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## Features

# A Survey of Physicians' Attitudes toward Decision-Making Authority for Initiating and Withdrawing VA-ECMO: Results and Ethical Implications for Shared Decision Making

*Ellen C. Meltzer, Natalia S. Ivascu, Meredith Stark, Alexander V. Orfanos, Cathleen A. Acres, Paul J. Christos, Thomas Mangione, and Joseph J. Fins*

### ABSTRACT

#### Objective

Although patients exercise greater autonomy than in the past, and shared decision making is promoted as the preferred model for doctor-patient engagement, tensions still exist in clinical practice about the primary locus of decision-making authority for complex, scarce, and resource-intensive medical therapies: patients and their surrogates, or physicians. We assessed physicians' attitudes toward decisional authority for adult venoarterial extracor-

poreal membrane oxygenation (VA-ECMO), hypothesizing they would favor a medical locus.

#### Design, Setting, Participants

A survey of resident/fellow physicians and internal medicine attendings at an academic medical center, May to August 2013.

#### Measurements

We used a 24-item, internet-based survey assessing physician-respondents' demographic characteristics, knowledge, and

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attitudes regarding decisional authority for adult VA-ECMO. Qualitative narratives were also collected.

### Main Results

A total of 179 physicians completed the survey (15 percent response rate); 48 percent attendings and 52 percent residents/fellows. Only 32 percent of the respondents indicated that a surrogate's consent should be required to discontinue VA-ECMO; 56 percent felt that physicians should have the right to discontinue VA-ECMO over a surrogate's objection. Those who self-reported as "knowledgeable" about VA-ECMO, compared to those who did not, more frequently replied that there should not be presumed consent for VA-ECMO (47.6 percent versus 33.3 percent,  $p = 0.007$ ), that physicians should have the right to discontinue VA-ECMO over a surrogate's objection (76.2 percent versus 50 percent,  $p = 0.02$ ) and that, given its cost, the use of VA-ECMO should be restricted (81.0 percent versus 54.4 percent,  $p = 0.005$ ).

### Conclusions

Surveyed physicians, especially those who self-reported as knowledgeable about VA-ECMO and/or were specialists in pulmonary/critical care, favored a medical locus of decisional authority for VA-ECMO. VA-ECMO is complex, and the data may (1) reflect physicians' hesitance to cede authority to presumably less knowledgeable patients and surrogates, (2) stem from a stewardship of resources perspective, and/or (3) point to practical efforts to avoid futility and utility disputes. Whether these results indicate a more widespread reversion to paternalism or a more circumscribed usurping of decisional authority occasioned by VA-ECMO necessitates further study.

## INTRODUCTION

Although patients exercise greater autonomy, and shared decision making is promoted as the preferred model for doctor-patient engagement, tensions still exist in clinical practice about the primary locus of decision-making authority: patients or physicians?<sup>1</sup> Historically physicians were charged with deciding when to initiate or withhold/withdraw life-sustaining therapies, but with increases in patients' autonomy, the locus of authority largely shifts to patients or, when they lack capacity, their surrogate decision makers (surrogates).<sup>2</sup> One example of such a therapy is adult VA-ECMO, a form of mechanical circulatory and oxygenation support. In our practices we have observed that the withholding and the terminal withdrawal of VA-ECMO engenders tensions among physicians regarding where decisional authority ought to reside—with some physicians expressing a preference to retain ultimate decisional authority. (For the purpose of this study we define "decisional authority" as the right to make medical decisions.)

To briefly review, VA-ECMO provides temporary oxygenation and perfusion to patients with cardiopulmonary failure, affording time for native cardiopulmonary recovery or serving as a bridge to transplantation or implantation of a longer term mechanical support device.<sup>3</sup> With VA-ECMO, venous blood is drained into the extracorporeal membrane oxygenation circuit via catheters implanted through either transthoracic or percutaneous cannulae.<sup>4</sup> Gas exchange occurs across a semipermeable membrane, and oxygenated blood is returned to the arterial circulation via a mechanical pump that takes the place of native cardiac function.<sup>5</sup> This is not to be confused with venovenous extracorporeal membrane oxygenation (VV-ECMO) for respiratory failure, in which oxygenated blood is returned to the venous circulation to be pumped by the patient's own heart.<sup>6</sup> Given the invasive mechanics of the technology, as well as the need for anticoagulation therapy, major complications for patients on VV- and VA-ECMO include stroke, bleeding, thrombosis, and infection.<sup>7</sup> A detailed description of machines/circuitry, indications for therapy, outcomes, and complications is beyond the scope of this article, but available in several review articles.<sup>8</sup> Possible outcomes of VA-ECMO include: patient recovers native cardiopulmonary function and weans off the ECMO; patient fails to recover and VA-ECMO serves as a provisional link to a ventricular assist device (VAD) or heart transplant; or patient fails to recover and dies.<sup>9</sup> Patients on VA-ECMO are frequently (but not always) intubated and generally (although not uniformly) sedated. As such, their participation in discussions regarding goals of care can be difficult, if not impossible, and physicians must often work with surrogates to craft decisions about treatment.<sup>10</sup>

In our experience, conflicts can arise between physicians and surrogates during end-of-life discussions about adult VA-ECMO.<sup>11</sup> When patients are neurologically devastated and/or the prospects for recovery on VA-ECMO vanish and transplantation or VAD are not viable options, physicians may recommend terminal discontinuation (withdrawal at end of life) of VA-ECMO. While such recommendations are in accordance with current guidelines, physicians may nonetheless face conflicts with surrogates who oppose withdrawal.<sup>12</sup> In New York City, where the consent of a surrogate is required to withhold or withdraw life-sustaining therapy, a futility dispute can arise, which may create moral distress for an entire healthcare team, including physicians, and may compromise optimal clinical care.<sup>13</sup>

Thus, in an effort to improve shared decision making with VA-ECMO and reduce moral distress

for physicians, healthcare team members, patients, and families, we set out to take a baseline assessment of physicians' attitudes towards decision making for VA-ECMO. Specifically, we sought to evaluate where physicians believed the locus of decisional authority ought to rest, and why. We hypothesized that physicians would favor a medically based locus of decisional authority.

## METHODS

### Survey

From August 2012 to March 2013, content and methodology experts worked together to create, pilot, and refine a 24-item, structured, internet-based survey to assess physicians' knowledge and attitudes regarding decisional authority for adult VA-ECMO for total cardiopulmonary support and, for another line of inquiry, cardiopulmonary resuscitation (CPR); demographic data and qualitative narratives were also collected. Questions spanned five domains in which physicians and surrogates make medical decisions: (1) consent for VA-ECMO, (2) initiation of VA-ECMO, (3) discontinuation of VA-ECMO, (4) administration of CPR, (5) do-not-resuscitate (DNR) orders and VA-ECMO, (5) and utilization of VA-ECMO. Experts in medical ethics, internal medicine, and critical care reached consensus about the five domains through brainstorming and the creation of a conceptual framework for decision making for VA-ECMO.<sup>14</sup> A pilot survey was completed by ten clinicians and ethicists and revised to ensure consistency and validity.

Physicians were instructed that, for the purposes of the survey, "ECMO" referred to total cardiopulmonary support (that is, VA-ECMO) and that questions should be answered based on their own beliefs, not state law or institutional policies or procedures. Physicians were instructed to express their opinion by selecting one answer from a six-point Likert scale (definitely no, probably no, possibly no, possibly yes, probably yes, definitely yes). In an effort to avoid concealing respondents' true sentiments, a neutral option was excluded. Although researchers debate whether or not to include a neutral option in surveys, this response was omitted to promote meaningful engagement with the survey and reporting of true attitudes, and to minimize "survey satisficing."<sup>15</sup> Demographic data included questions on gender, age, religion, self-report of religiosity, medical specialty/subspecialty, practice level (attending versus resident versus fellow), and self-report of ECMO knowledge and experience. At the conclusion of the survey, participants were provided

with a text box to submit any narrative comments about VA-ECMO for total cardiopulmonary support. The institutional review board approved the study. (The complete survey is available in Appendix A.)

### Collection of Data

From May to August 2013, internal medicine attendings and resident/fellow physicians at an urban, academic medical center were sent email invitations with a link to take the survey. Reminder emails (three in total) were sent at three-week intervals during this period. Investigators did not email participants directly, rather administrators with access to Department of Medicine and Graduate Medical Education list-serves forwarded emails on behalf of the investigators.

### Statistical Analyses

Descriptive statistics (including mean, standard deviation, median, minimum, maximum, frequency, and percent, as appropriate) were calculated to characterize physician-respondents' demographic characteristics and physicians' responses to 15 questions based on the five medical decision-making domains. All medical decision-making questions were cross-tabulated with demographic variables, and these relationships were analyzed using Fisher's exact test or the *chi-square* test, as appropriate. Question response data were analyzed using the six-point Likert scale but, for the sake of ease with reporting and to facilitate statistical analysis, were also collapsed to a three-point scale: yes (definitely yes, probably yes); no (definitely no, probably no); unsure (possibly yes, possibly no). All *p*-values are two-sided, with statistical significance evaluated at the 0.05 *alpha* level. Analyses were performed in SPSS Version 22.0.

## RESULTS

In all, 1,200 physicians received the survey, and 179 physicians completed the instrument, 48.7 percent attending and 51.3 percent resident/fellow physicians, yielding a 15 percent response rate. The majority of respondents were male (63 percent) with a mean age of 38 (+/-13) years. Just over 60 percent of respondents reported a primary medical specialty of internal medicine, and nearly 33 percent of all participants considered themselves religious. More than half (57.4 percent) of all respondents reported that they provide some critical care, with 48.8 percent reporting that they have participated in the care of one to ten patients on VA-ECMO. Only 26.9 percent of respondents considered themselves knowledgeable about VA-ECMO (see table 1).

Percentages across four domains related to VA-ECMO are presented for reference (see table 2). A minority of physicians (35.3 percent) responded that consent for VA-ECMO should be presumed. Only 32.3 percent responded that a surrogate's consent should be required to discontinue VA-ECMO, while 56.8 percent felt that physicians should have the right to discontinue VA-ECMO over a surrogate's objection. Nearly 62 percent of respondents felt that VA-ECMO use should be restricted given its cost; similarly 61.6 percent felt VA-ECMO should be used to perfuse organs for transplantation.

There were only a few differences across domains based on demographic factors. For example, respondents who self-reported as "knowledgeable" about VA-ECMO, compared to those who did not, answered more frequently that there should not be presumed consent for ECMO (47.6 percent versus 33.3 percent,  $p = 0.007$ ); that a physician should have the right to discontinue VA-ECMO treatment over a surrogate's objection (76.2 percent versus 50 percent,  $p = 0.02$ ); and that, given its cost, use of VA-ECMO should be restricted (81.0 percent versus 54.4 percent,  $p = 0.005$ ). Among subspecialties, those in pulmonary/critical care more frequently replied that a surrogate's consent should not be required to discontinue VA-ECMO (71.4 percent), compared to general internists (52.8 percent), cardiologists (52.4 percent), and others (15.8 percent) ( $p = 0.03$ ). There were no differences for on gender, religion, or self-report of religiosity.

### DISCUSSION

In an effort to understand and improve the state of shared decision making for VA-ECMO at our own institution, we studied physicians' attitudes towards the locus of decisional authority for initiation and discontinuation of this complex therapy. We hypothesized that, strides toward patient autonomy and shared decision making notwithstanding, physicians would favor themselves, more so than patients and surrogates, as the locus of decisional authority for initiation and discontinuation of VA-ECMO. Our data largely supported this hypothesis, as a substantial number of physicians believed that they ought to retain control over initiation and discontinuation, including terminal discontinuation, of adult VA-ECMO.

While many physicians surveyed had limited experience with VA-ECMO, those who self-reported as "knowledgeable" about VA-ECMO did respond more frequently that physicians ought to retain decisional authority and should be able to discontinue

**TABLE 1.** Characteristics of respondents ( $N = 179$ )

Characteristic	%	SD
Male gender	63	--
Mean age	38	--
SD	--	13
Religious affiliation		
Protestant	12.8	--
Catholic	21.2	--
Jewish	35.3	--
Muslim	.6	--
Hindu	3.2	--
None	14.1	--
Other	6.4	--
Prefer not to answer	6.4	--
Considers self religious		
No	67.1	
Yes	32.9	
Primary medical specialty		
Internal medicine	60.6	--
Surgery	7.1	--
Neurology	1.3	--
Emergency medicine	4.5	--
Obstetrics/gynecology	.6	--
Pediatrics	5.8	--
Anesthesiology	9.7	--
Psychiatry	1.9	--
Other	8.4	--
Subspecialty		
General medicine	40.0	--
Cardiology	23.3	--
Gastroenterology/hepatology	1.1	--
Pulmonary/critical care	15.6	--
Infectious disease	6.7	--
Hematology/oncology	3.3	--
Endocrinology	2.2	--
Nephrology	3.3	--
Rheumatology	4.4	--
Provider of critical care		
No	42.6	--
Yes	57.4	--
Practice level		
Resident/fellow	51.3	--
Attending	48.7	--
Number of ECMO cases		
0	48.1	--
0-10	48.8	--
>11	3.1	--
Knowledgeable about ECMO		
No	73.1	--
Yes	26.9	--

VA-ECMO treatment over a surrogate's objection. Similarly, those in pulmonary/critical care more frequently replied that a surrogate's consent should not be required to discontinue VA-ECMO. While attitudes are not necessarily indicative of behaviors and actions, the data indicate the need for further exploration of these attitudes and their implications for shared decision making and clinical practice. It is likely that those in pulmonary/critical care and those "knowledgeable" about VA-ECMO have these attitudes as a result of their direct experiences working with patients and families. VA-ECMO is complex, and physicians may be hesitant to cede authority to patients and surrogates who are presumably less knowledgeable about this therapy. Some of the qualitative narratives provided by participants supported this idea, with one respondent noting, "Patients and families most often do not have the medical knowledge to make informed decisions regarding ECMO therapy—considering its complexity and the multimodal specialties involved, there should be deference to the physician teams on whether to initiate or discontinue therapy."

The perceived complexity of VA-ECMO may present a barrier to shared decision making. After all, patients or surrogates cannot genuinely make an informed decision about VA-ECMO unless they really understand what it is and what it does, including its risks and benefits, advantages and limitations. While such an opinion is entirely understandable in the complex context of VA-ECMO, this sentiment is not new; it has historically been provided as a general, conventional objection to informed consent.<sup>16</sup> With recent strides toward shared

decision making, this attitude is now countered by current, normative practice and, in some instances, the law. Indeed, the Institute of Medicine (IOM) of the National Academy of Sciences recently emphasized patient-centered medical decision making, in which patients are "given the necessary information and opportunity to exercise the degree of control they choose over health care decisions that affect them," as a preferred decisional model.<sup>17</sup> So while it might be understandable, and even expected, that some physicians feel that patients and surrogates lack sufficient knowledge to make decisions about VA-ECMO, we must move forward and determine how to best educate these individuals so as to ensure that they can make informed decisions. Patient decision aids that are crafted with the input of patients and surrogates who have experienced VA-ECMO, may be helpful in this context.<sup>18</sup> Additional research, in the form of focus groups or surveys of surrogates, to understand the ECMO decision-making process from the vantage point of patients and their family members would add considerably to the knowledge base and may serve to fortify the prospects for implementing shared decision making in this complex realm. Lastly, as it pertains to patients' and families' perspectives, as the use of VA-ECMO becomes more commonplace, discussions about advance directives will likely need to include VA-ECMO as a topic for individual reflection and consideration.

Another plausible explanation for these results is that physicians may prefer to retain decision-making authority for more practical reasons, specifically in order to avoid end-of-life conflicts and futility

**TABLE 2.** Physicians' attitudes across four domains (N = 179)

Domain and questions	% Yes	% No	% Unsure
<b>Consent for VA-ECMO</b>			
Should consent for VA-ECMO be presumed?	35.3	37.1	27.5
Should consent for VA-ECMO include a provision that it may be discontinued if deemed futile?	95.2	1.2	3.6
<b>Initiation of VA-ECMO</b>			
Should religious objection to discontinuing VA-ECMO preclude its initiation?	52.1	20.4	27.5
Should VA-ECMO be initiated in a DNR patient?	3.6	77.1	19.3
<b>Discontinuation of VA-ECMO</b>			
Should surrogate consent be required to discontinue VA-ECMO?	32.3	40.4	27.3
Should physicians have the right to discontinue VA-ECMO over surrogate objection?	56.8	11.1	32.1
Should surrogates have the right to discontinue VA-ECMO over physician objection?	60.2	11.2	28.6
<b>Utilization of VA-ECMO</b>			
Should VA-ECMO be used to perfuse organs for transplantation?	61.9	4.4	33.8
Given the cost of VA-ECMO, should its use be restricted?	61.6	12.6	25.8

disputes with patients and surrogates. Patients on VA-ECMO who fail to recover and are not candidates for transplant or VAD have no long-term options for support; the VA-ECMO must ultimately be terminally discontinued in accordance with guidelines set forth by the Extracorporeal Life Support Organization (ELSO).<sup>19</sup> This is somewhat in contrast to patients receiving other types of life-sustaining therapy (LST). Take for example a patient intubated on mechanical ventilation with severe anoxic brain injury. This patient may have no hope for meaningful neurologic recovery, but could receive a tracheostomy and continue to receive LST (that is, ventilation) for a prolonged period of time, for years even, if that is the goal of care. While physicians may disagree with this goal of care, and even view the continuation of LST in this context as inappropriate, futile, or a misuse of resources, some courts have privileged surrogate decision makers to make these decisions, citing the best interests of patients and the promotion of patients' autonomy.<sup>20</sup> With VA-ECMO, however, there is no long-term option, due to the technology itself, for patients who do not recover and are not eligible for VAD or transplantation; there is only terminal discontinuation. Thus, there is a significant difference when it comes to end-of-life decisions in this realm, as presently patients cannot simply be continued on ECMO for a prolonged period (that is, months to years) if that is the goal of care. This can present a dilemma for treating physicians, who generally need a surrogate's consent to withdraw life-sustaining therapy, including VA-ECMO. Unfortunately, and all too often, end-of-life conflicts arise between physicians and surrogates, leaving physicians wanting a greater degree of professional autonomy.<sup>21</sup>

Concerns for the prospect of a futility dispute indeed were reflected in the respondents' qualitative responses, with one physician commenting, "I think we need to be careful about our cases, but also make sure that physicians are empowered to discontinue the therapy when it is not working." Another physician expressed similar sentiments, writing: "Pandora's box is now open for business yet again! We have not solved the problem of futility of care even now. We own this machine; We should NOT give it away to families. It should be the attending's decision who gets the treatment and for how long."

Whether this degree of expressed discretion stems from firmly entrenched beliefs and perhaps broad frustrations with perceived incursions on physicians' authority, or is simply reflective of a desire to avoid conflict in this specific context remains

unknown; regardless, this narrative is of concern. Importantly, it raises concerns about the moral distress of physicians and the strong desire to avoid conflict and ambiguity of decisional authority at the end of life. As we strive to include patients and surrogates in medical decision making, there remains a need to better support our colleagues as they face difficult end-of-life decisions and futility disputes. We have written previously on strategies to manage ethical issues with VA-ECMO, and, in general, we suggest the early involvement of the clinical ethics team, skilled mediation, and anticipatory or preventive ethics to ideally foresee and forestall, or at least manage and minimize, difficult ethical conflicts at end of life.<sup>22</sup> Further research is needed, however, on strategies to recognize moral distress amongst our colleagues. For, left unaddressed, it can lead to dissatisfaction, burnout, and medical errors.<sup>23</sup>

Finally, of considerable import were findings regarding physicians' attitudes toward the cost and utilization of VA-ECMO. Overall, respondents (particularly those who self-reported as "knowledgeable") indicated that the use of VA-ECMO ought to be restricted, given its cost. Given widespread concerns for rising costs in the healthcare system in the United States, particularly expenditures at end of life, these results are not particularly surprising. Nestled within this cost-containment trend, however, lurked a curious inconsistency. Of those surveyed, 61.9 percent felt that VA-ECMO ought to be used to perfuse organs for transplantation. While additional research is needed to better understand this apparent inconsistency, it does suggest a utilitarian perspective. Perhaps respondents felt that the substantial costs of VA-ECMO are justified when the benefit extends beyond one individual directly receiving ECMO to include the many organ recipients that might benefit; a form of a utilitarian greatest good for the greatest number calculus. Overall, however, respondents indicated that the use of VA-ECMO ought to be constrained. Accordingly, many respondents believed that there should not be presumed consent to initiate VA-ECMO. Two respondents commented on this matter, invoking costs/resources as a justification: "Candidates for ECMO should be designated *a priori* and relatively limited given the amount of resources involved"; and, "It is a costly and invasive life-sustaining therapy, which should only be initiated in FULL CODE patients with a high probability of coming off of it."

Most prominently, this examination makes apparent that further research is needed to understand why physicians expressed these views, particularly as the normative standard is presumed consent for

LST. Given these results, one wonders whether complex therapies such as VA-ECMO justify a departure from customary conventions. Should we endorse a return to paternalism for this single, complex therapy? As medical technology advances, will other life-sustaining therapies ultimately need their own set of ethical standards?<sup>24</sup> If a case cannot be made for a form of “ECMO-exceptionalism,” perhaps efforts to convey, adapt, and apply the foundations of bioethics—respect for personhood, informed consent, and informed refusal—must be enriched to address the technological and decisional challenge that is VA-ECMO.

While this research has the advantage of being the first study of physicians’ attitudes towards decision making with VA-ECMO, like any other study it does carry some limitations. Our response rate of 15 percent was low, likely because we were not permitted to directly contact participants and instead had to rely on administrators with access to Department of Medicine and Graduate Medical Education list-serves to forward emails on our behalf. It is possible that those who did not respond to the survey have different attitudes towards VA-ECMO than the attitudes expressed by those who responded to our survey. Next, our data were collected at one institution in New York, and thus may not be representative of attitudes in locales beyond. In addition, while our relatively small sample included both those experienced and inexperienced with ECMO, those who self-reported as “knowledgeable” more strongly endorsed physicians’ retention of decisional authority. While the inclusion of those who do not directly work in this realm might be thought to attenuate the results, it does serve to provide an important comparator. While the study included physicians with differing involvement in VA-ECMO, it did not include other members of the healthcare team, including nurses, physician assistants, and other vital healthcare professionals; thus, the results cannot be extrapolated to characterize the attitudes of these team members. Finally, with respect to making the leap from an attitudinal survey to actual clinical practice, further research is needed to better understand how physicians’ attitudes toward VA-ECMO may shape the provision of care, shared decision making, and the patient/surrogate experience. Overall, this was a baseline survey of physicians’ attitudes intended to help understand the current state of, and ultimately improve, shared decision making. Further research is needed to assess the generalizability of these findings, as well as to investigate and understand the rationales behind these views.

## CONCLUSION

Our data indicate that shared decision making in the realm of VA-ECMO remains substantially in flux, with those surveyed, especially those who self-reported as knowledgeable about VA-ECMO and/or are specialists in pulmonary/critical care, strongly endorsing the discretion of clinicians in decisions regarding initiation and discontinuation of this therapy. Given that VA-ECMO is a complex technology, the data may reflect physicians’ reluctance to cede authority to (presumably) less informed surrogates. Likewise, as end-of-life conflicts are burdensome to the healthcare team, including physicians, respondents’ preferences for greater decisional control may reflect a desire to avoid complex futility disputes. Further, as aggregate healthcare costs continue to rise, and physicians are enjoined to manage resources and be thoughtful stewards of the healthcare system, participants’ responses may reflect a push for judicious use of a costly technology. Lastly, while attitudes are not necessarily synonymous with actions, the data suggest that our respondents, particularly those most knowledgeable about the therapy, have adopted both an authoritative attitude and a prudential ethic with respect to VA-ECMO.

While analysis of the survey results can demonstrate these noteworthy effects, what the present data cannot yield, and what is left largely to conjecture, is the reasoning behind the observed findings. Perhaps the stress and reality of working with patients and families changes physicians’ attitudes towards medical decision making, as might be suggested by the differences in results between those in pulmonary/critical care versus others, and those “knowledgeable” about VA-ECMO compared to others; or perhaps those with certain views towards medical decision making gravitate toward particular medical specialties or work. What is clear, however, is that there is a need for further inquiry to better understand and improve the dominion of shared decision making, not only in spheres of everyday medical care, but also in the province of life-and-death decisions amidst complex medical technology. Perhaps VA-ECMO, a setting in which physicians, patients, and families have the potential to spar in the shadows of technology, seems an awfully good place to start—or continue, as the case may be—this vitally important work.

## DISCLOSURES AND ACKNOWLEDGMENTS

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**Appendix A. Survey Instrument**

ECMO (venoarterial extracorporeal membrane oxygenation) for total cardiopulmonary support in adults is a developing technology that serves to both oxygenate and circulate the blood. Variation exists, both among clinicians and across hospitals, with respect to its clinical applications and guidelines for use. Accordingly, we are conducting a survey of physicians' opinions and perspectives on venoarterial ECMO and cardiopulmonary resuscitation (CPR). Throughout the survey, all references to ECMO refer to total cardiopulmonary support.

Please answer the following questions based on your own beliefs and not your state law or your institution's current policies / procedures.

- |     |   |               |             |             |              |              |                |
|-----|---|---------------|-------------|-------------|--------------|--------------|----------------|
| 1.  | Should a physician have the right to withhold CPR, even if a surrogate wants resuscitation?       | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 2.  | Should ECMO be initiated in a DNR patient?  | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 3.  | Should there be presumed consent for ECMO?  | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 4.  | Should initial consent for ECMO contain a provision that it may be discontinued if deemed futile? | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 5.  | Should a religious objection to ECMO discontinuation preclude its initiation?                     | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 6.  | A patient on ECMO becomes asystolic. Should CPR be initiated?                                     | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 7.  | A patient on ECMO is DNR and becomes asystolic. Should CPR be initiated?                          | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 8.  | Should ECMO support be increased if a patient has a DNR order?                                    | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 9.  | Should surrogate consent be required to discontinue ECMO?   | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 10. | Should a physician have the right to discontinue ECMO over surrogate objection?                   | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 11. | Should a surrogate have the right to discontinue ECMO over physician objection?                   | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 12. | A patient on ECMO is made DNR. Should ECMO be discontinued?                                       | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 13. | Should ECMO be used to maintain perfusion and preserve organs for transplantation?                | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 14. | Given the cost of ECMO, should its use be restricted?   | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |
| 15. | Should a physician conduct a "slow code" when surrogates demand futile resuscitation?             | Definitely no | Probably no | Possibly no | Possibly yes | Probably yes | Definitely yes |

The survey concludes with a few demographic questions.

- |     |  |                       |                      |                      |                    |             |       |
|-----|--|-----------------------|----------------------|----------------------|--------------------|-------------|-------|
| 16. | What is your gender?   | Male                  | Female               | Prefer not to answer |                    |             |       |
| 17. | What is your age?  |                       |                      |                      |                    |             |       |
| 18. | What is your religion?                                       | Protestant            | Catholic             | Jewish               | Muslim             | Hindu       | None  |
| 19. | Other (Enter)  |                       | Prefer not to answer |                      |                    |             |       |
| 20. | Do you consider yourself religious?                          |                       | Yes                  | No                   |                    |             |       |
| 21. | What is your primary medical specialty?                      | Internal medicine     | Surgery              | Neurology            | Emergency medicine |             |       |
|     |  | Obstetrics/gynecology | Pediatrics           | Anesthesiology       | Psychiatry         | Dermatology | Other |
| 22. | Do you provide critical care?                                |                       | Yes                  | No                   |                    |             |       |
| 23. | What is your practice level?                                 |                       | Resident             | Fellow               | Attending          |             |       |
| 24. | In approximately how many ECMO cases have you been involved? |                       |                      |                      |                    |             |       |
|     |  | 0                     | 1-5                  | 6-10                 | 11-25              | >25         |       |
| 25. | Do you consider yourself knowledgeable about ECMO?           |                       | Yes                  | No                   |                    |             |       |

Thank you. The survey is now complete. Feel free to provide any thoughts or comments that you may have about ECMO for total cardiopulmonary support below.

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