### Supplementary Table 2. Stage 2 weaning models

| Model 24 HR | Testing Set Validation | 5-fold Cross-Validation |
|-------------|------------------------|-------------------------|
|             | Algorithm | Accuracy | Sensitivity | Specificity | AUC | Accuracy | Sensitivity | Specificity | AUC | AUC(95%CI) | Accuracy | Sensitivity | Specificity | AUC | AUC(95%CI) |
|             | Logistic Regression | 0.863 | 0.893 | 0.839 | 0.940 | 0.853±0.008 | 0.884±0.011 | 0.828±0.009 | 0.856±0.008 | 0.838-0.874 |
|             | Random Forest | 0.875 | 0.867 | 0.875 | 0.941 | 0.874±0.004 | 0.872±0.018 | 0.876±0.010 | 0.874±0.005 | 0.862-0.886 |
|             | SVM | 0.716 | 0.718 | 0.714 | 0.790 | 0.766±0.008 | 0.803±0.023 | 0.738±0.009 | 0.771±0.009 | 0.750-0.791 |
|             | KNN | 0.653 | 0.699 | 0.617 | 0.706 | 0.663±0.018 | 0.553±0.038 | 0.747±0.010 | 0.650±0.020 | 0.605-0.695 |
|             | LightGBM | 0.875 | 0.867 | 0.880 | 0.943 | 0.870±0.004 | 0.849±0.021 | 0.886±0.011 | 0.868±0.006 | 0.855-0.881 |
|             | MLP | 0.858 | 0.876 | 0.844 | 0.938 | 0.845±0.021 | 0.914±0.041 | 0.792±0.066 | 0.853±0.014 | 0.821-0.885 |
|             | XGboost | 0.865 | 0.860 | 0.869 | 0.935 | 0.832±0.011 | 0.680±0.022 | 0.949±0.009 | 0.814±0.012 | 0.788-0.841 |

| Model 48 HR | Testing Set Validation | 5-fold Cross-Validation |
|-------------|------------------------|-------------------------|
|             | Algorithm | Accuracy | Sensitivity | Specificity | AUC | Accuracy | Sensitivity | Specificity | AUC | AUC(95%CI) | Accuracy | Sensitivity | Specificity | AUC | AUC(95%CI) |
|             | Logistic Regression | 0.875 | 0.892 | 0.858 | 0.940 | 0.851±0.016 | 0.872±0.029 | 0.830±0.014 | 0.851±0.016 | 0.815-0.886 |
|             | Random Forest | 0.869 | 0.869 | 0.869 | 0.944 | 0.860±0.008 | 0.849±0.021 | 0.872±0.007 | 0.861±0.008 | 0.842-0.879 |
|             | SVM | 0.731 | 0.730 | 0.732 | 0.806 | 0.764±0.029 | 0.780±0.038 | 0.747±0.020 | 0.764±0.028 | 0.700-0.828 |
|             | KNN | 0.668 | 0.698 | 0.636 | 0.714 | 0.651±0.026 | 0.553±0.021 | 0.753±0.031 | 0.653±0.026 | 0.594-0.712 |
|             | LightGBM | 0.870 | 0.870 | 0.869 | 0.944 | 0.857±0.005 | 0.850±0.017 | 0.864±0.012 | 0.857±0.005 | 0.846-0.868 |
|             | MLP | 0.867 | 0.870 | 0.864 | 0.939 | 0.851±0.012 | 0.854±0.046 | 0.847±0.049 | 0.851±0.012 | 0.824-0.877 |
|             | XGboost | 0.864 | 0.859 | 0.869 | 0.935 | 0.824±0.005 | 0.708±0.009 | 0.945±0.010 | 0.827±0.005 | 0.816-0.838 |

| Model 72 HR | Testing Set Validation | 5-fold Cross-Validation |
|-------------|------------------------|-------------------------|
|             | Algorithm | Accuracy | Sensitivity | Specificity | AUC | Accuracy | Sensitivity | Specificity | AUC | AUC(95%CI) | Accuracy | Sensitivity | Specificity | AUC | AUC(95%CI) |
|             | Logistic Regression | 0.840 | 0.852 | 0.824 | 0.921 | 0.846±0.008 | 0.857±0.013 | 0.831±0.017 | 0.844±0.008 | 0.826-0.862 |
|             | Random Forest | 0.847 | 0.861 | 0.828 | 0.923 | 0.845±0.011 | 0.872±0.017 | 0.807±0.014 | 0.840±0.011 | 0.815-0.864 |
|             | SVM | 0.708 | 0.702 | 0.717 | 0.797 | 0.765±0.026 | 0.768±0.030 | 0.762±0.024 | 0.765±0.025 | 0.707-0.822 |
|             | KNN | 0.645 | 0.675 | 0.603 | 0.692 | 0.629±0.031 | 0.554±0.037 | 0.734±0.030 | 0.644±0.030 | 0.575-0.713 |
|             | LightGBM | 0.847 | 0.879 | 0.800 | 0.927 | 0.837±0.012 | 0.846±0.014 | 0.825±0.014 | 0.835±0.012 | 0.808-0.863 |
|             | MLP | 0.840 | 0.817 | 0.874 | 0.919 | 0.837±0.008 | 0.841±0.036 | 0.831±0.055 | 0.836±0.013 | 0.808-0.865 |
|             | XGboost | 0.834 | 0.833 | 0.835 | 0.922 | 0.812±0.012 | 0.726±0.017 | 0.935±0.015 | 0.831±0.012 | 0.803-0.858 |
| Model 96 HR |              | Testing Set Validation | 5-fold Cross-Validation |                  |                  |                  |                  |                  |                  |                  |
|------------|--------------|------------------------|-------------------------|---------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|            | Algorithm    | Accuracy   | Sensitivity | Specificity | AUC     | Accuracy   | Sensitivity | Specificity | AUC     | AUC(95%CI)      |
| Logistic Regression | 0.827 | 0.828 | 0.827 | 0.918 | 0.826±0.013 | 0.836±0.022 | 0.808±0.031 | 0.822±0.014 | 0.791-0.853 |
| Random Forest | 0.830 | 0.829 | 0.831 | 0.919 | 0.843±0.011 | 0.876±0.023 | 0.781±0.022 | 0.829±0.008 | 0.810-0.847 |
| SVM | 0.732 | 0.728 | 0.740 | 0.815 | 0.756±0.013 | 0.749±0.023 | 0.768±0.022 | 0.758±0.011 | 0.734-0.783 |
| KNN | 0.671 | 0.685 | 0.645 | 0.710 | 0.621±0.015 | 0.564±0.027 | 0.727±0.019 | 0.645±0.012 | 0.618-0.673 |
| LightGBM | 0.841 | 0.840 | 0.843 | 0.928 | 0.839±0.012 | 0.869±0.024 | 0.783±0.024 | 0.826±0.009 | 0.806-0.847 |
| MLP | 0.824 | 0.836 | 0.802 | 0.916 | 0.820±0.017 | 0.794±0.053 | 0.868±0.055 | 0.831±0.009 | 0.810-0.852 |
| XGboost | 0.827 | 0.828 | 0.827 | 0.915 | 0.809±0.019 | 0.756±0.035 | 0.906±0.011 | 0.831±0.013 | 0.803-0.860 |

| Model 120 HR |              | Testing Set Validation | 5-fold Cross-Validation |                  |                  |                  |                  |                  |                  |                  |
|------------|--------------|------------------------|-------------------------|---------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Logistic Regression | 0.827 | 0.827 | 0.826 | 0.913 | 0.826±0.020 | 0.832±0.017 | 0.811±0.032 | 0.821±0.023 | 0.770-0.873 |
| Random Forest | 0.824 | 0.822 | 0.829 | 0.918 | 0.841±0.016 | 0.878±0.016 | 0.758±0.027 | 0.818±0.017 | 0.778-0.857 |
| SVM | 0.713 | 0.714 | 0.712 | 0.797 | 0.754±0.012 | 0.744±0.021 | 0.777±0.028 | 0.760±0.012 | 0.733-0.788 |
| KNN | 0.649 | 0.679 | 0.580 | 0.683 | 0.620±0.016 | 0.584±0.024 | 0.705±0.024 | 0.644±0.014 | 0.614-0.675 |
| LightGBM | 0.842 | 0.842 | 0.842 | 0.923 | 0.835±0.011 | 0.887±0.012 | 0.716±0.008 | 0.801±0.010 | 0.778-0.824 |
| MLP | 0.805 | 0.804 | 0.807 | 0.905 | 0.821±0.013 | 0.837±0.032 | 0.785±0.059 | 0.811±0.019 | 0.768-0.854 |
| XGboost | 0.810 | 0.810 | 0.810 | 0.908 | 0.810±0.013 | 0.787±0.019 | 0.865±0.009 | 0.826±0.011 | 0.802-0.850 |

| Model 144 HR |              | Testing Set Validation | 5-fold Cross-Validation |                  |                  |                  |                  |                  |                  |                  |
|------------|--------------|------------------------|-------------------------|---------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Logistic Regression | 0.818 | 0.826 | 0.795 | 0.902 | 0.818±0.014 | 0.824±0.015 | 0.802±0.031 | 0.813±0.018 | 0.773-0.853 |
| Random Forest | 0.812 | 0.813 | 0.810 | 0.902 | 0.837±0.007 | 0.879±0.013 | 0.722±0.047 | 0.801±0.019 | 0.758-0.843 |
| SVM | 0.723 | 0.723 | 0.722 | 0.800 | 0.755±0.013 | 0.740±0.008 | 0.795±0.034 | 0.768±0.019 | 0.725-0.810 |
| KNN | 0.664 | 0.691 | 0.589 | 0.687 | 0.618±0.017 | 0.589±0.021 | 0.697±0.032 | 0.643±0.018 | 0.602-0.685 |
| LightGBM | 0.812 | 0.817 | 0.801 | 0.898 | 0.850±0.011 | 0.921±0.012 | 0.652±0.061 | 0.786±0.026 | 0.728-0.845 |
| MLP | 0.800 | 0.801 | 0.795 | 0.894 | 0.796±0.015 | 0.787±0.039 | 0.821±0.053 | 0.804±0.009 | 0.785-0.824 |
| XGboost | 0.815 | 0.815 | 0.813 | 0.896 | 0.814±0.012 | 0.810±0.020 | 0.826±0.026 | 0.818±0.011 | 0.794-0.842 |
| Algorithm       | Testing Set Validation | 5-fold Cross-Validation |
|-----------------|------------------------|------------------------|
|                 | Accuracy | Sensitivity | Specificity | AUC    | Accuracy | Sensitivity | Specificity | AUC    | AUC(95%CI) |
| Logistic Regression | 0.804    | 0.804       | 0.805       | 0.904  | 0.814±0.018 | 0.824±0.018 | 0.781±0.042 | 0.803±0.024 | 0.749-0.856 |
| Random Forest   | 0.831    | 0.833       | 0.822       | 0.915  | 0.845±0.017 | 0.892±0.018 | 0.692±0.023 | 0.792±0.017 | 0.754-0.830 |
| SVM             | 0.730    | 0.730       | 0.729       | 0.804  | 0.753±0.014 | 0.740±0.015 | 0.794±0.043 | 0.767±0.021 | 0.719-0.815 |
| KNN             | 0.635    | 0.650       | 0.586       | 0.674  | 0.623±0.015 | 0.605±0.017 | 0.682±0.042 | 0.643±0.021 | 0.595-0.692 |
| LightGBM        | 0.819    | 0.819       | 0.818       | 0.917  | 0.851±0.019 | 0.921±0.022 | 0.623±0.033 | 0.772±0.020 | 0.726-0.818 |
| MLP             | 0.792    | 0.792       | 0.795       | 0.896  | 0.799±0.031 | 0.805±0.055 | 0.777±0.071 | 0.791±0.022 | 0.741-0.842 |
| XGboost         | 0.819    | 0.823       | 0.805       | 0.904  | 0.831±0.016 | 0.848±0.018 | 0.776±0.026 | 0.812±0.017 | 0.773-0.851 |
| Logistic Regression | 0.787    | 0.778       | 0.784       | 0.890  | 0.808±0.008 | 0.816±0.013 | 0.778±0.033 | 0.797±0.014 | 0.766-0.828 |
| Random Forest   | 0.804    | 0.804       | 0.802       | 0.889  | 0.849±0.004 | 0.891±0.005 | 0.685±0.019 | 0.788±0.009 | 0.768-0.808 |
| SVM             | 0.730    | 0.730       | 0.729       | 0.811  | 0.744±0.010 | 0.730±0.016 | 0.798±0.019 | 0.764±0.008 | 0.747-0.781 |
| KNN             | 0.671    | 0.701       | 0.554       | 0.685  | 0.637±0.009 | 0.630±0.006 | 0.663±0.024 | 0.647±0.015 | 0.614-0.680 |
| LightGBM        | 0.823    | 0.822       | 0.826       | 0.911  | 0.864±0.009 | 0.931±0.009 | 0.607±0.034 | 0.769±0.017 | 0.731-0.807 |
| MLP             | 0.804    | 0.804       | 0.802       | 0.887  | 0.771±0.009 | 0.758±0.017 | 0.821±0.039 | 0.790±0.014 | 0.759-0.821 |
| XGboost         | 0.804    | 0.803       | 0.806       | 0.896  | 0.846±0.003 | 0.872±0.008 | 0.744±0.031 | 0.808±0.012 | 0.781-0.836 |
| Logistic Regression | 0.779    | 0.778       | 0.784       | 0.887  | 0.808±0.013 | 0.810±0.018 | 0.795±0.021 | 0.803±0.010 | 0.780-0.825 |
| Random Forest   | 0.783    | 0.783       | 0.784       | 0.882  | 0.852±0.014 | 0.892±0.014 | 0.675±0.045 | 0.784±0.024 | 0.730-0.838 |
| SVM             | 0.730    | 0.730       | 0.732       | 0.797  | 0.744±0.025 | 0.732±0.027 | 0.800±0.031 | 0.766±0.024 | 0.712-0.820 |
| KNN             | 0.588    | 0.567       | 0.680       | 0.658  | 0.653±0.024 | 0.657±0.030 | 0.636±0.013 | 0.647±0.016 | 0.611-0.683 |
| LightGBM        | 0.812    | 0.811       | 0.814       | 0.889  | 0.862±0.014 | 0.915±0.017 | 0.627±0.050 | 0.771±0.024 | 0.717-0.825 |
| MLP             | 0.780    | 0.781       | 0.779       | 0.882  | 0.783±0.048 | 0.780±0.076 | 0.795±0.080 | 0.788±0.015 | 0.755-0.821 |
| XGboost         | 0.769    | 0.770       | 0.766       | 0.870  | 0.852±0.016 | 0.883±0.021 | 0.718±0.030 | 0.800±0.016 | 0.764-0.837 |
| Algorithm       | Accuracy | Sensitivity | Specificity | AUC | Accuracy | Sensitivity | Specificity | AUC   | Accuracy | Sensitivity | Specificity | AUC   | AUC(95%CI) |
|-----------------|----------|-------------|-------------|-----|----------|-------------|-------------|-------|----------|-------------|-------------|-------|------------|
| Logistic Regression | 0.792   | 0.791       | 0.793       | 0.894 | 0.807±0.016 | 0.809±0.017 | 0.793±0.024 | 0.801±0.016 | 0.764-0.838 |
| Random Forest   | 0.809   | 0.809       | 0.808       | 0.895 | 0.860±0.010 | 0.898±0.014 | 0.677±0.036 | 0.788±0.015 | 0.753-0.822 |
| SVM             | 0.756   | 0.757       | 0.756       | 0.839 | 0.741±0.018 | 0.729±0.022 | 0.800±0.034 | 0.765±0.018 | 0.724-0.806 |
| KNN             | 0.685   | 0.701       | 0.610       | 0.706 | 0.655±0.015 | 0.662±0.022 | 0.623±0.025 | 0.642±0.007 | 0.627-0.657 |
| LightGBM        | 0.819   | 0.819       | 0.822       | 0.905 | 0.860±0.009 | 0.910±0.010 | 0.614±0.025 | 0.762±0.013 | 0.733-0.792 |
| MLP             | 0.797   | 0.797       | 0.798       | 0.898 | 0.802±0.014 | 0.817±0.020 | 0.730±0.040 | 0.774±0.018 | 0.734-0.813 |
| XGboost         | 0.808   | 0.808       | 0.808       | 0.902 | 0.865±0.013 | 0.896±0.014 | 0.710±0.032 | 0.803±0.017 | 0.764-0.842 |

| Algorithm       | Accuracy | Sensitivity | Specificity | AUC | Accuracy | Sensitivity | Specificity | AUC   | Accuracy | Sensitivity | Specificity | AUC   | AUC(95%CI) |
|-----------------|----------|-------------|-------------|-----|----------|-------------|-------------|-------|----------|-------------|-------------|-------|------------|
| Logistic Regression | 0.826   | 0.826       | 0.827       | 0.912 | 0.811±0.015 | 0.815±0.015 | 0.789±0.026 | 0.802±0.019 | 0.759-0.845 |
| Random Forest   | 0.836   | 0.836       | 0.837       | 0.910 | 0.864±0.010 | 0.901±0.013 | 0.661±0.029 | 0.781±0.014 | 0.750-0.812 |
| SVM             | 0.753   | 0.753       | 0.755       | 0.821 | 0.746±0.005 | 0.738±0.008 | 0.790±0.022 | 0.764±0.009 | 0.744-0.785 |
| KNN             | 0.740   | 0.815       | 0.337       | 0.655 | 0.673±0.011 | 0.682±0.014 | 0.625±0.017 | 0.654±0.010 | 0.632-0.675 |
| LightGBM        | 0.832   | 0.832       | 0.832       | 0.916 | 0.870±0.014 | 0.914±0.013 | 0.630±0.042 | 0.772±0.024 | 0.718-0.826 |
| MLP             | 0.820   | 0.822       | 0.811       | 0.898 | 0.794±0.012 | 0.805±0.026 | 0.739±0.080 | 0.739±0.080 | 0.707-0.836 |
| XGboost         | 0.804   | 0.804       | 0.801       | 0.902 | 0.872±0.009 | 0.904±0.007 | 0.699±0.056 | 0.801±0.027 | 0.739-0.863 |