

At-a-Glance

Proposal to Collect Extracorporeal Membrane Oxygenation (ECMO) Data Upon Waitlist Removal for Lung Candidates

- **Affected/Proposed Policy:** No policies are affected by this proposal

Thoracic Organ Transplantation Committee

Extracorporeal membrane oxygenation (ECMO) has become a more common treatment for patients with end-stage lung disease awaiting lung transplantation. However, the Thoracic Committee has been unable to consider the impact of ECMO support on lung allocation because this information is not routinely collected and reported to the OPTN. The Thoracic Committee proposes the collection of ECMO information at the time of waiting list removal to retrospectively capture each candidate's mechanical ventilatory support history. This will provide the Thoracic Committee with data on a contemporary cohort of candidates in order to appropriately analyze how ECMO should be incorporated into the LAS calculation.

- **Affected Groups**

Transplant Administrators
Transplant Data Coordinators
Transplant Physicians/Surgeons
Transplant Program Directors

- **Number of Potential Candidates Affected**

Transplant programs will be required to submit this information upon waiting list removal for each lung candidate. In 2013, 2,434 lung candidates were removed from the waiting list. If ECMO is ultimately incorporated into the LAS, it could affect the entire lung transplant waiting list.

- **Compliance with OPTN Strategic Plan and Final Rule**

This proposal furthers the OPTN Strategic Goal of improving survival for patients with end stage organ failure by better matching donated organs to recipients by collecting data to fully understand the medical condition of candidates transplanted while supported by ECMO.

This proposal also furthers §121.8 of the Final Rule, which states: "(a) the Board of Directors...shall develop...policies for the equitable allocation of cadaveric organs among potential recipients. Such allocation policies: (1) Shall be based on sound medical judgment; ... (6) Shall be reviewed periodically and revised as appropriate". Collecting ECMO data will assist the Thoracic Committee in further refining the LAS based on contemporary objective medical evidence. It will also assist the Thoracic Committee in reviewing the LAS to ensure that it properly accounts for the medical condition of candidates supported by ECMO during their time on the waiting list.

Proposal to Collect Extracorporeal Membrane Oxygenation (ECMO) Data Upon Waitlist Removal for Lung Candidates

Affected/Proposed Policy: No policies are affected by this proposal.

Thoracic Organ Transplantation Committee

Public comment response period: September 29, 2014 – December 5, 2014

Summary and Goals of the Proposal:

Extracorporeal membrane oxygenation (ECMO) has become a more common treatment for patients with end-stage lung disease awaiting lung transplantation. The Thoracic Committee has been unable to consider the impact of ECMO support on lung allocation because this information is not routinely collected and reported to the OPTN. The Thoracic Committee proposes the collection of ECMO information at the time of waiting list removal to retrospectively capture each candidate's mechanical ventilatory support history. This will provide the Thoracic Committee with data on a contemporary cohort of candidates in order to appropriately analyze how ECMO should be incorporated into the LAS calculation.

Background and Significance of the Proposal:

The Lung Subcommittee of the Thoracic Committee began discussing ECMO data collection during an August 2012 teleconference in response to the following email from a member:

A question came up...regarding policy for lung candidates who are supported with ECMO prior to transplant. Many centers...don't adjust the scores when patients' FIO₂ comes down on ECMO or claiming it's equivalent to being on 100% O₂ so the LAS remains high. Other centers are keeping their high scores from ventilation with high FIO₂ claiming they don't have to update for two weeks. As we have talked about in past meetings, there was no ECMO data in the set used to build the LAS and the odds ratio for acute mortality is extremely high in the UNOS data, so is it your feeling that it is OK for centers to simply come up with the highest score they can?

The member's email highlighted two separate problems related to reporting ECMO use in lung transplant candidates: 1) there are differences in how transplant programs report ventilatory support while on ECMO through the "continuous mechanical ventilation" field in WaitlistSM; and 2) there is a lack of data to analyze whether the LAS system appropriately calculates a score for candidates supported by ECMO prior to transplant.

The Lung Subcommittee addressed the inconsistent reporting problem first. Currently, transplant programs must report the candidate's ventilation status as "BiPAP," "CPAP," "continuous mechanical," "intermittent mechanical," and "no assisted ventilation needed." Transplant programs must also report whether the candidate requires supplemental oxygen, and the possible selections are "at night," "at rest," "with exercise only," and "not needed." The program must also input the amount of oxygen the candidate requires, either as a percentage or as liters per minute.

The Subcommittee ultimately determined that candidates who are extubated and on ECMO should be reported as on “continuous mechanical ventilation,” with 100% oxygen. The Lung Subcommittee decided upon 100% oxygen because candidates on ECMO are effectively ensured maximal oxygenation via the membrane oxygenator, and it ensures that these candidates will receive the highest calculated LAS based on their reported information. The Thoracic Committee approved the Lung Subcommittee’s recommendation and distributed a memo to all lung transplant programs in February 2013 entitled “Reporting for Lung Transplant Candidates Supported by ECMO.” Despite the distribution of the memo, there is no way to assure that transplant programs are consistently reporting this data, and reporting ECMO use is still not mandatory.

The Lung Subcommittee then turned its attention to the other problem: lack of information about candidates supported by ECMO prior to transplant. The OPTN does not currently collect these data because ECMO is not a variable in the LAS calculation. The Thoracic Committee did not include ECMO in the modified version of the LAS adopted by the Board of Directors in November 2012 because there were no ECMO data on waiting candidates.¹ Though the LAS modification was adopted, the American Society of Transplantation, during the public comment period noted “there should be some other considerations,” stating, “Inclusion of ECMO was not considered into the model on the post-transplant side.” OPTN/UNOS Board members also commented on the importance of collecting ECMO data during the November 2012 Board of Directors meeting. Since the November 2012 Board of Directors meeting, other members of the lung transplant community have noted the absence of ECMO in the LAS, and argued that “[t]he uncertainty regarding ECMO benefits raises ethical concerns about organ waste and preferential use of marginal allografts or cadaveric lobar transplants.”²

The Lung Subcommittee defined two goals in collecting ECMO data: 1) ensure that candidates supported by ECMO receive an LAS that reflects the severity of their condition; and 2) capture data on a contemporary cohort of lung candidates treated with ECMO to inform future versions of the LAS calculation. These data will also help to identify candidates who are potentially too sick to be transplanted and to assess national trends in ECMO use.

Proposed ECMO Data Points

After determining that additional data collection is required, the Lung Subcommittee debated the specific data elements that should be reported. The Lung Subcommittee favored data collection that included variables likely to help differentiate candidates based on medical urgency in the future. An explicit goal is to use the information on ECMO to further refine the LAS, so collected data must be of sufficient granularity to further stratify candidates that are supported by ECMO and/or mechanical ventilation.

¹ Alcorn, James B., “Summary of actions taken at OPTN/UNOS Board of Directors Meeting (November 12-13, 2012) and OPTN/UNOS Executive Committee Meetings (August 28, 2012; October 19, 2012; and November 12, 2012).” December 3, 2012. http://optn.transplant.hrsa.gov/ContentDocuments/2012-12_Policy_Notice.pdf.

² Venado, Aida, Charles W. Hoopes, and Enrique Diaz-Guzman, MD. “Prolonged extracorporeal membrane oxygenation use as a bridge to lung transplantation: It is time for a national registry”, *Chest Journal* 145(1) (2014):184-185. Accessed August 11, 2014. doi:10.1378/chest.13-1851.

The Lung Subcommittee agreed upon collecting the dates of cannulation/intubation and decannulation/extubation, if applicable, for each ECMO device or mechanical ventilatory support device used to support the candidate while on the waitlist. These data will help determine whether waiting list mortality or post-transplant survival are affected by ECMO use at any time while waiting for transplant, or if only recent ECMO use is relevant.

The Subcommittee debated whether to collect information on the site of cannulation (peripheral or central), and ultimately determined it is appropriate to collect this information because it is likely to be predictive of waiting list and post-transplant outcomes. Additionally, the Lung Subcommittee determined that the ambulation status of ECMO and mechanically ventilated patients may be an important variable, or relevant surrogate, in the determination of risk.

The Subcommittee also discussed whether it is important to collect the type of ECMO used to support a candidate. It determined that distinguishing candidates supported by veno-venous (VV) ECMO from candidates supported by veno-arterial (VA) ECMO is likely to be relevant in determining how to incorporate ECMO into the LAS calculation. Lung Subcommittee members noted that based on clinical experience, there is a significant difference in the medical condition of candidates placed on VV ECMO as opposed to VA ECMO. Though ECMO technology is rapidly evolving, the Subcommittee agreed that these two broad categories should capture most, if not all, future ECMO types as well.

The Lung Subcommittee debated whether to permit a transplant program to report ECMO use as “unknown” type in the device type field. The Lung Subcommittee ultimately determined that selecting “unknown” was ambiguous and may lead to inaccurate data reporting.

The Lung Subcommittee does not believe it is necessary to collect information on whether the ECMO unit is driven by a pump; nor is it necessary to collect information regarding the ECMO device brand or connection type (such as pulmonary artery to left atrium). The Lung Subcommittee believes that the basic information regarding device type will be sufficient for the purposes of analysis for potential inclusion in future versions of the LAS without the added complexity of additional data entry.

Though the Committee wants to keep the data entry as simple as possible while still collecting ample data to assess risk stratification amongst lung transplant candidates supported by ECMO, the Committee is mindful that other data variables may affect a candidate’s condition while the candidate is supported by ECMO, including flow rates, sweep gas flow rates and fraction of delivered oxygen ($F_{D}O_2$). However, the Committee was concerned that variability in these parameters driven by physiological changes would not be adequately or accurately captured with the periodic data reporting required for waitlisted candidates.

Mechanism for Collecting ECMO Data

Lastly, the Lung Subcommittee discussed the best mechanism to collect the data. The Lung Subcommittee discussed developing a policy change requiring transplant programs to report ECMO information in a manner similar to that used for all LAS variables. Current policy requires transplant programs to report data relevant to the calculation of the LAS every six months, with the exception of certain variables that must be updated every 14 days in some circumstances. The transplant program is not required to provide retrospective data reflecting the whole reporting period; rather, the transplant program submits a “snapshot” of data that meets the reporting requirements. A candidate could go on and off ECMO within the reporting period, and the

transplant program would not be required to report that the candidate was ever on ECMO during that period, and therefore would fail to capture all the information the Lung Subcommittee seeks.

The Lung Subcommittee also considered requiring all candidates on the waiting list supported by ECMO to apply to the Lung Review Board (LRB) for an LAS exception in order to capture the data. The Subcommittee, however, realized that candidates on ECMO are likely to already have high LAS scores and their physicians will be unlikely to be motivated to request approval from the LRB for a higher LAS. A targeted data collection study is also unlikely to yield numbers necessary to properly analyze the effect of ECMO on waiting list and post-transplant survival. Because the number of candidates on ECMO may be relatively small, data on all candidates supported by ECMO, not just a sample of those candidates, is required in order to have sufficient information to analyze the effect of ECMO.

ELSO (Extracorporeal Life Support Organization) is an international registry that maintains “a registry of, at least, use of extracorporeal membrane oxygenation in active ELSO centers.”³ The Lung Subcommittee considered the feasibility of requesting data from ELSO to support policy development, but ultimately determined this would also be an inadequate solution. A significant number of lung transplant programs are not members of the ELSO registry. Therefore, a significant portion of the lung transplant population that may potentially be treated with ECMO would not be included in the data provided by the ELSO registry. Additionally, the ELSO database registers patients that have received ECMO but were never registered on the waiting list. These patients would not be relevant to the analysis the Lung Subcommittee must perform. Therefore, despite the ELSO registry, some in the transplant community agree that “[e]stablishment of a registry for [use of ECMO as a bridge to lung transplant] will be vital to systematically track practices, correlate outcomes, and establish standards of care.”⁴

The Lung Subcommittee therefore recommends collecting information on mechanical ventilatory support devices, including ECMO, used to support the candidate at the time the candidate is removed from WaitlistSM. This would mimic the data reporting requirements for mechanical circulatory support devices for heart candidates. Transplant programs will be required to report all instances in which the candidate was supported by a mechanical ventilatory support device throughout their time on the waitlist. This approach will allow the Subcommittee to collect the most complete data possible for all candidates. Another benefit of this approach is that it will keep heart, lung, and heart-lung data collection as consistent as possible, making it easier for transplant programs to navigate and complete the forms.

The Lung Subcommittee thoroughly debated the costs of each option, including the cost of programming these fields on the upon waitlist removal, and concluded that programming these changes is the only way to ensure complete and accurate reporting for all lung transplant candidates. Additionally, the UNOS IT Department determined that the cost of programming, though large, is significantly lower than the original estimate presented to the Policy Oversight Committee and Executive Committee in March 2014.

On August 25, 2014, the Thoracic Committee voted to distribute this proposal for public comment. (18 support; 0 oppose; 0 abstained)

³ <http://www.elseo.org/about> (Accessed on 8/7/2014)

⁴ Fadul, RA, Budev, MM, McCurry, KR, Yun, JJ. “Extracorporeal Membrane Oxygenation (ECMO) Practices for Bridging to Lung Transplantation in North America: A Multicenter Survey.” *Journal of Heart and Lung Transplantation*, 32:4S (2014): S246-S247. Accessed on September 2, 2014. doi: 10.1016/j.healun.2014.01.644.

Supporting Evidence and/or Modeling:

ECMO use at the time of listing is currently collected on the Transplant Candidate Registration (TCR) form, and ECMO use at the time of transplant is currently collected on the Transplant Recipient Registration (TRR) form. ECMO data obtained from these forms may not reflect the entire population of lung candidates supported by ECMO, as ECMO use may be initiated after listing but withdrawn prior to the candidate's removal from the Waitlist. The Lung Subcommittee nevertheless reviewed the data that are available.

Figure 1 reveals that use of ECMO is growing, with the percentage of candidates on ECMO at transplant more than tripling between transplants in the first half of 2010 compared to the first half of 2013 (0.9 percent vs. 3.5 percent). A survey conducted in 2014 to "better define the current use of ECMO as a bridge to transplant" revealed that "a significant proportion of US lung transplant programs use ECMO as a bridge to transplant."⁵ As ECMO use continues to increase in bridging end-stage lung disease candidates to transplant, the Lung Subcommittee recognizes the need to collect more ECMO data to determine how to incorporate it into the LAS.

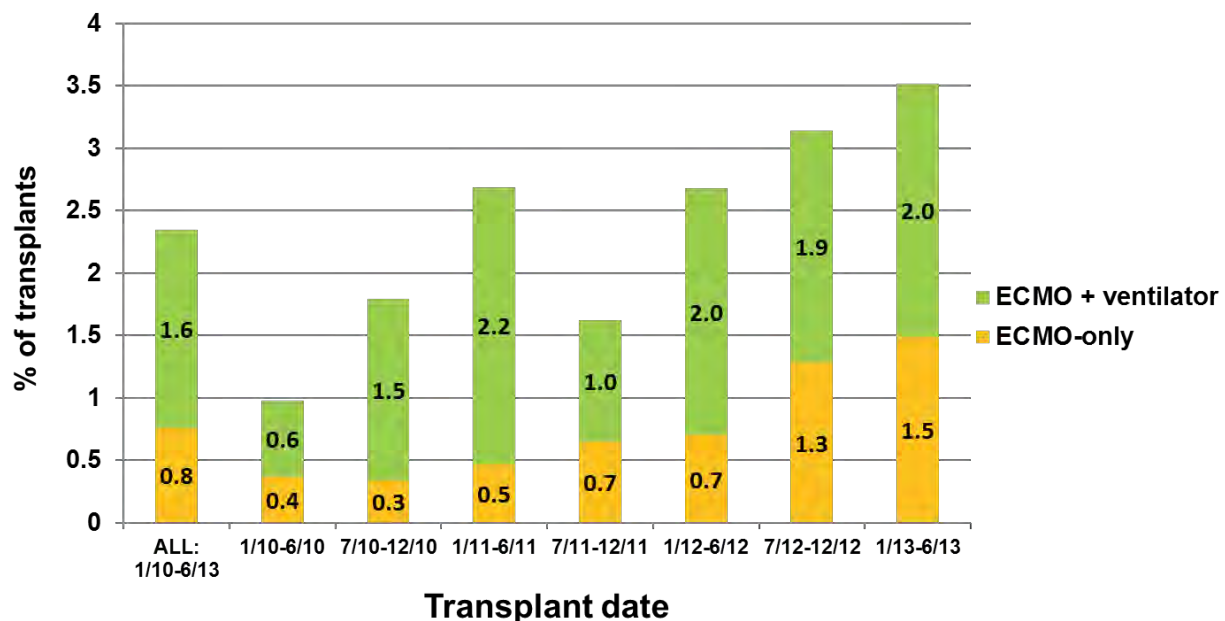


Figure 1: ECMO Use at Transplant

The Lung Subcommittee also reviewed data to determine whether certain factors reported in WaitlistSM could have contributed to differences in LAS at transplant based on the device at transplant (ECMO or ventilator). The data show that recipients on ECMO at the time of transplant had higher oxygen use at rest, required more help with activities of daily living (ADLs), and were more frequently on assisted ventilation. Over 80 percent of the recipients on ECMO at transplant were reported to be on 100 percent oxygen at rest on the waiting list, compared to 20 percent of those on a ventilator at transplant. All of these factors contribute to a higher LAS for recipients on ECMO at the time of transplant. There may be an effect of high LAS at transplant for ECMO patients, as one study revealed that "high acuity patients (LAS score >50) within our institutions

⁵ Fadul, et.al, "Extracorporeal Membrane Oxygenation (ECMO) Practices for Bridging to Lung Transplantation in North America: A Multicenter Survey."

who require and ECMO bridge were at a survival disadvantage compared with high acuity patients (LAS score >50) who did not require mechanical support.”⁶

Additionally, Figure 2 shows those candidates supported by ECMO and a ventilator at the time of transplant have a notably lower one year post-transplant survival rate than recipients who were supported by ECMO only, a ventilator only, or neither device.

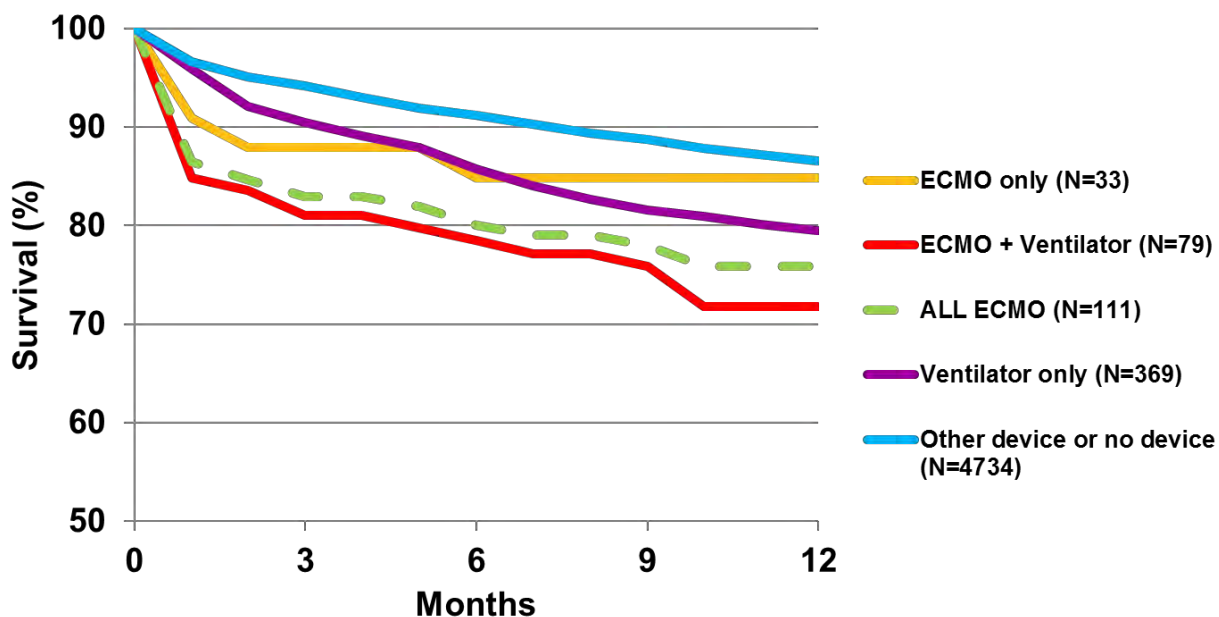


Figure 2: Post-Transplant Survival by Device

Single-center and multi-center retrospective studies have also examined the efficacy of bridging lung candidates to transplant with ECMO by examining post-transplant outcomes. Some found that one- and two-year survival rates are not adversely affected by pre-transplant ECMO use.⁷ Others found use of ECMO as a bridge to transplant to be warranted, but found that “time on ECMO was a significant risk factor for death, either during the bridge or after transplant.”⁸ As post-transplant survival is an important factor in the LAS calculation, it is necessary for the Lung Subcommittee to ensure that this aspect of the LAS is verified for candidates supported by ECMO.

Though the OPTN collects some relevant data, the Thoracic Committee determined that it is not sufficient to determine how ECMO should be incorporated into the LAS calculation, and therefore proposes collecting ECMO data on upon waitlist removal in UNetSM.

Expected Impact on Living Donors or Living Donation:

No known impact on living donors or living donation.

⁶ Hoopes, Charles W., Kukreja, J., Golden, J., Davenport, D.L, Diaz-Guzman, E., and Zwischenberger, J.B. “Extracorporeal membrane oxygenation as a bridge to pulmonary transplantation.” *The Journal of Thoracic and Cardiovascular Surgery*, 145:3 (2013): 862-868. Accessed August 11, 2014. DOI: 10.1016/j.jtcvs.2012.12.022

⁷ Toyoda, Yoshiya, Bhama, J.K., Shigemura, N., Zaldonis, D., Pilewski, J., Crespo, M., and Bermudez, C. “Efficacy of extracorporeal membrane oxygenation as a bridge to lung transplantation.” *The Journal of Thoracic and Cardiovascular Surgery*, 145:4 (2013): 1065-1071. Accessed August 11, 2014. DOI: 10.1016/j.jtcvs.2012.12.067.

⁸ Crotti, Stefania, Iotti, G., Lissoni, A., Belliato, M., Zanierato, M. Chierichetti, M., Di Meo, G., Meloni, F., Pappalè, M., Nosotti, M. Santambrogio, L., Viganò, M., Braschi, A. and Gattinoni, L. “Organ allocation waiting time during extracorporeal bridge to lung transplant affects outcomes.” *Chest Journal*. 144(3)(2013):1018-1025. Accessed August 11, 2014. doi:10.1378/chest.12-114.

Expected Impact on Specific Patient Populations:

No known impact to specific patient populations.

Expected Impact on OPTN Strategic Plan, and Adherence to OPTN Final Rule:

This proposal furthers the OPTN Strategic Goal of improving survival for patients with end-stage organ failure by better matching donated organs to recipients by collecting data to fully understand the medical condition of candidates transplanted while supported by ECMO.

This proposal also furthers §121.8 of the Final Rule, which states: “(a) the Board of Directors...shall develop...policies for the equitable allocation of cadaveric organs among potential recipients. Such allocation policies: (1) Shall be based on sound medical judgment; ... (6) Shall be reviewed periodically and revised as appropriate”. Collecting ECMO data will assist the Thoracic Committee in further refining the LAS based on objective medical evidence. It will also assist the Thoracic Committee in reviewing the LAS to ensure that it properly accounts for the medical condition of candidates supported by ECMO during their time on the waiting list.

Plan for Evaluating the Proposal:

The Thoracic Committee hypothesizes that more data regarding ECMO and ventilatory support will be submitted to the OPTN upon implementation of the modifications to the candidate removal page in WaitlistSM. The Committee further hypothesizes that the percentage of candidates supported by ECMO during their time on the waitlist will increase as ECMO continues to become a more common therapy for patients with end-stage lung disease.

The Thoracic Committee will review the additional data reported on the candidate removal page during its annual review of the LAS system. When the Committee agrees there are ample data to begin analysis and to model whether ECMO can be incorporated into the LAS calculation, the Lung Subcommittee will work with SRTR to complete this task.

Additional Data Collection:

As described in depth above, additional data collection will be required as a result of this proposal. This data collection effort is justified by the OPTN Principle of Data Collection: “Institutional members must provide sufficient data to OPTN to allow it to: a) Develop transplant, donation and allocation policies.”

Expected Implementation Plan:

This proposal will require programming in UNetSM to edit the candidate removal page in WaitlistSM to add a section on mechanical ventilatory support.

Upon implementation, transplant programs will be required to provide the OPTN with data regarding all ventilatory devices used to support a candidate during his or her time on the waitlist. This information will be reported retrospectively, each time a candidate is removed from the waitlist. Transplant programs should become familiar with the new data fields so that the data are reported accurately.

Communication and Education Plan:

Upon Board approval, transplant professionals (specifically lung program personnel) will be informed about the upcoming requirement of submitting ECMO use information on the candidate removal page.

System notices will be sent to UNetSM users to provide advance notice of the change 30 days before implementation and again upon implementation, and a brief article about the implementation will be posted online. Any training will also be announced online. UNOS will develop educational materials in order to help transplant programs understand the new requirements.

The table below outlines the proposed communication and education activities.

Communication Activities			
Communication	Audience(s)	Deliver Method(s)	Timeframe
System Notice	UNet SM users	Through UNet SM	Upon implementation
Brief news items on the website and in the monthly e-newsletter.	Lung transplant centers	Online	Upon implementation

Compliance Monitoring:

This proposal will not affect monitoring of transplant hospitals.

Policy or Bylaw Proposal:

This section is not applicable because policy language is not affected by this proposal. However, the OPTN Principles of Data Collection require that “new data collection will require approval by the Policy Oversight Committee and the Board of Directors of the OPTN, and be subject to public comment.” Because this proposal requires additional data collection from OPTN members, it must be circulated for public comment.