Machine Learning Predicts Prolonged Acute Hypoxemic Respiratory Failure in Pediatric Severe Influenza

Supplemental Digital Content

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SDC 1: Performance of all models with 95% confidence interval. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated using probability cutoff of 0.5.

Models	Timing	Algorithm	AUC	Sensitivity	Specificity	Pos. pred. value	Neg pred value	Accuracy
OI	Day 1	LR	0.78 (0.74–0.81)	0.56 (0.44–0.68)	0.87 (0.76–0.97)	0.76 (0.63–0.92)	0.74 (0.68–0.79)	0.74 (0.7–0.77)
OI	Day 1	RF	0.69 (0.62–0.74)	0.51 (0.41–0.62)	0.79 (0.72–0.84)	0.63 (0.55–0.71)	0.69 (0.64–0.74)	0.67 (0.63–0.71)
PF	Day 1	LR	0.72 (0.68–0.75)	0.75 (0.65–0.85)	0.56 (0.39–0.69)	0.57 (0.48–0.66)	0.74 (0.69–0.8)	0.64 (0.57–0.69)
PF	Day 1	RF	0.71 (0.62–0.77)	0.77 (0.65–0.86)	0.61 (0.36–0.71)	0.61 (0.48–0.68)	0.78 (0.67–0.85)	0.68 (0.54–0.73)
OSI	Day 1	LR	0.8 (0.76–0.84)	0.77 (0.6–0.89)	0.62 (0.48–0.75)	0.62 (0.55–0.7)	0.77 (0.67–0.88)	0.68 (0.64–0.72)
OSI	Day 1	RF	0.69 (0.61–0.79)	0.67 (0.54–0.9)	0.56 (0.46–0.66)	0.55 (0.48–0.61)	0.68 (0.6–0.87)	0.61 (0.56–0.69)
SF	Day 1	LR	0.75 (0.72–0.78)	0.67 (0.56–0.76)	0.72 (0.62–0.79)	0.49 (0.41–0.56)	0.84 (0.79–0.88)	0.7 (0.65–0.74)
SF	Day 1	RF	0.79 (0.73–0.84)	0.64 (0.29–0.83)	0.76 (0.66–0.89)	0.52 (0.42–0.61)	0.84 (0.74–0.92)	0.73 (0.67–0.78)
OSI (all SpO2)	Day 1	LR	0.77 (0.74–0.79)	0.51 (0.42–0.59)	0.92 (0.88–0.97)	0.7 (0.6–0.82)	0.85 (0.82–0.88)	0.82 (0.8–0.84)
OSI (all SpO2)	Day 1	RF	0.76 (0.73–0.79)	0.52 (0.39–0.62)	0.89 (0.84–0.93)	0.61 (0.51–0.7)	0.85 (0.81–0.88)	0.8 (0.76–0.83)
SF (all SpO2)	Day 1	LR	0.77 (0.74–0.8)	0.27 (0.01–0.62)	0.92 (0.79–1)	0.7 (0.45–1)	0.8 (0.74–0.87)	0.75 (0.73–0.78)
SF (all SpO2)	Day 1	RF	0.78 (0.72–0.82)	0.59 (0.34–0.72)	0.83 (0.75–0.9)	0.53 (0.45–0.62)	0.86 (0.79–0.9)	0.77 (0.72–0.8)
Multivariables	Day 1	LR	0.82 (0.79–0.85)	0.55 (0.48–0.64)	0.89 (0.85–0.93)	0.63 (0.55–0.72)	0.86 (0.83–0.88)	0.81 (0.78–0.83)
Multivariables	Day 1	RF	0.9 (0.85–0.93)	0.67 (0.57–0.78)	0.93 (0.88–0.97)	0.76 (0.66–0.86)	0.9 (0.86–0.93)	0.86 (0.83–0.89)
OI	Day 2	LR	0.76 (0.73–0.79)	0.55 (0.4–0.68)	0.79 (0.71–0.93)	0.69 (0.62–0.85)	0.68 (0.62–0.75)	0.68 (0.65–0.71)
OI	Day 2	RF	0.73 (0.66–0.78)	0.63 (0.52–0.72)	0.74 (0.64–0.81)	0.67 (0.59–0.74)	0.7 (0.64–0.76)	0.69 (0.63–0.73)
PF	Day 2	LR	0.72 (0.69–0.75)	0.61 (0–0.9)	0.7 (0.29–1)	0.66 (0.48–0.84)	0.69 (0.51–0.8)	0.65 (0.5–0.71)
PF	Day 2	RF	0.68 (0.61–0.73)	0.67 (0.54–0.75)	0.63 (0.51–0.73)	0.61 (0.54–0.68)	0.68 (0.6–0.74)	0.65 (0.58–0.69)
OSI	Day 2	LR	0.84 (0.79–0.88)	0.68 (0.44–0.9)	0.84 (0.71–0.99)	0.78 (0.66–0.97)	0.78 (0.67–0.91)	0.77 (0.72–0.81)
OSI	Day 2	RF	0.74 (0.66–0.8)	0.58 (0.42–0.73)	0.78 (0.68–0.85)	0.67 (0.56–0.74)	0.71 (0.62–0.79)	0.69 (0.61–0.76)
SF	Day 2	LR	0.77 (0.74–0.8)	0.66 (0.44–0.76)	0.76 (0.64–0.87)	0.57 (0.46–0.65)	0.83 (0.75–0.87)	0.73 (0.67–0.77)
SF	Day 2	RF	0.69 (0.63–0.74)	0.47 (0.35–0.61)	0.77 (0.66–0.84)	0.49 (0.39–0.58)	0.76 (0.71–0.8)	0.67 (0.61–0.72)
OSI (all SpO$_2$)	Day 2	LR	0.78 (0.75–0.8)	0.49 (0.41–0.57)	0.95 (0.89–0.98)	0.77 (0.62–0.9)	0.85 (0.82–0.87)	0.83 (0.81–0.86)

OSI (all SpO₂)	Day 2	RF	0.78 (0.75–0.81)	0.56 (0.44–0.67)	0.92 (0.87–0.95)	0.69 (0.59–0.8)	0.86 (0.83–0.9)	0.83 (0.79–0.86)
SF (all SpO₂)	Day 2	LR	0.79 (0.76–0.81)	0.53 (0.36–0.64)	0.87 (0.77–0.94)	0.58 (0.46–0.67)	0.85 (0.8–0.88)	0.78 (0.74–0.81)
SF (all SpO₂)	Day 2	RF	0.75 (0.71–0.8)	0.43 (0.31–0.57)	0.87 (0.79–0.93)	0.54 (0.42–0.66)	0.82 (0.79–0.86)	0.76 (0.72–0.8)
Multivariables	Day 2	LR	0.86 (0.83–0.88)	0.61 (0.52–0.7)	0.87 (0.81–0.92)	0.62 (0.52–0.71)	0.87 (0.84–0.9)	0.81 (0.77–0.83)
Multivariables	Day 2	RF	0.93 (0.89–0.95)	0.69 (0.59–0.79)	0.94 (0.89–0.97)	0.79 (0.68–0.88)	0.9 (0.87–0.93)	0.88 (0.85–0.9)
OI	Day 1+2	LR	0.81 (0.77–0.84)	0.66 (0.54–0.81)	0.77 (0.69–0.88)	0.74 (0.67–0.84)	0.71 (0.63–0.82)	0.72 (0.66–0.77)
OI	Day 1+2	RF	0.82 (0.75–0.86)	0.71 (0.54–0.84)	0.79 (0.6–0.89)	0.76 (0.62–0.87)	0.74 (0.64–0.84)	0.75 (0.65–0.83)
PF	Day 1+2	LR	0.73 (0.67–0.77)	0.79 (0.68–0.9)	0.52 (0.35–0.68)	0.63 (0.54–0.72)	0.71 (0.64–0.81)	0.66 (0.6–0.72)
PF	Day 1+2	RF	0.79 (0.73–0.85)	0.82 (0.64–0.96)	0.63 (0.49–0.77)	0.7 (0.61–0.77)	0.79 (0.64–0.95)	0.73 (0.65–0.8)
OSI	Day 1+2	LR	0.82 (0.74–0.87)	0.79 (0.55–1)	0.63 (0.27–0.91)	0.7 (0.54–0.88)	0.77 (0.61–1)	0.71 (0.6–0.77)
OSI	Day 1+2	RF	0.72 (0.61–0.8)	0.64 (0.44–0.83)	0.59 (0.41–0.83)	0.62 (0.51–0.77)	0.61 (0.49–0.76)	0.61 (0.52–0.71)
SF	Day 1+2	LR	0.82 (0.78–0.85)	0.73 (0.58–0.86)	0.74 (0.66–0.8)	0.59 (0.52–0.64)	0.85 (0.77–0.91)	0.74 (0.7–0.76)
SF	Day 1+2	RF	0.81 (0.76–0.85)	0.68 (0.47–0.86)	0.8 (0.7–0.9)	0.64 (0.54–0.75)	0.84 (0.75–0.92)	0.76 (0.71–0.81)
OSI (all SpO₂)	Day 1+2	LR	0.78 (0.75–0.8)	0.51 (0.43–0.61)	0.94 (0.88–0.98)	0.75 (0.62–0.87)	0.85 (0.83–0.88)	0.83 (0.81–0.86)
OSI (all SpO₂)	Day 1+2	RF	0.78 (0.75–0.81)	0.58 (0.46–0.7)	0.91 (0.87–0.95)	0.69 (0.59–0.8)	0.87 (0.83–0.9)	0.83 (0.79–0.86)
SF (all SpO₂)	Day 1+2	LR	0.8 (0.78–0.83)	0.62 (0.49–0.71)	0.82 (0.75–0.88)	0.53 (0.46–0.61)	0.87 (0.82–0.9)	0.77 (0.73–0.79)
SF (all SpO₂)	Day 1+2	RF	0.83 (0.78–0.87)	0.62 (0.48–0.76)	0.86 (0.79–0.92)	0.6 (0.51–0.71)	0.87 (0.83–0.91)	0.8 (0.76–0.83)
Multivariables	Day 1+2	LR	0.86 (0.83–0.89)	0.64 (0.52–0.75)	0.86 (0.81–0.91)	0.61 (0.53–0.69)	0.88 (0.84–0.91)	0.81 (0.77–0.83)
Multivariables	Day 1+2	RF	0.93 (0.9–0.95)	0.71 (0.6–0.82)	0.93 (0.88–0.97)	0.78 (0.67–0.88)	0.91 (0.87–0.94)	0.88 (0.85–0.91)
Multivariables (reduced)	Day 1+2	LR	0.84 (0.81–0.87)	0.59 (0.48–0.69)	0.9 (0.85–0.94)	0.68 (0.57–0.77)	0.87 (0.83–0.9)	0.83 (0.79–0.85)
Multivariables (reduced)	Day 1+2	RF	0.91 (0.88–0.94)	0.72 (0.61–0.83)	0.91 (0.86–0.96)	0.74 (0.64–0.85)	0.91 (0.87–0.94)	0.86 (0.83–0.89)
Multivariables (reduced+year)	Day 1+2	LR	0.84 (0.8–0.86)	0.6 (0.48–0.71)	0.9 (0.84–0.94)	0.67 (0.55–0.76)	0.87 (0.83–0.9)	0.82 (0.78–0.85)
Multivariables (reduced+year)	Day 1+2	RF	0.92 (0.88–0.94)	0.72 (0.61–0.84)	0.92 (0.87–0.97)	0.76 (0.66–0.87)	0.91 (0.87–0.94)	0.87 (0.84–0.9)

AUC: area under the ROC curve, RF: random forests, LR: logistic regression.

SDC 2: Importance of predictors in random forest models using the error rate classification after permutation of the predictors. MAwP: mean airway pressure.