Follow-Up Data and Machine Learning [Improve Mortality Predictions for Patients with Mechanical Circulatory Support](https://www.ahajournals.org/doi/pdf/10.1161/CIRCGEN.119.002877)

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**MAIN RESULTS**

Table 1: Patient characteristics selected for inclusion in the final mortality risk prediction model.

|  | | | **Hazard ratio (95% CI)** | |
| --- | --- | --- | --- | --- |
| **label** | **Number (%) missing values** | **Mean (SD) or Number (%)** | **Unadjusted** | **Adjusted** |
| *Pre-implant variables* | | | | |
| Patient age, years | 0 (0.00%) | 57.0 (12.9) | 1.35 (1.30, 1.41) | 1.25 (1.20, 1.30) |
| *Week 1 variables* | | | | |
| BUN, md/dL | 121 (0.96%) | 30.2 (20.8) | 1.30 (1.26, 1.33) | 1.06 (1.03, 1.10) |
| *Month 1 variables* | | | | |
| Total bilirubin, mg/dL | 2,669 (21%) | 1.19 (2.69) | 1.32 (1.30, 1.35) | 1.17 (1.14, 1.19) |
| BUN, mg/dL | 320 (2.5%) | 22.9 (16.9) | 1.31 (1.29, 1.34) | 1.12 (1.09, 1.16) |
| Platelet count | 338 (2.7%) | 296 (108) | 0.66 (0.63, 0.68) | 0.86 (0.82, 0.89) |
| Intubated | 180 (1.4%) | 1119 (8.97%) | 3.76 (3.43, 4.13) | 1.37 (1.21, 1.56) |
| Right heart failure, INO | 139 (1.1%) | 2102 (16.8%) | 2.49 (2.30, 2.71) | 1.28 (1.16, 1.41) |
| Followup status: outpatient | 103 (0.81%) | 7230 (57.6%) | 0.44 (0.41, 0.48) | 0.79 (0.72, 0.86) |
| White blood cell count | 335 (2.6%) | 9.24 (4.16) | 1.21 (1.19, 1.23) | 1.11 (1.08, 1.14) |
| SGOT | 2,704 (21%) | 41.0 (149) | 1.09 (1.08, 1.10) | 1.01 (0.99, 1.04) |
| LDH | 2,721 (21%) | 399 (305) | 1.11 (1.09, 1.14) | 1.06 (1.03, 1.09) |
| NYHA: unable to carry on minimal physical activity | 3,674 (29%) | 1492 (16.6%) | 2.28 (2.08, 2.49) | 1.30 (1.18, 1.43) |
| Albumin, g/dL | 3,011 (24%) | 3.21 (0.63) | 0.74 (0.71, 0.76) | 0.95 (0.91, 0.98) |
| On dialysis | 201 (1.6%) | 771 (6.19%) | 3.73 (3.36, 4.14) | 1.13 (0.99, 1.29) |
| Respiratory adverse event count | 0 (0.00%) | 0.14 (0.41) | 1.34 (1.31, 1.37) | 1.07 (1.04, 1.10) |

Table 2: Incidence rates and ratios for patients classified as high or low risk at pre-implant and one month following implant of mechanical circulatory support device.

|  | **1-year Mortality risk classification** | | | |
| --- | --- | --- | --- | --- |
|  | **Low risk at both visits** | **High risk at pre-implant only** | **High risk at month 1 only** | **High risk at both visits** |
| *Overall* | | | | |
| Number (%) of patients | 9,169 (72%) | 1,228 (9.7%) | 1,313 (10%) | 948 (7.5%) |
| Number of events | 1,635 | 403 | 621 | 498 |
| Months of follow up | 181,648 | 27,088 | 18,766 | 13,781 |
| Incidence rate (95% CI) | 9.0 (8.6, 9.4) | 15 (13, 16) | 33 (31, 36) | 36 (33, 39) |
| Incidence ratio (95% CI) | 1 (ref) | 1.7 (1.5, 1.8) | 3.7 (3.3, 4.0) | 4.0 (3.6, 4.4) |
| *Stage 1: Critical cardiogenic shock* | | | | |
| Number (%) of patients | 1,106 (60%) | 217 (12%) | 250 (14%) | 278 (15%) |
| Number of events | 185 | 48 | 116 | 132 |
| Months of follow up | 19,993 | 3,639 | 3,010 | 3,455 |
| Incidence rate (95% CI) | 9.3 (8.0, 11) | 13 (9.8, 17) | 39 (32, 46) | 38 (32, 45) |
| Incidence ratio (95% CI) | 1 (ref) | 1.4 (1.0, 1.9) | 4.0 (3.2, 5.0) | 4.0 (3.2, 5.0) |
| *Stage 2: Progressive decline* | | | | |
| Number (%) of patients | 3,080 (71%) | 438 (10%) | 494 (11%) | 348 (8.0%) |
| Number of events | 520 | 155 | 234 | 188 |
| Months of follow up | 59,049 | 9,811 | 7,031 | 5,197 |
| Incidence rate (95% CI) | 8.8 (8.1, 9.6) | 16 (13, 18) | 33 (29, 38) | 36 (31, 42) |
| Incidence ratio (95% CI) | 1 (ref) | 1.8 (1.5, 2.2) | 3.8 (3.2, 4.4) | 4.1 (3.5, 4.8) |
| *Stage 3: Stable but inotrope dependent* | | | | |
| Number (%) of patients | 3,468 (77%) | 392 (8.7%) | 407 (9.1%) | 220 (4.9%) |
| Number of events | 625 | 137 | 193 | 108 |
| Months of follow up | 69,122 | 8,880 | 6,061 | 3,532 |
| Incidence rate (95% CI) | 9.0 (8.4, 9.8) | 15 (13, 18) | 32 (28, 37) | 31 (25, 37) |
| Incidence ratio (95% CI) | 1 (ref) | 1.7 (1.4, 2.0) | 3.6 (3.0, 4.2) | 3.4 (2.8, 4.1) |
| *Stage 4 or higher* | | | | |
| Number (%) of patients | 1,512 (77%) | 181 (9.3%) | 161 (8.2%) | 102 (5.2%) |
| Number of events | 303 | 63 | 77 | 70 |
| Months of follow up | 33,446 | 4,758 | 2,663 | 1,597 |
| Incidence rate (95% CI) | 9.1 (8.1, 10) | 13 (10, 17) | 29 (23, 36) | 44 (34, 55) |
| Incidence ratio (95% CI) | 1 (ref) | 1.5 (1.1, 1.9) | 3.2 (2.5, 4.1) | 4.8 (3.7, 6.2) |

Figure 1: Benchmark comparison of the reference and xgboost modeling algorithms.



**SUPPLEMENT**

Figure S1: Benchmark comparison of the empirical proportional hazards and xgboost modeling algorithms.

