

Outcomes in Solid-Organ Transplantation:

Success and Stagnation

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Since emerging as a field in the 1980s, solid-organ transplantation has progressed rapidly, enabled by advances in immunosuppression, imaging methods, antimicrobial agents, and donor–recipient matching. However, as the healthcare landscape shifts in the United States and long-term outcomes are increasingly scrutinized against costs, it is crucial to the field's future course that areas of success and potential improvement be identified. Toward this end, we surveyed Organ Procurement and Transplantation Network waiting-list and recipient databases for all solid-organ transplant types since 1987.¹⁻³

Successes

Adult kidney transplantation is perhaps the greatest success among all the procedures; more than 270,000 initial transplantations have been performed since 1970. Receiving a cadaveric graft doubles a patient's chances of survival, and a living-donor graft quadruples them, in comparison with those who remain on the waiting list. Across all such procedures, 1.37 million life-years (4.4 yr/recipient) have been added; the median survival time among recipients is 12.4 years, compared with 5.4 years among those on the waiting list.¹

More than 50% of liver transplant recipients survive for 7 years, in comparison with approximately 25% of patients on the waiting list. Adult cadaveric liver transplantation nearly quadruples the median survival time, from 3.1 to 11.1 years. The most remarkable impact is in the pediatric population—survival duration often exceeds 25 years. In total, 465,000 life-years have been added (mean, 4.3 yr/recipient).²

Similar 7-year survival rates are seen in heart transplantation: more than 50% of recipients survive, compared with approximately 25% of individuals on the waiting list. In adult recipients, the median survival time is 9.4 years, in comparison with 2.4 years among patients awaiting a heart. In pediatric recipients, the median survival time is 12.8 years. Overall, heart transplantation has added approximately 270,000 life-years (mean, 4.9 yr/recipient).³

The success of repeat kidney, liver, or heart transplantation is somewhat diminished; nevertheless, survival rates are still considerably higher in recipients. The least productive repeat procedure, liver transplantation, adds only about 1.5 life-years per recipient.²

In sum, across all solid organs, 2.3 million life-years have been added through 2017; we project that the total will exceed 4 million.

Stagnation

Early gains in short-term survival rates after transplantation have been impressive; however, longer-term outcomes have been less so. Liver transplantation is the best example. One-year survival rates rapidly increased from 67% during the 1980s to 90% in 2014, but improvement has reached a plateau (Fig. 1).² Among candidates for livers, mortality rates have essentially not changed, hovering around 20% to 25% since 1988, and the one-year intent-to-treat survival rate in those patients remains similarly stable at approximately 80% (Fig. 2). The liver transplantation rate in adults decreased from 82% to 44% of those on the waiting list from 1988 through 2000 and has only slightly improved.²

Overall long-term survival duration has not changed. According to our analysis, beyond the first year, the likelihood of surviving for 5, 10, or even 20 years was as high for a 1980s-era organ recipient as it is for a more recent recipient.¹⁻³ Causes of death have also remained the same, with no significant change in deaths from graft failure

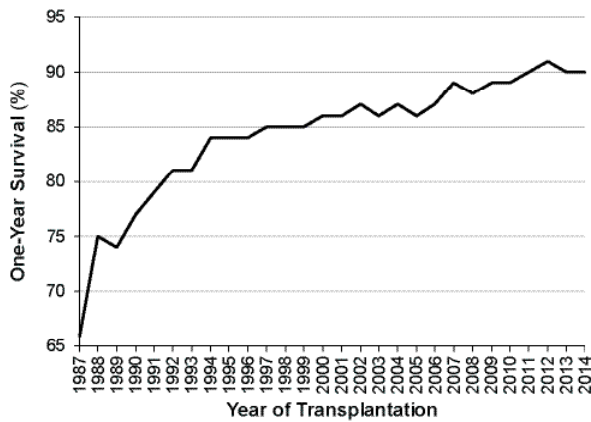


Fig. 1 Graph of one-year survival rates in liver transplantation shows a rapid increase from 1987 through 1994 and a comparative plateau thereafter.

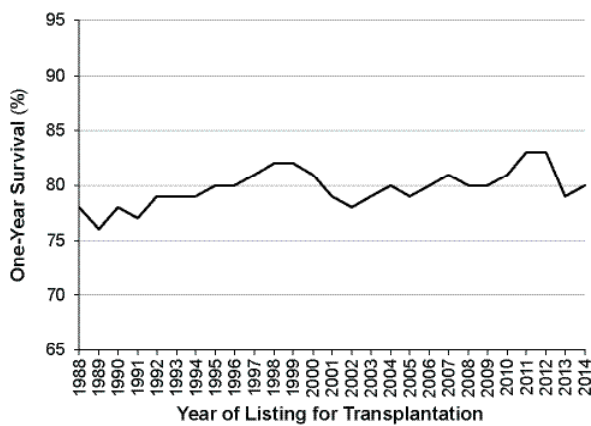


Fig. 2 Graph of one-year intent-to-treat survival rates in liver transplantation shows little change from 1988 through 2014.

or infection.¹⁻³ Death from malignancy has increased modestly over time.¹⁻³

Support in Lieu of Transplantation

The effectiveness of mechanical and therapeutic support methods is approaching that of organ transplantation. In the early 2000s, significant gaps in survival existed between waitlisted candidates and recipients. However, within the past 5 years, data for kidney-transplant candidates suggest that survival rates are only slightly higher in those who remain on the waiting list than in those who undergo transplantation.² The same is true among heart-transplant candidates and recipients.³ Progress in replacement therapies, mechanical circulatory support, and the medical management of organ failure has equaled or exceeded advances in transplantation.

Conclusion

Solid-organ transplantation has demonstrably improved modern medicine. Its positive social and economic impact has enabled thousands of patients to improve their functional status and live longer. If transplantation is to remain an effective treatment option, long-term management methods and approaches must continue to improve.

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