**ONLINE DATA SUPPLEMENT**

**Title:** Non-linear imputation of PaO2/FIO2 from SpO2/FIO2 among mechanically ventilated patients in the intensive care unit: a prospective, observational study

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| **Table E1. Equations used to estimate PaO2.** |  |
| **Equation** | **Method** |
| $$PO\_{2}=\left\{\frac{11,700}{\left(^{1}/\_{S}-1\right)}+\left[50^{3}+\left(\frac{11,700}{^{1}/\_{S}-1}\right)^{2}\right]^{1/2}\right\}^{1/3}$$$$+ \left\{\frac{11,700}{\left(^{1}/\_{S}-1\right)} -\left[50^{3}+\left(\frac{11,700}{^{1}/\_{S}-1}\right)^{2}\right]^{1/2}\right\}^{1/3}$$ | Non-linear\* |
| $PO\_{2}=F∙\left(\frac{\frac{S}{F} - 64}{0.84}\right)$  | Linear |
| $$PO\_{2}=F∙10^{\left(0.48+0.78 ∙ log\_{10}\left(\frac{S}{F}\right)\right)}$$ | Log-linear |

PO2 = PaO2; S = SaO2 or SpO2; F=FiO2

\*The equation is used to estimate PaO2 from SaO2. We did not formally model the relationship between SpO2 and SaO2.

In the non-linear equation, we imputed PaO2 from SpO2, while the linear and log-linear equations imputed PaO2:FIO2 from SpO2:FIO2.

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| **Table E2** Chemistry panel closest in time to ABG |
| **Variables** |  |
| Sodium, mEq/L | 140.5 ± 6.2 (n = 1034) |
| Potassium, mEq/L | 4.2 ± 0.7 (n = 1034) |
| Bicarbonate, mEq/L | 23.5 ± 6.2 (n = 1031) |
| Chloride, mEq/L | 105.3 ± 8.2 (n = 1034) |
| BUN, mg/dL | 35.9 ± 27.4 (n = 1026) |
| Creatinine, mg/dL | 1.7 ± 1.5 (n = 1028) |

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| **Table E3** Ventilator Settings at time of ABG |
| **Variables** |  |
| PEEP, cm H20 | 7.9 ± 3.5 (n = 1030) |
| FIO2, decimal | 0.5 ± 0.2 (n = 1034) |
| Tidal volume, ml | 440 ± 112 (n = 820) |
| Tidal volume (adjusted for ideal body weight), ml/kg | 6.89 ± 1.42 (n = 810) |
| Minute ventilation, L/min | 10.4 ± 3.8 (n = 1032) |

| Table E4A. AUC for Severe ALI (PF ratio ≤ 150) where SpO2 ≤ 96% |
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|  | **All ABGs (N = 650)** |  | **Other ARDS criteria are met (N = 299)** |  | **Other ARDS criteria are NOT met (N = 351)** |
|  | **AUC** | **95% CI** |  | **AUC** | **95% CI** |  | **AUC** | **95% CI** |
| Nonlinear | 0.96 | (0.94, 0.97) |   | 0.93 | (0.90, 0.96) |   | 0.97 | (0.96, 0.99) |
| Linear/log-linear | 0.95 | (0.93, 0.97) |   | 0.92 | (0.88, 0.95) |   | 0.97 | (0.95, 0.98) |

| Table E4B. AUC for ALI (PF ratio ≤ 300) where SpO2 ≤ 96% |
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|  | **All ABGs (N = 650)** |  | **Other ARDS criteria are met (N = 299)** |  | **Other ARDS criteria are NOT met (N = 351)** |
|  | **AUC** | **95% CI** |  | **AUC** | **95% CI** |  | **AUC** | **95% CI** |
| Nonlinear | 0.86 | (0.81, 0.92) |   | 0.77 | (0.58, 0.95) |   | 0.87 | (0.81, 0.92) |
| Linear/log-linear | 0.87 | (0.82, 0.93) |   | 0.81 | (0.63, 0.98) |   | 0.87 | (0.82, 0.92) |

Table E5. Lookup table for imputed PaO2 for a given SpO2 based on non-linear equation

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| **Measured SpO2 (%)** | **Imputed PaO2 (mmHg)** |
| 100\* | 167\*§ |
| 99\* | 132\* |
| 98\* | 104\* |
| 97\* | 91\* |
| 96 | 82 |
| 95 | 76 |
| 94 | 71 |
| 93 | 67 |
| 92 | 64 |
| 91 | 61 |
| 90 | 59 |
| 89 | 57 |
| 88 | 55 |
| 87 | 53 |
| 86 | 51 |
| 85 | 50 |
| 84 | 49 |
| 83 | 47 |
| 82 | 46 |
| 81 | 45 |
| 80 | 44 |
| 79 | 43 |
| 78 | 42 |
| 77 | 42 |
| 76 | 41 |
| 75 | 40 |
| 74 | 39 |
| 73 | 39 |
| 72 | 38 |
| 71 | 37 |
| 70 | 37 |
| \*Generally considered unreliable on the basis of the sigmoidal shape of the hemoglobin-oxygen dissociation curve§Based on SpO2 99.5%. |