Variables included in ECMO use model:

Age; underweight; chromosomal syndrome; extracardiac anomaly; STS pre-operative factors including cardiac arrest, shock, organ injury, and pre-operative mechanical circulatory support; pre-operative mechanical ventilation; STAT category (including non-classifiable)

Variables included in mortality model:

Age; underweight; pre-operative factors including cardiac arrest, shock, organ injury, and pre-operative mechanical circulatory support; pre-operative mechanical ventilation; STAT category (including non-classifiable); any other specific pre-operative risk factor (excluding neurological deficit and renal failure due to not being significant on univariate analysis and low incidence, respectively.)



Supplemental Figure 1a. Calibration plot for ECMO use model



Supplemental Figure 1b. Calibration plot for mortality model

Supplemental Figure 2a. Observed and case-mix adjusted post-operative mortality rate for ECMO hospitalizations

Supplemental Figure 2b. Observed and case-mix adjusted post-operative mortality rate for non-ECMO hospitalizations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Risk Adjusted ECMO Use Tertile | Overall | Low ECMO Use Hospital | Middle ECMO Use Hospital | High ECMO Use Hospital | P Value |
| # Hospitals | 37  |  14 | 13 | 10 |  |
| # ECMO runs (total) | 1802 | 286 | 731 | 785 |  |
| **First Post Op ECMO timing** |  |  |  |  |  |
| Intra-operative ECMO (% of all surgical cases) | 479 (1.1%) | 86 (0.6%) | 193 (1.1%) | 203 (1.6%) | <0.0001 |
| CPB time for ECMO placed on intra-operative  | 246(170-344) | 293(224-401) | 210(154-312) | 255(155-354) | 0.0001 |
| Intra-operative ECMO (% of all post-op ECMO cases) | 479 (34.3%) | 86 (36.8%) | 193 (33%) | 203 (34%) | 0.664 |
| Post-operative ECMO course initiated preoperatively (% of all post-op ECMO cases) | 84 (6%) | 11 (4.7%) | 30 (5.2%) | 43 (7.3%) | 0.2 |
| **First Post Op ECMO indication** | N=1397  | N=234  | N=577 |  N=586 |  |
| Systemic circulatory failure | 660 (47.2%) | 97 (41.5%) | 272 (47.1%) | 291 (49.7%) | 0.1 |
| ECPR | 442 (31.6%) | 81 (34.6%) | 183 (31.7%) | 178 (30.4%) | 0.5 |
| Other | 295 (21.1%) | 56 (23.9%) | 122 (21.1%) | 117 (20%) | 0.45 |
| Hypoxemia | 156 (11.2%) | 35 (15%) | 62 (10.7%) | 59 (10.1%) |  |
| Arrhythmia | 28 (2%) | 2 (0.9%) | 17 (2.9%) | 9 (1.5%) |  |
| Bleeding | 10 (0.7%) | 1 (0.4%) | 6 (1%) | 3 (0.5%) |  |
| Hypercarbic respiratory failure | 42 (3%) | 13 (5.6%) | 18 (3.1%) | 11 (1.9%) |  |
| Shunt occlusion | 39 (2.8%) | 3 (1.3%) | 8 (1.4%) | 28 (4.8%) |  |
| Multisystem organ failure | 13 (0.9%) | 2 (0.9%) | 5 (0.9%) | 6 (1%) |  |
| Unknown | 7 (0.5%) | 0 | 6 (1%) | 1 (0.2%) |  |

Supplemental Table 1. ECMO cannulation timing and indications by ECMO use tertile

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Overall | Low ECMO Use Hospital (<2.5%) | Middle ECMO Use Hospital (2.6-4.4%) | High ECMO Use Hospital (>4.5%) | P Value |
| **Hospitals** | 37 | 14 | 13 | 10 |  |
| % of surgical hospitalizations | N=43,640 (100%) | N=13,272 (30%) | N=17,693 (41%) | N=12,675 (29%) |  |
| ECMO runs, N | 1,397 | 234 | 577 | 586 |  |
| % ECMO patients | 3.21% | 1.76% | 3.26% | 4.62% | <0.0001  |
| % ECMO patients with ECPR as indication | 0.99% | 0.54% | 1.02% | 1.40% | <0.0001 |
| % ECMO patients without ECPR indication | 2.22% | 1.22% | 2.24% | 3.22% |  <0.0001  |
| **Patient covariate** |  |  |  |  |  |
| Age | # (column %) | # (column %) | # (column %) | # (column %) | <0.0001 |
| Preterm neonate | 1,114 (2.6%) | 4405 (33.2%) | 6134 (34.7%) | 4207 (33.2%) |  |
| Full term neonate | 7,135 (16.4%) | 5675 (42.8%) | 7205 (40.7%) | 5367 (42.3%) |  |
| Infant | 14,746 (33.8%) | 312 (2.4%) | 478 (2.7%) | 324 (2.6%) |  |
| Child | 18,247 (41.8%) | 2083 (15.7%) | 2970 (16.8%) | 2082 (16.4%) |  |
| Adult | 2,398 (5.5%) | 797 (6.0%) | 906 (5.1%) | 695 (5.5%) |  |
| Chromosomal anomaly | 10,146 (23.3%) | 3154 (23.8%) | 4113 (23.3%) | 2879 (22.7%) | 0.135 |
| Extra-cardiac anomaly | 7,548 (17.3%) | 2278 (17.2%) | 3247 (18.4%) | 2023 (16.0%) | <0.0001 |
| Under Weight | 10,047 (23.0%) | 2903 (21.9%) | 4111 (23.2%) | 3033 (23.9%) | <0.0001 |
| High risk pre-op | 1,089 (2.5%) | 419 (3.2%) | 368 (2.1%) | 302 (2.4%) | <0.0001 |
| Low risk pre-op | 13,076 (30.0%) | 4085 (30.8%) | 5466 (30.9%) | 3525 (27.8%) | <0.0001 |
| Pre-operative mechanical ventilation | 4,428 (10.2%) | 1176 (8.9%) | 1990 (11.3%) | 1262 (10.0%) | <0.0001 |
| STAT category |  |  |  |  | <0.0001 |
| 1 | 12,115 (27.8%) | 3703 (27.8%) | 4870 (27.5%) | 3542 (27.9%) |  |
| 2 | 13,731 (31.5%) | 4306 (32.4%) | 5521 (31.2%) | 3904 (30.8%) |  |
| 3 | 5,644 (12.9%) | 1563 (11.8%) | 2322 (13.1%) | 1759 (13.9%) |  |
| 4 | 10,021 (23.0%) | 3108 (23.4%) | 4086 (23.1%) | 2827 (22.3%) |  |
| 5 | 1,941 (4.5%) | 549 (4.1%) | 822 (4.7%) | 570 (4.5%) |  |
| Non-classifiable | 188 (0.4%) | 43 (0.3%) | 72 (0.4%) | 73 (0.6%) |  |
| Post-operative mechanical ventilation | 28,383 (65.0%) | 9523 (71.8%) | 11544 (65.3%) | 7886 (62.2%) | <0.0001 |
| Post-operative arrhythmia | 3,236 (7.4%) | 1001 (7.5%) | 1130 (6.4%) | 1105 (8.7%) | <0.0001 |
| CPB time- overall cohort\* (min) | 91 (53-144) | 103 (59-158) | 85 (47-137) | 90 (54-138) | <0.0001 |
| CPB time- ECMO cohort\* (min) | 168 (97-263) | 201.5 (127-300) | 161 (88-250) | 162.5 (99-256) | <0.0001 |
| Post-operative VIS\* | 5 (0-8) | 5 (0-6.9) | 5 (2-8) | 5 (0-8.5) | <0.0001 |
| # of prior cardiothoracic operations |  |  |  |  | <0.0001 |
| 0 | 28,764 (65.9%) | 8734 (65.8%) | 11664 (65.9%) | 8366 (66.0%) |  |
| 1 or 2 | 10,845 (24.9%) | 3339 (25.2%) | 4478 (25.3%) | 3028 (23.9%) |  |
| 3 or more | 4,031 (9.2%) | 1199 (9.0%) | 1551 (8.8%) | 1281 (10.1%) |  |

Supplemental Table 2. Patient and surgical characteristics by ECMO use tertile