

## Supplemental Materials

### Details of Modeling Used in the Interrupted Time Series Analysis

To assess the immediate implementation effect and outcome trajectory over time that was associated with the rapid response algorithms, we performed an interrupted time series analysis using an ordinary least squares (OLS) time series model. We fit the OLS model to monthly outcome data, which had already been adjusted for the covariates of age, sex, PICU admission after a rapid response, number of CCCs, PRISM 3 score, and a rapid response–PRISM 3 interaction term. The OLS model incorporated sine and cosine terms to adjust for seasonality effects within the time series data. We used Newey-West standard errors to adjust for autocorrelation and we determined and adjusted the number of lags in our model on the basis of the Cumby–Huizinga general test for autocorrelation. We specified the following

OLS model to assess the association of rapid response algorithm implementation with rates of clinical outcomes over time in the study population:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 X_t T_t + \beta_4 \sin \frac{2\pi T_t}{P} + \beta_5 \cos \frac{2\pi T_t}{P} + \varepsilon_t$$

where:  $Y_t$  = the adjusted outcome variable measured at each equally spaced time point; separate models were fitted for the outcome variables of critical deterioration event rate, rate of NPPV within 12 hours of PICU admission, rate of intubation within 12 hours of PICU admission or rate of intubation within 1 hour of PICU admission  
 $T_t$  = the time, in months since the start of the study (ie, the study month)  
 $X_t$  = indicator (dummy) variable representing the intervention period

$$= \begin{cases} 1 & \text{if postalgorithm implementation} \\ 0 & \text{if prealgorithm implementation} \end{cases}$$

$X_t T_t$  = intervention × time interaction term  
 $\beta_0$  = intercept, which is the starting level of the outcome variable

$\beta_1$  = slope, or trajectory, of the outcome variable until the introduction of the rapid response algorithms

$\beta_2$  = change in the level of the outcome that occurs in the period immediately after the introduction of the rapid response algorithm (ie, the immediate intervention effect)

$\beta_3$  = difference between preintervention and post-intervention slopes of the outcome (ie, the intervention effect over time)

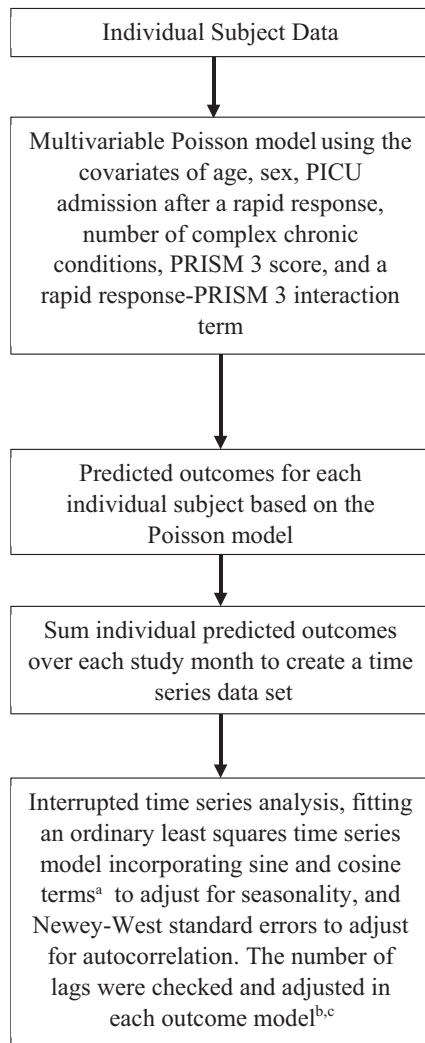
$\beta_4, \beta_5$  = regression coefficients for sine and cosine terms

P = period described by one sine or cosine function over  $(0, 2\pi)$  (in our case, P = 12 months)

$\varepsilon_t$  = residual term normally distributed around the regression line.



**SUPPLEMENTAL FIGURE 4** QR code link to pediatric rapid response algorithms. The QR code is a link to the full set of pediatric rapid response algorithms. By following the link, you will be directed to a brief survey. After completing the survey, you will be provided with a PDF copy of the complete set of pediatric rapid response algorithms.



**SUPPLEMENTAL FIGURE 5** Overview of statistical analysis. <sup>a</sup>Sine term included in the model:  $\sin(2\pi t/T)$  cosine term included in the model:  $\cos(2\pi t/T)$  where  $T=12$  months and  $t$  = the study month, (for July 2017:  $t=1$ , August 2017:  $t=2$ , etc). <sup>b</sup>The number of lags in the model were adjusted on the basis of the results of the Cumby–Huizinga general test for autocorrelation. <sup>c</sup>For the CDEs outcome model, we used a lag term of 10; for the noninvasive positive pressure within 12 hours of PICU admission outcome model, we used a lag term of 10, for the intubation within 12 hours of PICU admission model, we used a lag term of 11; and, for the intubation within 1 hour of PICU admission, we used a lag term.

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**SUPPLEMENTAL TABLE 3** Unadjusted Outcomes

	Preimplementation ( <i>n</i> = 615), No. (95% CI)	Postimplementation ( <i>n</i> = 277), No. (95% CI)	IRR (95% CI)	<i>P</i>
CDEs per 1000 non-ICU patient days	4.29 (3.85 to 4.78)	4.58 (3.93 to 5.33)	1.07 (0.88 to 1.29)	.50
NPPV within 12 h of PICU admission per 1000 non-ICU patient days	3.17 (2.80 to 3.60)	3.72 (3.14 to 4.40)	1.17 (0.94 to 1.45)	.14
Intubation within 12 h of PICU admission per 1000 non-ICU patient days	1.46 (1.21 to 1.75)	1.41 (1.07 to 1.85)	0.97 (0.68 to 1.36)	.84
Vasopressors within 12 h of PICU admission per 1000 non-ICU patient days	0.34 (0.23 to 0.50)	0.36 (0.21 to 0.62)	1.05 (0.50 to 2.12)	.87
CPAs before PICU admission per 1000 non-ICU patient days	0.32 (0.21 to 0.47)	0.14 (0.06 to 0.33)	0.44 (0.13 to 1.17)	.08
Death before PICU discharge per 1000 non-ICU patient days	0.25 (0.16 to 0.39)	0.22 (0.11 to 0.44)	0.88 (0.34 to 2.12)	.79
Intubation within 1 h of PICU admission per 1000 non-ICU patient days	1.35 (1.11 to 1.64)	0.88 (0.62 to 1.25)	0.65 (0.42 to 0.98)	.03
PICU LOS, median (IQR), d	2.10 (1.1–4.52)	2.41 (1.26–5.71)	—	.02

—, not applicable.