Supplementary information for

Early risk assessment for COVID-19 patients
from emergency department data using machine learning

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Supplemental figures

Supplementary Figure S1. Ethnicity distribution. Number of patients in different ethnic groups. Numbers in squares indicate percentage over entire data set. Note logarithmic y-axis.
Supplementary Figure S2. Patient selection criteria. 1235 patients in total fell within the study parameters. A series of inclusion and exclusion criteria (see Methods for details) was applied to obtain a cohort for each of the three clinical endpoints. 
**Supplementary Figure S3. Model calibration.** The fraction of true positive patients over the predicted risk is shown for AICU admission (A), ventilation (B) and mortality (C) prediction. Brier score is provided in brackets. Solid lines and shaded areas indicate the mean and standard deviation across three cross-validation folds, respectively. Dashed lines indicate perfect calibration.
Supplementary Figure S4. Confusion matrices. Confusion matrices of logistic regression, random forest and XGBoost (top to bottom) for predictions of AICU admission, mechanical ventilation and mortality (left to right). Patient numbers are shown in each field. Predictions are shown at each model’s optimal classification threshold as determined by Youden’s J statistic on the ROC curve.
Supplementary Figure S5. Patient age distributions. Distributions of patient age for AICU admission (A), ventilation (B) and mortality (C) cohorts are shown separated by patient sex (left) and target and control patients (right). Solid lines indicate fitted normal distributions.
Supplementary Figure S6. Clinical indicators of disease severity by patient age. Laboratory results for C-reactive protein, D-Dimer level, ferritin and peripheral oxygen saturation are shown in four age groups. Boxes indicate the median and inter-quartile range. Diamonds mark the mean.
Supplemental Tables

**Supplementary Table S1.** Composition of individual patient cohorts.

|                | Cohort A (AICU admission) | Cohort B (Ventilation) | Cohort C (Mortality) |
|----------------|---------------------------|------------------------|----------------------|
| **Patient age (years)** |                           |                        |                      |
| Range          | 18.0 - 99.0               | 18.0 - 99.0            | 22.0 - 99.0          |
| Overall mean (standard deviation) | 67.6 (16.9)   | 67.6 (16.9)            | 67.0 (17.2)          |
| Female mean (standard deviation) | 70.0 (17.4)   | 70.0 (17.4)            | 69.9 (17.8)          |
| Male mean (standard deviation) | 66.3 (16.3)   | 66.3 (16.4)            | 65.5 (16.6)          |
| **Sex (number of patients)** |                           |                        |                      |
| Female         | 324 (36.9%)               | 324 (36.9%)            | 213 (34.4%)          |
| Male           | 554 (63.0%)               | 553 (63.0%)            | 405 (65.4%)          |
| Unknown        | 1 (0.1%)                  | 1 (0.1%)               | 1 (0.2%)             |
| **Ethnicity (number of patients)** |                           |                        |                      |
| White British  | 248 (28.2%)               | 248 (28.2%)            | 170 (27.5%)          |
| Not Stated     | 205 (23.3%)               | 205 (23.3%)            | 134 (21.6%)          |
| Ethnic Other   | 105 (11.9%)               | 105 (12.0%)            | 72 (11.6%)           |
| White Other    | 90 (10.2%)                | 90 (10.3%)             | 58 (9.4%)            |
| Asian Indian   | 65 (7.4%)                 | 65 (7.4%)              | 53 (8.6%)            |
| Asian Other    | 42 (4.8%)                 | 42 (4.8%)              | 34 (5.5%)            |
| Unknown        | 30 (3.4%)                 | 30 (3.4%)              | 28 (4.5%)            |
| Black African  | 26 (3.0%)                 | 25 (2.8%)              | 21 (3.4%)            |
| Black Caribbean| 23 (2.6%)                 | 23 (2.6%)              | 16 (2.6%)            |
| Asian Pakistani| 13 (1.5%)                 | 13 (1.5%)              | 8 (1.3%)             |
| Other          | 32 (3.6%)                 | 32 (3.6%)              | 25 (4.0%)            |
**Supplementary Table S2. Clinical features and their coverage in the data set.**

| Feature (unit)                                      | Coverage (%) |
|-----------------------------------------------------|--------------|
| **Demographics**                                    |              |
| Age (years)                                         | 100.0        |
| Sex                                                 | 99.9         |
| Ethnicity                                           | 73.3         |
| **Vitals**                                          |              |
| Heart rate (beats per minute)                       | 99.3         |
| Respiratory rate (breaths per minute)               | 99.3         |
| Temperature (degrees Celcius)                       | 99.1         |
| FiO2 level (%)                                      | 26.8         |
| **Laboratory measurements**                         |              |
| Haemoglobin (g/L)                                   | 90.6         |
| Red blood cell width (%)                            | 90.2         |
| Haematocrit (L/L)                                   | 90.2         |
| Mean corpuscular Haemoglobin (pg)                   | 90.2         |
| Mean corpuscular volume (fL)                        | 90.2         |
| Monocyte count (10^9/L)                             | 90.2         |
| Eosinophil count (10^9/L)                           | 90.2         |
| Neutrophil count (10^9/L)                           | 90.2         |
| Lymphocyte Count (10^9/L)                           | 90.2         |
| Red blood cell count (10^9/L)                       | 90.2         |
| MCHC (g/L)                                          | 90.2         |
| Basophil count (10^9/L)                             | 90.2         |
| White blood cells (10^9/L)                          | 90.2         |
| Nucleated red blood cell count (10^9/L)             | 90.1         |
| Mean platelet volume (fL)                           | 90.0         |
| Platelet count (10^9/L)                             | 89.9         |
| Blood urea (mmol/L)                                 | 89.2         |
| Blood chloride (mmol/L)                             | 89.2         |
| Creatinine (μmol/L)                                 | 89.1         |
| Blood sodium (mmol/L)                               | 88.9         |
| Alkaline phosphatase (U/L)                          | 86.3         |
| C-reactive protein (mg/L)                           | 85.0         |
| Albumin (g/dL)                                      | 84.9         |
| Bilirubin total (μmol/L)                            | 83.2         |
| Blood potassium (mmol/L)                            | 83.2         |
| Alanine aminotransferase (U/L)                      | 81.8         |
| Troponin T (ng/L)                                   | 59.8         |
| Prothrombin time (seconds)                          | 53.7         |
| Act. partial thromboplatin time (seconds)            | 53.7         |
| Fibrinogen (g/L)                                    | 52.9         |
| Blood calcium (mmol/L)                              | 52.9         |
| Adjusted calcium (mmol/L)                           | 52.3         |
| Blood phosphate (mmol/L)                            | 52.0         |
| Blood total protein (g/L)                           | 49.7         |
| Globulin (g/L)                                      | 49.0         |
| Creatine kinase (U/L)                               | 42.5         |
| Glucose (mmol/L)                                    | 40.5         |
| D-Dimer level (ng/ml)                               | 38.0         |
| Test                                | Value |
|-------------------------------------|-------|
| Blood LDH level (U/L)               | 35.6  |
| Blood lactate (mmol/L)              | 27.3  |
| Blood ferritin (ng/ml)              | 27.1  |
| Bicarbonate (mmol/L)                | 27.0  |
| Oxygen partial pressure (kPa)       | 26.8  |
| Blood pH                            | 26.8  |
| Ionised calcium (mmol/L)            | 26.8  |
| Anion gap (mmol/L)                  | 26.8  |
| Methaemoglobin (%)                  | 26.7  |
| Oxyhaemoglobin (g/dL)               | 26.7  |
| Deoxyhaemoglobin (g/dL)             | 26.6  |
| Carboxyhaemoglobin (%)              | 26.6  |
| Blood magnesium (mmol/L)            | 20.4  |
| Amylase (U/L)                       | 18.1  |
| Base excess (mmol/L)                | 11.8  |
| Thyroxine T4 (pmol/L)               | 10.7  |
| Thyroid stimulating hormone (mU/L)  | 10.4  |
| Brain natriuretic peptide (pg/ml)   | 9.2   |
| Cortisol (nmol/L)                   | 8.1   |
Supplementary Table S3. Clinical features for control and target patients in the AICU admission cohort.

| Feature                              | Control patients | Target patients |
|--------------------------------------|------------------|-----------------|
| Age                                  | 69.43            | 57.14           |
| Sex female                           | 38.5%            | 27.1%           |
| Sex male                             | 61.3%            | 72.9%           |
| Sex unknown                          | 0.1%             | 0.0%            |
| Act. partial thromboplastin time      | 32.74            | 32.72           |
| Adjusted calcium                     | 2.29             | 2.25            |
| Alanine aminotransferase             | 47.31            | 68.56           |
| Albumin                              | 34.35            | 33.52           |
| Alkaline phosphatase                 | 99.53            | 99.2            |
| Amylase                              | 64.27            | 200.68          |
| Anion gap                            | 14.15            | 14.93           |
| Base excess                          | 3.07             | 3.2             |
| Basophil count                       | 0.01             | 0.01            |
| Bicarbonate                          | 23.17            | 22.12           |
| Bilirubin total                      | 13.04            | 15.32           |
| Blood calcium                        | 190.3            | 97.83           |
| Blood ferritin                       | 1001.79          | 1355.79         |
| Blood lactate                        | 1.8              | 1.8             |
| Blood LDH level                      | 487.92           | 644.69          |
| Blood magnesium                      | 0.82             | 0.93            |
| Blood pH                             | 7.43             | 7.44            |
| Blood phosphate                      | 1.05             | 1.07            |
| Blood potassium                      | 4.12             | 4.15            |
| Blood sodium                         | 136.03           | 133.6           |
| Blood total protein                  | 68.32            | 68.83           |
| Blood urea                           | 9.37             | 7.87            |
| Brain natriuretic peptide            | 178.43           | 215.4           |
| C-reactive protein                   | 125.37           | 177.04          |
| Carboxyhaemoglobin                   | 2.57             | 2.04            |
| Cortisol                             | 754.45           | 804.06          |
| Creatine kinase                      | 495.96           | 606.26          |
| Creatinine                           | 126.77           | 106.21          |
| D-Dimer level                        | 2357.71          | 1946.77         |
| Deoxyhaemoglobin                     | 15.52            | 8.84            |
| Eosinophil count                     | 0.03             | 0.04            |
| Fibrinogen                           | 6.5              | 7.19            |
| FiO2 level                           | 35.5             | 54.8            |
| Globulin                             | 33.29            | 34.69           |
| Glucose                              | 8.7              | 9.22            |
| Haematocrit                          | 0.4              | 0.43            |
| Haemoglobin                          | 132.76           | 141.34          |
| Heart rate                           | 90.32            | 98.65           |
| Ionised calcium                      | 1.11             | 1.11            |
| Lymphocyte Count                     | 1.11             | 0.99            |
| MCHC                                 | 332.72           | 332.39          |
| Mean corpuscular Haemoglobin         | 29.79            | 29.17           |
| Test                                  | Value   | Reference Range |
|---------------------------------------|---------|-----------------|
| Mean corpuscular volume               | 89.59   | 7.218 - 678     |
| Mean platelet volume                  | 8.48    | 676 - 9.102     |
| Methaemoglobin                        | 0.69    | 0.335 - 0.63    |
| Monocyte count                        | 0.62    | 0.429 - 0.57    |
| Neutrophil count                      | 6.79    | 4.27 - 8.28     |
| Nucleated red blood cell count        | 0.01    | 0.072 - 0.04    |
| Oxygen partial pressure               | 9.18    | 5.217 - 10.0    |
| Oxyhaemoglobin                        | 81.42   | 17.171 - 88.55  |
| Platelet count                        | 238.12  | 109.581 - 227.6 |
| Prothrombin time                      | 16.83   | 12.364 - 14.91  |
| Red blood cell count                  | 4.48    | 0.725 - 4.91    |
| Red blood cell width                  | 14.44   | 2.234 - 13.67   |
| Respiratory rate                      | 22.83   | 5.246 - 27.6    |
| SpO2                                  | 95.25   | 3.894 - 92.11   |
| Temperature                           | 36.94   | 0.882 - 37.32   |
| Thyroid stimulating hormone           | 1.4     | 1.073 - 1.26    |
| Thyroxine T4                           | 14.12   | 2.526 - 12.94   |
| Troponin T                            | 138.92  | 908.983 - 131.26|
| White blood cells                     | 8.57    | 4.978 - 9.91    |
### Table S4. Clinical features for control and target patients in the mechanical ventilation cohort.

| Feature                                | Control patients | Target patients |
|----------------------------------------|------------------|-----------------|
| Age                                    | Mean 68.24       | Mean 59.6       |
|                                        | Std. dev. 16.918 | Std. dev. 13.979|
|                                        | n patients 816   | n patients 62   |
| Sex female                             | 37.9%            | 24.2%           |
| Sex male                               | 62.0%            | 75.8%           |
| Sex unknown                            | 0.1%             | 0.0%            |
|                                        |                  |                 |
| Act. partial thromboplatin time        | 32.41            | 32.5            |
|                                        | 5.672            | 3.469           |
|                                        | 396              | 44              |
| Adjusted calcium                       | 2.29             | 2.2             |
|                                        | 0.14             | 0.105           |
|                                        | 383              | 21              |
| Alanine aminotransferase               | 50.86            | 55.81           |
|                                        | 133.467          | 49.003          |
|                                        | 596              | 57              |
| Albumin                                | 34.35            | 31.37           |
|                                        | 4.818            | 4.163           |
|                                        | 623              | 54              |
| Alkaline phosphatase                   | 100.91           | 95.71           |
|                                        | 71.498           | 83.744          |
|                                        | 632              | 57              |
| Amylase                                | 87.42            | 76.0            |
|                                        | 173.341          | 33.067          |
|                                        | 137              | 8               |
| Anion gap                              | 14.27            | 14.66           |
|                                        | 4.173            | 3.811           |
|                                        | 189              | 47              |
| Base excess                            | 3.1              | 2.75            |
|                                        | 3.221            | 2.04            |
|                                        | 86               | 18              |
| Basophil count                         | 0.01             | 0.01            |
|                                        | 0.04             | 0.054           |
|                                        | 686              | 57              |
| Bicarbonate                            | 23.13            | 21.96           |
|                                        | 4.789            | 4.111           |
|                                        | 190              | 47              |
| Bilirubin total                        | 13.39            | 13.66           |
|                                        | 10.15            | 16.255          |
|                                        | 610              | 56              |
| Blood calcium                          | 2.19             | 2.09            |
|                                        | 0.158            | 0.1             |
|                                        | 389              | 22              |
| Blood chloride                         | 100.09           | 99.3            |
|                                        | 6.864            | 5.745           |
|                                        | 660              | 61              |
| Blood ferritin                         | 1029.87          | 1584.07         |
|                                        | 1600.614         | 2647.655        |
|                                        | 174              | 27              |
| Blood lactate                          | 1.79             | 1.66            |
|                                        | 1.762            | 1.177           |
|                                        | 192              | 48              |
| Blood LDH level                        | 514.71           | 654.12          |
|                                        | 544.185          | 291.713         |
|                                        | 239              | 25              |
| Blood magnesium                        | 0.84             | 0.78            |
|                                        | 0.19             | 0.076           |
|                                        | 144              | 7               |
| Blood pH                               | 7.43             | 7.45            |
|                                        | 0.075            | 0.077           |
|                                        | 189              | 47              |
| Blood phosphate                        | 1.05             | 1.0             |
|                                        | 0.421            | 0.367           |
|                                        | 382              | 21              |
| Blood potassium                        | 4.13             | 4.06            |
|                                        | 0.634            | 0.513           |
|                                        | 606              | 57              |
| Blood sodium                           | 135.85           | 133.84          |
|                                        | 6.955            | 4.947           |
|                                        | 656              | 59              |
| Blood total protein                    | 68.31            | 66.59           |
|                                        | 6.209            | 7.89            |
|                                        | 365              | 17              |
| Blood urea                             | 9.41             | 7.17            |
|                                        | 8.837            | 4.794           |
|                                        | 656              | 57              |
| Brain natriuretic peptide             | 199.01           | 30.12           |
|                                        | 426.737          | 35.228          |
|                                        | 71               | 8               |
| C-reactive protein                     | 129.75           | 152.38          |
|                                        | 100.408          | 95.4            |
|                                        | 626              | 57              |
| Carboxyhaemoglobin                     | 2.55             | 2.11            |
|                                        | 1.596            | 1.319           |
|                                        | 188              | 46              |
| Cortisol                               | 748.79           | 834.21          |
|                                        | 380.339          | 466.747         |
|                                        | 57               | 14              |
| Creatine kinase                        | 533.49           | 664.47          |
|                                        | 1216.465         | 1369.27         |
|                                        | 299              | 36              |
| Creatinine                             | 127.71           | 102.99          |
|                                        | 131.88           | 49.676          |
|                                        | 658              | 58              |
| D-Dimer level                          | 2383.53          | 1468.22         |
|                                        | 2764.831         | 951.304         |
|                                        | 260              | 23              |
| Deoxyhaemoglobin                       | 15.44            | 9.07            |
|                                        | 16.709           | 8.309           |
|                                        | 187              | 47              |
| Eosinophil count                       | 0.03             | 0.0             |
|                                        | 0.15             | 0.013           |
|                                        | 686              | 57              |
| Fibrinogen                             | 6.57             | 6.94            |
|                                        | 1.991            | 1.992           |
|                                        | 389              | 44              |
| FIO2 level                             | 35.32            | 55.46           |
|                                        | 22.014           | 26.1            |
|                                        | 189              | 47              |
| Globulin                               | 33.27            | 35.88           |
|                                        | 5.377            | 7.928           |
|                                        | 359              | 17              |
| Glucose                                | 8.75             | 7.84            |
|                                        | 5.091            | 3.754           |
|                                        | 307              | 48              |
| Haematocrit                            | 0.4              | 0.43            |
|                                        | 0.06             | 0.051           |
|                                        | 686              | 57              |
| Haemoglobin                            | 133.46           | 139.69          |
|                                        | 20.556           | 17.431          |
|                                        | 688              | 61              |
| Heart rate                             | 91.46            | 92.41           |
|                                        | 24.533           | 16.993          |
|                                        | 812              | 62              |
| Ionised calcium                        | 1.11             | 1.1             |
|                                        | 0.09             | 0.079           |
|                                        | 189              | 47              |
| Lymphocyte Count                       | 1.12             | 0.93            |
|                                        | 2.188            | 0.46            |
|                                        | 686              | 57              |
| MCHC                                   | 332.71           | 329.18          |
|                                        | 10.725           | 12.752          |
|                                        | 686              | 57              |
| Mean corpuscular Haemoglobin           | 29.74            | 29.49           |
|                                        | 2.55             | 2.823           |
|                                        | 686              | 57              |
| Test                                | Value 1     | Value 2     | Value 3     | Value 4     | Value 5     |
|-------------------------------------|-------------|-------------|-------------|-------------|-------------|
| Mean corpuscular volume             | 89.41       | 7.314       | 686         | 89.66       | 9.022       |
| Mean platelet volume                | 8.49        | 1.131       | 684         | 8.59        | 1.15        |
| Methaemoglobin                      | 0.69        | 0.341       | 188         | 0.61        | 0.265       |
| Monocyte count                      | 0.62        | 0.436       | 686         | 0.53        | 0.394       |
| Neutrophil count                    | 7.0         | 4.504       | 686         | 6.91        | 4.887       |
| Nucleated red blood cell count      | 0.01        | 0.074       | 685         | 0.06        | 0.358       |
| Oxygen partial pressure             | 9.25        | 5.223       | 189         | 9.73        | 4.204       |
| Oxyhaemoglobin                      | 81.52       | 17.236      | 188         | 88.24       | 9.093       |
| Platelet count                      | 237.27      | 110.316     | 683         | 220.56      | 99.242      |
| Prothrombin time                    | 16.45       | 10.887      | 396         | 14.12       | 2.294       |
| Red blood cell count                | 4.52        | 0.741       | 686         | 4.8         | 0.641       |
| Red blood cell width                | 14.41       | 2.197       | 686         | 13.36       | 1.243       |
| Respiratory rate                    | 23.27       | 5.527       | 812         | 27.42       | 6.921       |
| Sp02                                | 94.97       | 4.548       | 812         | 92.89       | 4.736       |
| Temperature                         | 36.97       | 0.879       | 811         | 37.37       | 0.822       |
| Thyroid stimulating hormone         | 1.31        | 1.009       | 71          | 1.3         | 0.827       |
| Thyroxine T4                         | 13.97       | 2.55        | 74          | 13.12       | 2.404       |
| Troponin T                          | 135.09      | 908.292     | 430         | 38.45       | 116.419     |
| White blood cells                   | 8.79        | 5.224       | 686         | 8.4         | 5.115       |
**Supplementary Table S5. Clinical features for control and target patients in the mortality cohort.**

| Feature                                | Control patients | Target patients | Feature                                | Control patients | Target patients |
|----------------------------------------|------------------|-----------------|----------------------------------------|------------------|-----------------|
| Age                                    | 63.51            | 74.68           | Age                                    | 17.659           | 13.08           |
| Sex female                             | 37.1%            | 28.5%           | Sex male                               | 62.7%            | 71.5%           |
| Sex male                               | 0.2%             | 0.0%            | Sex unknown                            | 0.2%             | 0.0%            |
| Act. partial thromboplastin time        | 32.5             | 34.2            | Adjusted calcium                       | 7.545            | 6.191           |
| Alkaline phosphatase                   | 35.24            | 33.66           | Alkaline phosphatase                   | 4.665            | 4.241           |
| Amylase                                | 95.22            | 99.55           | Adjusted calcium                       | 71.537           | 62.477          |
| Anion gap                              | 13.51            | 15.99           | Base excess                            | 0.0%             | 0.0%            |
| Act. partial thromboplastin            | 3.09             | 1.84            | Basophil count                         | 0.01             | 1.0             |
| Alanine aminotransferase               | 2.28             | 2.3             | Blood lactate                          | 0.01             | 0.01            |
| Albumin                                | 44.9             | 53.01           | Blood lactate                          | 6.758            | 6.141           |
| Albumin                                | 23.75            | 20.55           | Blood lactate                          | 4.356            | 3.719           |
| Act. partial thromboplastin            | 12.97            | 14.17           | Blood lactate                          | 0.153            | 0.016           |
| Act. partial thromboplastin            | 95.22            | 105.71          | Blood lactate                          | 9.983            | 8.353           |
| Act. partial thromboplastin            | 2.19             | 2.18            | Blood lactate                          | 0.156            | 0.016           |
| Act. partial thromboplastin            | 99.51            | 100.6           | Blood lactate                          | 5.879            | 8.141           |
| Act. partial thromboplastin            | 1123.89          | 804.73          | Blood lactate                          | 1796.91          | 865.972         |
| Act. partial thromboplastin            | 1.49             | 1.98            | Blood lactate                          | 0.892            | 1.285           |
| Act. partial thromboplastin            | 488.29           | 483.72          | Blood lactate                          | 339.953          | 218.632         |
| Act. partial thromboplastin            | 23.75            | 20.55           | Blood lactate                          | 4.356            | 3.719           |
| Act. partial thromboplastin            | 12.97            | 14.17           | Blood lactate                          | 0.153            | 0.016           |
| Act. partial thromboplastin            | 99.51            | 100.6           | Blood lactate                          | 5.879            | 8.141           |
| Act. partial thromboplastin            | 1123.89          | 804.73          | Blood lactate                          | 1796.91          | 865.972         |
| Act. partial thromboplastin            | 1.49             | 1.98            | Blood lactate                          | 0.892            | 1.285           |
| Act. partial thromboplastin            | 488.29           | 483.72          | Blood lactate                          | 339.953          | 218.632         |
| Act. partial thromboplastin            | 23.75            | 20.55           | Blood lactate                          | 4.356            | 3.719           |
| Act. partial thromboplastin            | 12.97            | 14.17           | Blood lactate                          | 0.153            | 0.016           |
| Act. partial thromboplastin            | 99.51            | 100.6           | Blood lactate                          | 5.879            | 8.141           |
| Act. partial thromboplastin            | 1123.89          | 804.73          | Blood lactate                          | 1796.91          | 865.972         |
| Act. partial thromboplastin            | 1.49             | 1.98            | Blood lactate                          | 0.892            | 1.285           |
| Act. partial thromboplastin            | 488.29           | 483.72          | Blood lactate                          | 339.953          | 218.632         |
| Act. partial thromboplastin            | 23.75            | 20.55           | Blood lactate                          | 4.356            | 3.719           |
| Act. partial thromboplastin            | 12.97            | 14.17           | Blood lactate                          | 0.153            | 0.016           |
| Act. partial thromboplastin            | 99.51            | 100.6           | Blood lactate                          | 5.879            | 8.141           |
| Act. partial thromboplastin            | 1123.89          | 804.73          | Blood lactate                          | 1796.91          | 865.972         |
| Act. partial thromboplastin            | 1.49             | 1.98            | Blood lactate                          | 0.892            | 1.285           |
| Act. partial thromboplastin            | 488.29           | 483.72          | Blood lactate                          | 339.953          | 218.632         |
| Act. partial thromboplastin            | 23.75            | 20.55           | Blood lactate                          | 4.356            | 3.719           |
| Act. partial thromboplastin            | 12.97            | 14.17           | Blood lactate                          | 0.153            | 0.016           |
| Act. partial thromboplastin            | 99.51            | 100.6           | Blood lactate                          | 5.879            | 8.141           |
| Act. partial thromboplastin            | 1123.89          | 804.73          | Blood lactate                          | 1796.91          | 865.972         |
| Act. partial thromboplastin            | 1.49             | 1.98            | Blood lactate                          | 0.892            | 1.285           |
| Act. partial thromboplastin            | 488.29           | 483.72          | Blood lactate                          | 339.953          | 218.632         |
| Act. partial thromboplastin            | 23.75            | 20.55           | Blood lactate                          | 4.356            | 3.719           |
| Act. partial thromboplastin            | 12.97            | 14.17           | Blood lactate                          | 0.153            | 0.016           |
| Medical Parameter               | Value 1  | Value 2  | Value 3  | Value 4  | Value 5  | Value 6  |
|--------------------------------|----------|----------|----------|----------|----------|----------|
| Mean corpuscular volume        | 88.51    | 7.137    | 380      | 89.48    | 8.217    | 171      |
| Mean platelet volume           | 8.5      | 1.065    | 379      | 8.75     | 1.148    | 171      |
| Methaemoglobin                 | 0.7      | 0.306    | 90       | 0.71     | 0.312    | 35       |
| Monocyte count                 | 0.6      | 0.393    | 380      | 0.6      | 0.407    | 171      |
| Neutrophil count               | 6.7      | 4.193    | 380      | 7.67     | 5.078    | 171      |
| Nucleated red blood cell count | 0.01     | 0.056    | 379      | 0.01     | 0.045    | 171      |
| Oxygen partial pressure        | 8.81     | 4.285    | 90       | 11.28    | 6.31     | 35       |
| Oxyhaemoglobin                 | 82.63    | 17.161   | 90       | 84.54    | 15.853   | 35       |
| Platelet count                 | 241.96   | 111.173  | 379      | 228.48   | 96.361   | 170      |
| Prothrombin time               | 16.5     | 13.515   | 215      | 16.99    | 7.062    | 98       |
| Red blood cell count           | 4.6      | 0.686    | 380      | 4.51     | 0.833    | 171      |
| Red blood cell width           | 14.09    | 2.0      | 380      | 14.95    | 2.293    | 171      |
| Respiratory rate               | 22.69    | 4.997    | 424      | 25.97    | 6.463    | 192      |
| Sp02                           | 95.4     | 4.548    | 424      | 93.64    | 4.706    | 192      |
| Temperature                    | 37.07    | 0.803    | 423      | 36.9     | 0.964    | 191      |
| Thyroid stimulating hormone    | 1.58     | 1.214    | 35       | 1.27     | 1.128    | 12       |
| Thyroxine T4                   | 13.52    | 2.555    | 35       | 13.57    | 2.21     | 13       |
| Troponin T                     | 42.01    | 121.515  | 226      | 293.37   | 1545.349 | 139      |
| White blood cells              | 8.4      | 4.479    | 380      | 9.5      | 6.645    | 171      |
**Supplementary Table S6.** Sensitivity and specificity on clinical endpoints (standard deviation shown in brackets) at each model’s ideal classification threshold as determined by Youden’s J statistic on the ROC curve.

| Model        | Endpoint A (AICU admission) | Endpoint B (ventilation) | Endpoint C (mortality) |
|--------------|------------------------------|--------------------------|------------------------|
|              | Sensitivity | Specificity | Sensitivity | Sensitivity | Sensitivity | Sensitivity | Sensitivity |
| Logistic regression | 0.72         | 0.68        | 0.73        | 0.66        | 0.74        | 0.59        |
|              | (0.141)     | (0.086)     | (0.215)     | (0.113)     | (0.041)     | (0.011)     |
| Random forest | 0.75         | 0.77        | **0.82**     | 0.73        | **0.76**     | **0.67**     |
|              | (0.075)     | (0.062)     | (0.074)     | (0.077)     | (0.102)     | (0.072)     |
| XGBoost      | 0.74         | **0.80**    | 0.76        | **0.85**    | 0.74        | 0.66        |
|              | (0.062)     | (0.024)     | (0.080)     | (0.057)     | (0.056)     | (0.004)     |