# S4 Text - Detailed performance metrics, including Average Precision, Positive and Negative Predictive Value, F-1 score, Mathews Correlation Coefficient as well as Brier calibration score, for the internal, prospective, and the external validation cohorts for each of the outcomes of interest

## Retrospective evaluation of European cohort

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***ICU*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.76[0.76-0.77] | 0.72[0.71-0.73] | 0.67[0.65-0.68] | 0.71[0.70-0.71] | 0.66[0.65-0.67] | 0.37[0.36-0.39] | 0.20[0.19-0.20] |
| **FF** | 0.77[0.76-0.78] | 0.72[0.71-0.73] | 0.66[0.65-0.67] | **0.73**[0.72-0.74] | **0.68**[0.67-0.69] | 0.39[0.38-0.41] | 0.20[0.20-0.20] |
| **Xgb** | **0.79**[0.78-0.79] | **0.76**[0.75-0.76] | **0.68**[0.67-0.69] | **0.73**[0.73-0.74] | **0.68**[0.68-0.69] | **0.41**[0.40-0.42] | **0.19**[0.19-0.19] |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  ***30-day*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.75[0.74-0.76] | 0.72[0.71-0.73] | 0.67[0.66-0.68] | 0.70[0.70-0.70] | 0.66[0.65-0.66] | 0.37[0.36-0.37] | 0.20[0.20-0.21] |
| **FF** | 0.75[0.75-0.76] | 0.72[0.71-0.73] | 0.66[0.65-0.67] | **0.72**[0.72-0.73] | **0.68**[0.67-0.68] | 0.38[0.37-0.39] | 0.20[0.20-0.21] |
| **Xgb** | **0.77**[0.77-0.78] | **0.76**[0.75-0.76] | **0.69**[0.68-0.70] | 0.71[0.71-0.72] | 0.67[0.67-0.68] | **0.40**[0.38-0.41] | **0.19**[0.19-0.20] |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Low risk*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.85[0.84-0.86] | 0.48[0.46-0.50] | 0.44[0.39-0.49] | 0.92[0.92-0.92] | 0.43[0.41-0.45] | 0.36[0.34-0.39] | 0.10[0.09-0.10] |
| **FF** | 0.85[0.84-0.87] | **0.50**[0.48-0.52] | **0.51**[0.48-0.54] | 0.92[0.92-0.92] | 0.42[0.40-0.44] | 0.37[0.35-0.39] | **0.09**[0.08-0.09] |
| **Xgb** | **0.86**[0.85-0.87] | 0.49[0.47-0.51] | 0.44[0.42-0.47] | **0.93**[0.93-0.93] | **0.44**[0.43-0.45] | **0.37**[0.36-0.38] | 0.10[0.09-0.10] |

## External validation on the French cohort

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***ICU*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.80[0.80-0.80] | 0.70[0.70-0.70] | 0.65[0.64-0.65] | 0.75[0.75-0.76] | 0.63[0.63-0.64] | 0.40[0.39-0.40] | 0.18[0.18-0.18] |
| **FF** | 0.80[0.80-0.80] | 0.70[0.70-0.71] | 0.66[0.66-0.67] | 0.79[0.79-0.80] | 0.68[0.68-0.69] | 0.46[0.46-0.47] | 0.18[0.18-0.18] |
| **Xgb** | **0.82**[0.82-0.82] | **0.73**[0.72-0.73] | **0.67**[0.66-0.67] | **0.80**[0.80-0.80] | **0.69**[0.69-0.69] | **0.47**[0.47-0.48] | **0.17**[0.17-0.17] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***30-day*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.77[0.76-0.77] | 0.66[0.66-0.66] | 0.60[0.60-0.60] | 0.76[0.76-0.77] | 0.63[0.63-0.63] | 0.37[0.37-0.37] | **0.19**[0.19-0.20] |
| **FF** | 0.77[0.77-0.77] | 0.66[0.66-0.66] | 0.59[0.59-0.60] | **0.79**[0.79-0.80] | 0.65[0.65-0.66] | 0.39[0.39-0.40] | 0.20[0.20-0.20] |
| **Xgb** | **0.79**[0.79-0.79] | **0.68**[0.68-0.68] | **0.64**[0.63-0.64] | **0.79**[0.79-0.79] | **0.67**[0.67-0.67] | **0.44**[0.43-0.44] | **0.19**[0.19-0.19] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Low risk*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | **0.86**[0.85-0.86] | 0.50[0.50-0.51] | 0.55[0.54-0.55] | 0.87[0.87-0.87] | 0.48[0.47-0.49] | 0.38[0.38-0.39] | 0.12[0.12-0.12] |
| **FF** | 0.85[0.85-0.85] | 0.51[0.50-0.51] | 0.55[0.55-0.56] | 0.85[0.85-0.86] | 0.39[0.38-0.39] | 0.31[0.31-0.32] | 0.12[0.12-0.12] |
| **Xgb** | **0.86**[0.86-0.87] | **0.54**[0.54-0.55] | **0.57**[0.56-0.57] | **0.88**[0.88-0.88] | **0.50**[0.50-0.51] | **0.41**[0.40-0.42] | **0.11**[0.11-0.11] |

## Prospective evaluation performance of the European cohort in internal cross-validation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***ICU*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.76[0.76-0.77] | 0.68[0.67-0.69] | 0.64[0.64-0.65] | 0.74[0.73-0.74] | 0.64[0.64-0.65] | 0.38[0.37-0.39] | 0.20[0.19-0.20] |
| **FF** | 0.76[0.76-0.77] | 0.68[0.67-0.69] | 0.65[0.64-0.66] | 0.73[0.73-0.74] | 0.64[0.63-0.65] | 0.38[0.37-0.39] | 0.20[0.19-0.20] |
| **Xgb** | **0.79**[0.79-0.80] | **0.72**[0.71-0.72] | **0.67**[0.66-0.68] | **0.75**[0.74-0.75] | **0.66**[0.65-0.66] | **0.41**[0.40-0.43] | **0.18**[0.18-0.18] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***30-day*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.75[0.75-0.76] | 0.67[0.66-0.68] | 0.65[0.64-0.67] | 0.72[0.71-0.73] | 0.61[0.60-0.62] | 0.37[0.35-0.39] | 0.20[0.20-0.20] |
| **FF** | 0.75[0.75-0.76] | 0.67[0.66-0.68] | 0.63[0.62-0.64] | **0.74**[0.74-0.75] | 0.64[0.63-0.65] | 0.38[0.36-0.39] | 0.20[0.20-0.20] |
| **Xgb** | **0.77**[0.77-0.78] | **0.70**[0.69-0.72] | **0.66**[0.65-0.67] | **0.74**[0.73-0.75] | **0.63**[0.62-0.64] | **0.39**[0.37-0.41] | **0.19**[0.19-0.19] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Low risk*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.84[0.83-0.85] | 0.47[0.45-0.48] | 0.45[0.43-0.46] | 0.90[0.90-0.90] | 0.42[0.42-0.43] | 0.34[0.33-0.35] | 0.11[0.11-0.11] |
| **FF** | 0.85[0.85-0.86] | 0.49[0.47-0.51] | **0.64**[0.60-0.68] | 0.90[0.90-0.90] | 0.36[0.34-0.39] | 0.35[0.33-0.37] | **0.09**[0.09-0.09] |
| **Xgb** | **0.87**[0.86-0.87] | **0.51**[0.49-0.53] | 0.47[0.45-0.50] | **0.92**[0.92-0.92] | **0.48**[0.46-0.49] | **0.40**[0.38-0.42] | 0.10[0.09-0.10] |

## Prospective evaluation on the cohort of patients admitted after the cut-off date

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***ICU*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.82[0.82-0.82] | 0.81[0.81-0.81] | 0.77[0.77-0.77] | 0.72[0.72-0.72] | 0.75[0.75-0.75] | 0.49[0.49-0.50] | **0.17**[0.17-0.17] |
| **FF** | 0.82[0.82-0.82] | 0.81[0.81-0.81] | 0.77[0.77-0.77] | 0.72[0.71-0.72] | 0.75[0.74-0.75] | 0.48[0.48-0.49] | 0.18[0.18-0.18] |
| **Xgb** | **0.83**[0.83-0.83] | **0.82**[0.82-0.82] | **0.78**[0.77-0.78] | **0.73**[0.72-0.73] | **0.76**[0.76-0.76] | **0.50**[0.50-0.50] | **0.17**[0.17-0.17] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***30-day*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.77[0.77-0.77] | 0.80[0.80-0.80] | **0.78**[0.78-0.78] | 0.62[0.61-0.62] | 0.69[0.69-0.69] | 0.39[0.39-0.40] | 0.20[0.20-0.21] |
| **FF** | 0.77[0.77-0.78] | **0.81**[0.80-0.81] | 0.76[0.76-0.76] | **0.65**[0.65-0.66] | **0.73**[0.72-0.73] | **0.41**[0.41-0.42] | 0.20[0.19-0.20] |
| **Xgb** | 0.77[0.77-0.77] | **0.81**[0.81-0.81] | **0.78**[0.77-0.78] | 0.62[0.62-0.63] | 0.70[0.70-0.70] | 0.40[0.40-0.41] | 0.20[0.20-0.20] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Low risk*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.84[0.84-0.84] | 0.41[0.41-0.41] | 0.39[0.39-0.40] | 0.92[0.92-0.92] | 0.45[0.44-0.45] | 0.36[0.35-0.36] | 0.13[0.13-0.13] |
| **FF** | **0.85**[0.85-0.85] | 0.44[0.43-0.44] | **0.47**[0.46-0.48] | 0.91[0.91-0.91] | 0.40[0.39-0.42] | 0.34[0.33-0.35] | **0.10**[0.10-0.10] |
| **Xgb** | **0.85**[0.85-0.85] | **0.47**[0.46-0.47] | 0.40[0.39-0.41] | **0.93**[0.93-0.93] | **0.46**[0.45-0.46] | **0.37**[0.36-0.38] | 0.11[0.11-0.11] |

## Internal cross-validation of the overall European cohort

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***ICU*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.78[0.77-0.79] | 0.73[0.72-0.73] | **0.68**[0.67-0.69] | 0.74[0.73-0.75] | 0.68[0.67-0.69] | 0.42[0.41-0.43] | 0.19[0.19-0.19] |
| **FF** | 0.78[0.77-0.79] | 0.72[0.71-0.73] | 0.65[0.64-0.66] | **0.77**[0.76-0.77] | **0.69**[0.69-0.70] | 0.42[0.40-0.43] | 0.20[0.19-0.20] |
| **Xgb** | **0.81**[0.80-0.81] | **0.75**[0.75-0.76] | **0.68**[0.67-0.69] | 0.75[0.75-0.76] | **0.69**[0.69-0.69] | **0.43**[0.42-0.44] | **0.18**[0.18-0.18] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***30-day*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.76[0.76-0.77] | 0.71[0.71-0.72] | **0.68**[0.67-0.69] | 0.71[0.70-0.71] | 0.65[0.64-0.65] | 0.38[0.37-0.39] | 0.20[0.20-0.20] |
| **FF** | 0.76[0.76-0.77] | 0.71[0.70-0.72] | 0.66[0.65-0.67] | **0.73**[0.72-0.73] | 0.66[0.65-0.67] | 0.38[0.37-0.39] | 0.20[0.20-0.20] |
| **Xgb** | **0.78**[0.77-0.78] | **0.74**[0.73-0.74] | **0.68**[0.67-0.69] | **0.73**[0.73-0.74] | **0.68**[0.67-0.68] | **0.41**[0.40-0.42] | **0.19**[0.19-0.19] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Low risk*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.86[0.85-0.87] | 0.50[0.48-0.53] | 0.49[0.46-0.51] | **0.92**[0.92-0.93] | 0.48[0.46-0.50] | 0.40[0.38-0.43] | 0.10[0.09-0.10] |
| **FF** | 0.85[0.84-0.87] | 0.51[0.48-0.53] | 0.51[0.47-0.54] | 0.91[0.91-0.92] | 0.45[0.43-0.47] | 0.38[0.35-0.41] | 0.10[0.09-0.10] |
| **Xgb** | **0.87**[0.86-0.88] | **0.52**[0.49-0.54] | **0.52**[0.48-0.55] | **0.92**[0.92-0.93] | **0.49**[0.47-0.51] | **0.42**[0.40-0.45] | 0.10[0.09-0.10] |

## External validation of the European cohort on the patients from non-European ICUs

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***ICU*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.84[0.84-0.84] | 0.84[0.84-0.84] | 0.82[0.82-0.82] | 0.65[0.65-0.65] | 0.70[0.69-0.70] | 0.46[0.45-0.46] | 0.18[0.18-0.18] |
| **FF** | 0.84[0.84-0.85] | 0.84[0.84-0.85] | 0.81[0.81-0.82] | **0.71**[0.70-0.72] | 0.76[0.76-0.77] | 0.52[0.52-0.53] | 0.17[0.17-0.17] |
| **Xgb** | **0.89**[0.89-0.89] | **0.88**[0.88-0.88] | **0.84**[0.84-0.85] | **0.71**[0.71-0.72] | **0.77**[0.76-0.77] | **0.55**[0.55-0.56] | **0.15**[0.15-0.15] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***30-day*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.83[0.83-0.83] | 0.85[0.85-0.85] | **0.82**[0.82-0.82] | 0.68[0.67-0.68] | 0.74[0.73-0.74] | 0.50[0.49-0.50] | 0.17[0.17-0.18] |
| **FF** | 0.83[0.83-0.83] | 0.84[0.84-0.84] | 0.81[0.80-0.81] | 0.72[0.71-0.72] | 0.77[0.77-0.77] | **0.53**[0.52-0.53] | 0.17[0.17-0.17] |
| **Xgb** | **0.86**[0.86-0.86] | **0.87**[0.86-0.87] | 0.81[0.80-0.81] | **0.74**[0.74-0.74] | **0.79**[0.78-0.79] | 0.55[0.54-0.55] | **0.16**[0.15-0.16] |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***Low risk*** | **AUC** | **AP** | **PPV** | **NPV** | **F-1** | **MCC** | **Brier** |
| **LR** | 0.85[0.85-0.85] | 0.59[0.59-0.60] | 0.64[0.63-0.64] | **0.80**[0.80-0.80] | **0.42**[0.41-0.43] | **0.33**[0.33-0.34] | 0.15[0.15-0.15] |
| **FF** | 0.85[0.85-0.85] | 0.58[0.58-0.58] | 0.64[0.63-0.64] | 0.79[0.79-0.80] | 0.39[0.38-0.40] | 0.31[0.31-0.32] | **0.14**[0.14-0.14] |
| **Xgb** | **0.86**[0.86-0.86] | **0.63**[0.62-0.63] | **0.68**[0.67-0.69] | 0.79[0.79-0.79] | 0.37[0.36-0.39] | 0.32[0.31-0.33] | **0.14**[0.14-0.14] |