to help answer key questions on how to best care for children on ECMO and/or mechanical ventilation who require LTx. If the aforementioned confounding factors were not addressed, I would recommend further exploration of the UNOS Registry focused on children under 18 years of age on ECMO and/or mechanical ventilation at pediatric LTx programs. If there truly are inferior outcomes earlier in the post-LTx course for children on ECMO and/or mechanical ventilation that were not present in the previous work from 2015 (3), that is suggestive of management issues during the postoperative course or treatment of early LTx complications, so pediatric LTx programs in the United States should address that. ■

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Reply: Early Mortality for Children on Extracorporeal Membrane Oxygenation at Lung Transplant: True or Due to Confounding Variables?

From the Authors:

We thank Dr. Hayes for the thoughtful comments in his letter in response to our recent publication entitled, "Early Mortality for Children on Extracorporeal Membrane Oxygenation at Lung Transplant" (1). Before discussing these further, we would like to clarify our findings regarding the mortality trends. In our study, we found that mechanical support, which included use of both pretransplant extracorporeal membrane oxygenation (ECMO) and/or mechanical ventilation (MV), was associated with an increase in mortality at the time of hospital discharge. This was an increase in mortality for both ECMO and MV and not simply ECMO alone. However, at both 1 year and 5 years after transplantation, there was no difference in pretransplant mechanical support (ECMO and/or MV) and no mechanical support. This suggests that if patients survive to hospital discharge, the need for and use of pretransplant mechanical support, including ECMO, has no long-term survival impact but does impact the initial survival.

As Dr. Hayes has pointed out, many confounding factors may have impacted our results, the first being transplant center. We included pediatric lung transplant volume and transplant center as a random effect in our mixed-effect logistic regression analysis to adjust for center characteristics. We did not, however, control specifically for centers by annual cystic fibrosis lung transplant volume. Lastly, the decision to include transplants up to but not including 21 years of age is different than the prior studies by Hayes. Because many patients continue to receive lung transplants at pediatric transplant centers beyond the age of 18, we found it important to include those <21 years of age. We cannot rule out residual confounding from these specific center characteristics, despite adjusting for random variability by center in our analyses. The limitations of the dataset and our analyses are discussed in detail in our manuscript.

The issues related to confounding raised by Dr. Hayes illustrate a greater need to look at data beyond what is available through the United Network for Organ Sharing (UNOS) database, especially data on ECMO support, to further understand outcomes of children bridged to lung transplantation with ECMO. In addition, in the editorial that accompanied our manuscript, Barbaro and colleagues highlight the need for evaluating those listed for lung transplant during ECMO support, with a more comprehensive view of ECMO use in this population (2). This would provide mortality data on not only those who survived the pretransplant period and went on to receive a transplant but also those who died before transplant. This was done with pediatric heart transplant patients and would be important information for lung transplant patients (2, 3). ■

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