

Background

Neonates who develop sepsis and septic shock are at high risk of mortality. Previous local work demonstrated variability in monitoring and vasoactive medication prescribing practices among infants with sepsis and septic shock. Therefore, a *Sepsis Monitoring and Management algorithm* was created to standardize clinical care, aiming to provide a standardized approach to the type and frequency of physiological and laboratory monitoring, and reduce management variability.

Objectives

To assess the impact of the algorithm on key clinical measures:

- **Process:** time to antibiotic administration, frequency of BP monitoring, and time to fluid, vasopressor/inotrope, hydrocortisone
- **Outcome:** episode-related mortality (within 7d), death before discharge

Methods

Study design: Retrospective, single-center, before-after study from two epochs (Epoch 1: Dec 2017 – Dec 2019 and Epoch 2: Jun 2021 – Jan 2023). An 18-month washout period (Jan 2020 – May 2021) was included to account for the impact of the COVID-19 pandemic.

Inclusion criteria: Preterm neonates < 35 weeks gestational age, > 3 days age with blood or CSF culture-positive for any organism.

Exclusion criteria: Neonates with contaminant cultures and those transferred within 6 hours of sepsis onset.

Statistical analysis: Student t-test for continuous variables, Chi-Square test for dichotomous outcomes, Mann–Whitney U-test for comparison of medians as appropriate. Logistic regression was conducted to account for clinically relevant variables. Control charts were used to assess for special cause variation.

QIP Implementation

Multidisciplinary education

Quality huddles

Lanyard cards

Frequent audit cycles

EMR order set

In-unit data displays

157 neonates developed culture-positive sepsis, of whom 30 (19%) develop septic shock (Epoch 1: 24%, Epoch 2: 13%).

Table 1: Baseline and demographic variables pre and post implementation.

Variable	Epoch 1 (n=88)	Epoch 2 (n=69)	p-value
GA at birth (weeks), median (IQR)	25 (24, 26)	24 (23, 26)	0.14
Birth weight (grams), median (IQR)	690 (605, 875)	670 (560, 875)	0.08
Male sex, % (n/N)	44 (39/88)	58 (40/69)	0.09
Singleton, % (n/N)	67 (59/88)	75 (52/69)	0.26
Vaginal delivery, % (n/N)	57 (50/88)	59 (41/69)	0.74
Antenatal steroids, % (n/N)	95 (83/87)	91 (63/69)	0.34
SGA, % (n/N)	16 (14/88)	26 (18/69)	0.12
Maternal diabetes, % (n/N)	2 (2/88)	19 (13/69)	<0.01
PPROM, % (n/N)	34 (30/88)	28 (19/69)	0.38
Chorioamnionitis, % (n/N)	14 (12/88)	14 (10/69)	0.88
Apgar 5 <5, % (n/N)	30 (26/88)	22 (15/69)	0.27

Table 2: Illness severity variables pre and post implementation.

Variable	Epoch 1 (n=88)	Epoch 2 (n=69)	p-value
Corrected GA at illness (weeks), median (IQR)	27 (25, 30)	27 (25, 30)	0.30
Age at illness (days), median (IQR)	14 (8, 25.5)	12 (8, 22)	0.79
Gram negative organism, n (%)	24/84 (29)	17/68 (25)	0.62
Lowest systolic BP at illness onset (mmHg), mean (SD)	60.9 (15.7)	60.7 (15.3)	0.93
Lowest diastolic BP at illness onset (mmHg), mean (SD)	32.6 (13.6)	33.4 (10.9)	0.72
Lowest mean BP at illness onset (mmHg), mean (SD)	42.2 (13.4)	42.2 (11.9)	0.98
Highest heart rate at illness onset (bpm), mean (SD)	177.9 (14.1)	177.3 (15.3)	0.82
Highest FiO2 at illness onset (%), median (IQR)	40 (30, 55)	37 (28, 50)	0.33

Table 3: Process and outcome measures pre and post implementation.

Variable	Epoch 1 (n=88)	Epoch 2 (n=69)	p-value
Time to antibiotics (minutes), median (IQR)	66 (13.5, 111)	44 (15, 83)	0.11
Time to first 1 st BP measurement (minutes), median (IQR)	164 (70, 336)	47 (22, 109)	<0.01*
Number of BPs in 1 st 12 hours after sepsis onset, median (IQR)	3 (1, 9.5)	11 (7, 17)	<0.01*
Number of gases in 1 st 24 hours after sepsis onset, median (IQR)	3 (1, 4)	2 (2, 4)	0.76
Need for fluid bolus, n (%)	37 (42)	24 (35)	0.35
Time to first fluid bolus (minutes), median (IQR)	126 (58, 257)	47(21, 97)	<0.01*
Total fluid volume received in the first 48 hours (ml/kg), median (IQR)	20 (15,40)	20 (10,30)	0.15
Need for vasopressors/inotropes, n (%)	21(24)	9 (13)	0.09
Time to vasopressor/inotrope initiation (minutes), median (IQR)	385 (225, 549)	761 (236, 913)	0.24
Total duration of vasopressors/inotrope (hours) median (IQR)	39 (26, 55)	26 (16, 52)	0.33
Need for corticosteroids, n (%)	10 (11)	8 (12)	0.96
Presence of hypoxic respiratory failure, n (%)	23 (26)	18 (26)	0.99
Death within 7 days from sepsis onset, n (%)	10 (11)	8 (12)	0.96
Death before discharge, n (%)	9 (10)	11 (16)	0.29

Results

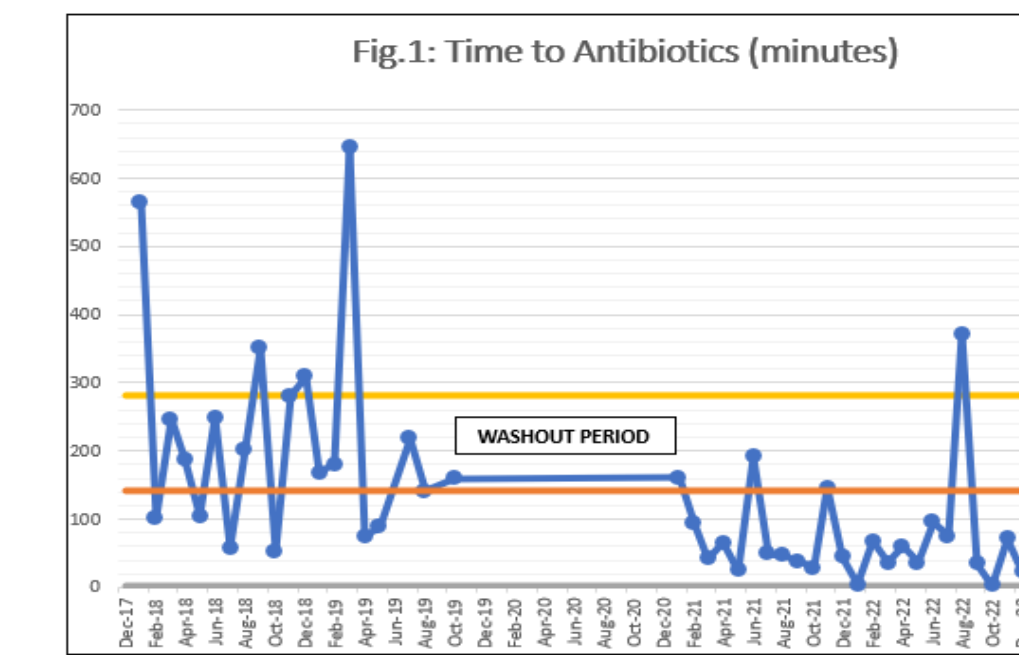


Figure 1: PROCESS MEASURE
Reduction in median time to antibiotic administration (66 vs 44 minutes).

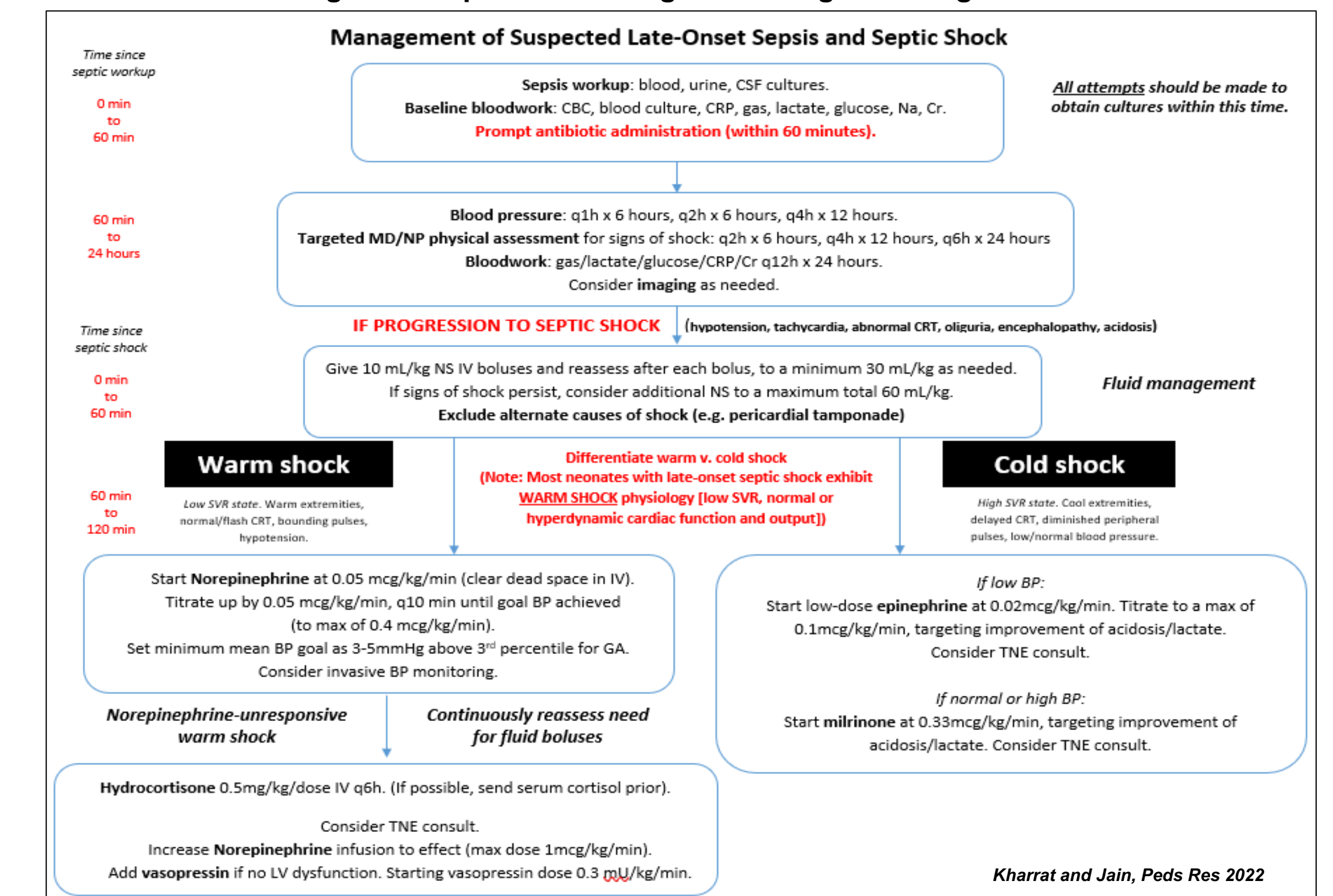
PROCESS MEASURES

- Time to initiation of BP monitoring: (median 164 vs 47 minutes, p <0.01)
- Frequency of BPs in first 12 hours: (median 11 vs 3 hours, p <0.01)
- Time to first fluid bolus in shock: (126 vs 47 minutes, p <0.01)

OUTCOME MEASURES

- No significant difference noted in episode-related mortality: (aOR 0.98, 95% CI [0.32, 2.96])
- BPD among survivors higher in Epoch 2: (aOR 9.38, [1.53-57.73])

Figure 2. Sepsis Monitoring and Management Algorithm



Conclusions

Implementation of a standardized sepsis care algorithm improved sepsis-related processes. Though there was no impact on mortality, only a small number of infants met this outcome. There was a higher BPD rate among survivors in Epoch 2, warranting further investigation.