranged from 4.1 to 4.4, meaning about four candidates underwent transplant for every candidate who died. The reduction in ratio is a combination of decreases in transplants performed and increase in wait list deaths (Figure 3).

There were no noticeable differences in the proportion of new kidney listings by age, sex, race, or diagnosis before to after the onset of the pandemic. Transplant rates for all demographics dropped immediately after the onset of the pandemic, but rebounded by 3 months after the onset. However, the transplant rate dropped again noticeably during the winter 2020–2021 wave for candidates 50 years and older but not for younger candidates. Among candidates aged 50–64 years, the lowest rate of transplant in the year before the pandemic was 19.1 transplants per 100 patient-years; by contrast the rate was 11.6

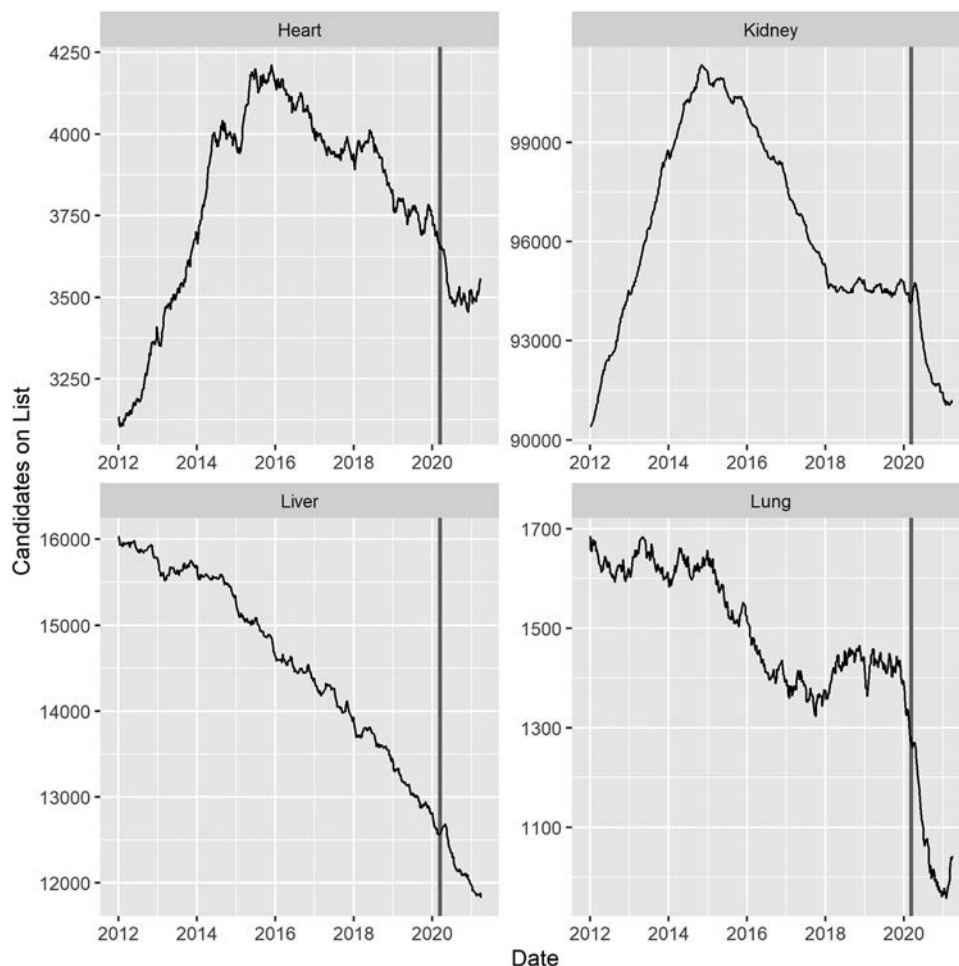


FIGURE 1 Number of unique persons on solid organ waiting lists weekly from January 1, 2012 to March 28, 2021. Vertical line is at March 13, 2020, the date of declaration of a national emergency for COVID-19

transplants per 100 patient-years during the week of April 5, 2020, during the initial wave and 16.0 transplants per 100 patient-years during the week of December 20, 2020, during the winter wave of the pandemic (Figures S1–S4).

Weekly waitlist death rates for older candidates (Figure S1) and men (Figure S3), typically higher at all times, showed relatively notable peaks during waves of the pandemic. When considered by ethnicity/race, all races saw increases in death rates during waves of the pandemic, but the increases were most notable among Hispanic candidates. In the year before the pandemic, the highest weekly death rate among Hispanic candidates was 5.8 deaths per 100 person-years; by comparison, the death rate was 11.3 deaths per 100 person-years during the week of January 17, 2021, during the winter wave of the pandemic (Figure S2). Among primary diagnoses for kidney transplant, candidates with diabetes saw the most notable increases in weekly waitlist death rate during the pandemic: the highest weekly death rate in the year before the pandemic was 8.1 deaths per 100 person-years, but was over 12 deaths per 100 person-years during some weeks in both the initial wave and the winter 2020–2021 wave of the pandemic (Figure S4).

4 | DISCUSSION

In this study, we describe a substantial decrease in the length of the US solid organ transplant waiting lists after the COVID-19 pandemic began. The listing-to-removal ratio for heart and lung candidates has returned to a level that indicates stability or possible slight growth in the waiting list for the near future. In contrast, the number of listings for kidney candidates remains below the number of removals, indicating that the waiting list is still shrinking and removal from the waiting list due to death has differed by demographics among kidney candidates. Kidney candidates who were older, Hispanic, or had diabetes showed surges in rates of waitlist removal due to death during the initial wave of COVID and during the winter 2020–2021 wave.

Waiting lists may have shortened due to decisions to delay listing patients until the pandemic stabilizes. This explanation is consistent with the initial sharp decline in number of listings and waiting list length immediately after the pandemic began, which gave rise to predictions of a post-pandemic listing surge.⁵ The heart and lung waiting lists, which did not show increases in waiting list mortality, may fit this

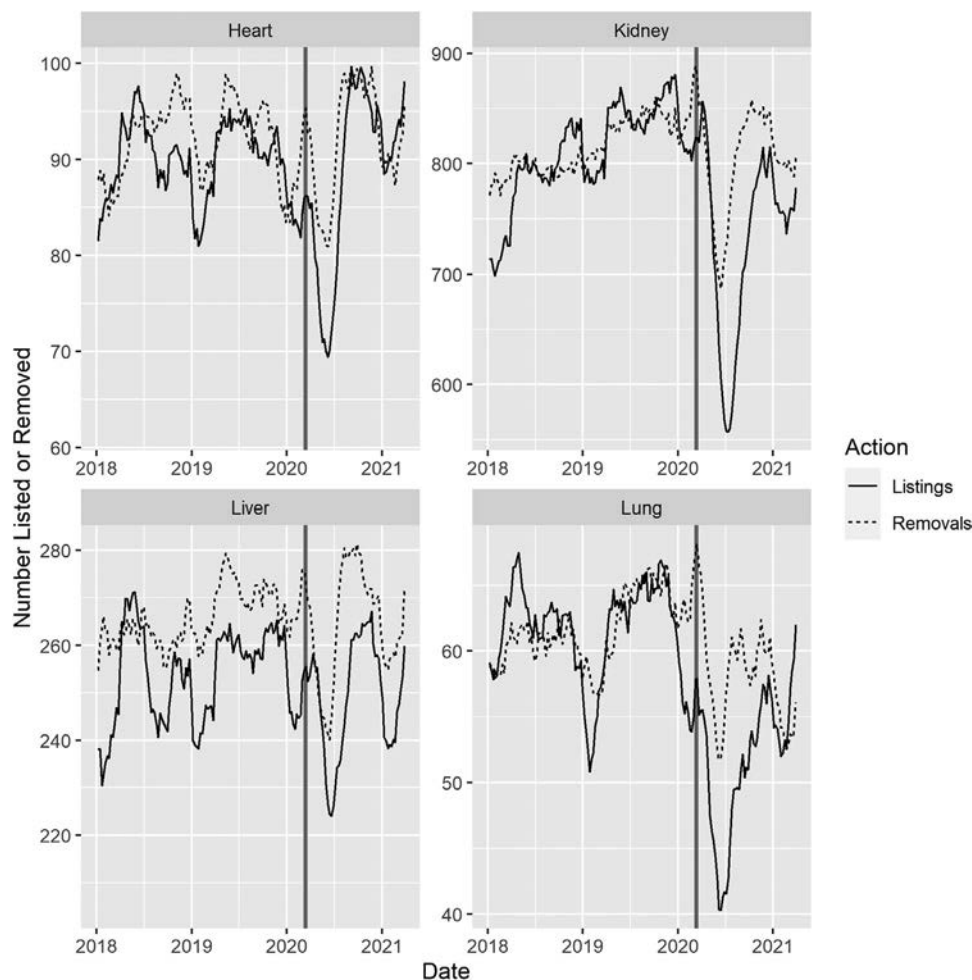


FIGURE 2 Thirteen-week moving average of new listings and new removals on solid organ waiting lists each week from January 1, 2018 to March 28, 2021. Vertical line is at March 13, 2020, the date of declaration of a national emergency for COVID-19. Listings and removals do not necessarily represent unique people, as individual people may be listed multiple times

scenario, in which waiting list lengths return quickly to pre-pandemic equilibrium.

A grim alternative explanation may be that organ transplant waiting lists have shrunk due to high mortality during the pandemic among patients waiting for a transplant and among those with advanced organ dysfunction that would eventually make them transplant candidates. Our findings are consistent with growing evidence that waiting list mortality increased during the pandemic for kidney patients.^{1,8-10} In addition, the population most likely to be listed for a kidney transplant includes patients with diabetes and hypertension, groups that experienced greater mortality during the pandemic.¹¹ The United States Renal Data System (USRDS), which tracks dialysis use, found a 20% decline in incident end-stage kidney disease early in the pandemic,¹² further supporting the possibility that the population at risk for being added to the kidney waiting list is decreasing and that the list may be slow to reach a post-pandemic equilibrium. The USRDS proposed that the decline in incident kidney disease may have been due to postponing dialysis initiation, which would lead to rebounds in prevalence as the pandemic comes under control, or due to increased mortality among patients at risk for kidney disease, which would lead preva-

lence to remain lower for some time after the pandemic is under control.¹² However, despite decreases in waiting list length after the pandemic began, the number of patients waiting for kidneys, in particular, still substantially outnumbers the number of transplants performed each year.

This study demonstrates trends due to the COVID-19 pandemic that could affect organ transplant waiting list lengths in the near future. However, these findings should not be extrapolated to predict longer-term future trends, particularly because the pandemic has not yet come under control.

One year into the pandemic, there is no evidence of the predicted post-pandemic surge in listings that could strain transplant system resources, although transplant volumes have returned to pre-pandemic levels.¹³ Beyond the size of the waitlist, however, the pandemic may be having impacts on the composition of the kidney waiting list. In particular, demographic groups that have experienced the greatest waitlist mortality during the pandemic, including candidates older than 50 years, candidates with diabetes, and Hispanic candidates, are also the groups that have been growing steadily in their relative proportion of the waiting list during the past decade.⁶

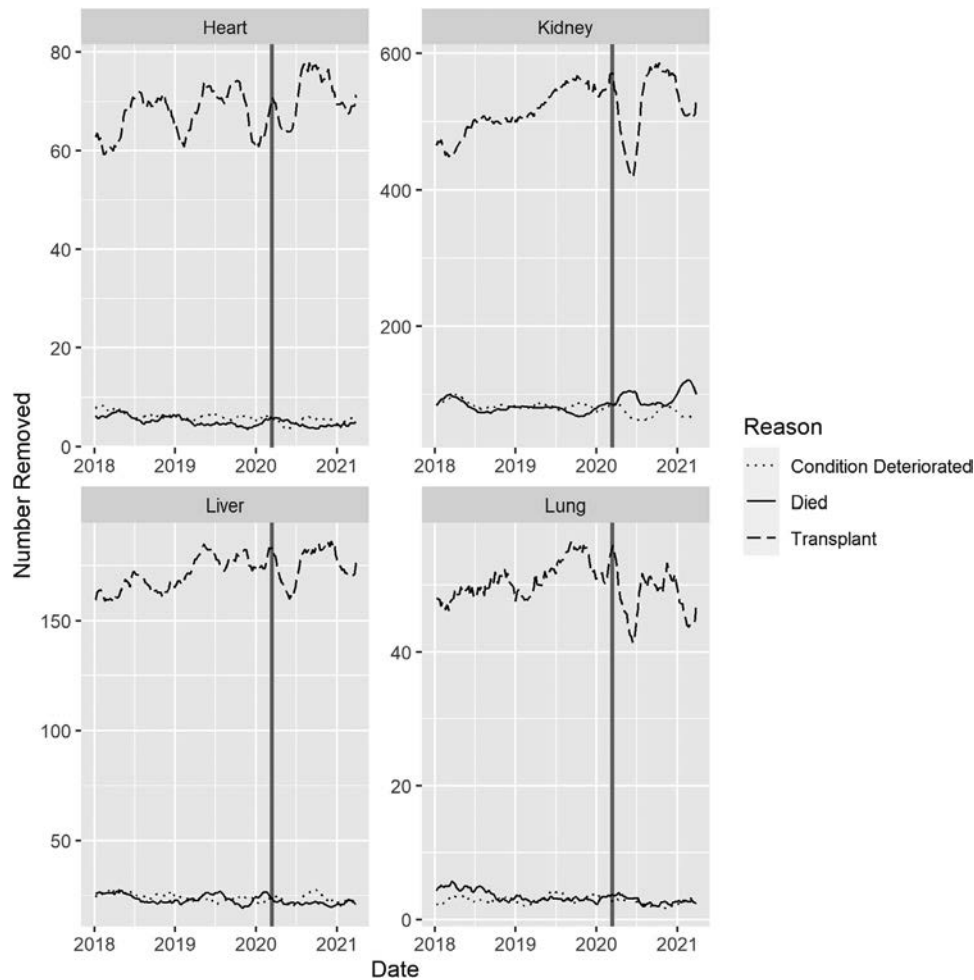


FIGURE 3 Thirteen-week moving average of reasons for removal from solid organ waiting lists each week from January 1, 2018 to March 28, 2021. Vertical line is at March 13, 2020, the date of declaration of a national emergency for COVID-19. Listings and removals do not necessarily represent unique people, as individual people may be listed multiple times

Additionally, kidney candidates older than 35 years showed lower rates of transplant corresponding to both waves of the pandemic, indicating that older candidates may be facing the twin risks of COVID-19 and complications from delaying medical care. Continuing SRTR real-time reporting of the impact of COVID-19 on the US transplant system (see <https://www.srtr.org/tools/covid-19-evaluation/>) will allow these systems to plan care for their patients.

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AUTHOR CONTRIBUTION

Jonathan Miller, Andrew Wey, Donald Musgrove, and Yoon Son Ahn participated in the research design, data analysis and writing of the paper. Maryam Valapour, Allyson Hart, Ryutaro Hirose, Ajay Israni, and Jon Snyder participated in the research design, data analysis and writing of the paper.

CONFLICT OF INTEREST

The authors declare no conflicts of interest as described by *Clinical Transplantation*.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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