1793

CLINICAL OUTCOMES AMONG FEBRILE INFANTS BEFORE AND AFTER IMPLEMENTATION OF BIOFIRE® FILMARRAY® PANELS

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BACKGROUND

The clinical benefits of multiplex polymerase chain reaction panels are not well defined. We evaluated outcomes among infants before and after implementation of the BioFire® FilmArray® Respiratory Panel 2 (RP2) and Meningitis Encephalitis Panel (MEP).

METHODS

Patient Population

- Febrile or hypothermic infants ≤90 days old presenting to our institution's Emergency Department

Study Design

- Observational, pre-post intervention study over 3 periods
- **Period 1:** 1/1/2011-12/31/2014; no clinical practice guideline (CPG) or rapid mPCR testing
- **Period 2:** 1/1/2015-4/30/2018; CPG available but no rapid mPCR testing
- **Period 3:** 5/1/2018-6/15/2019; both CPG and rapid mPCR testing available
- Statistical analyses were performed using Kruskal-Wallis and Pearson tests.

TABLE 1: PATIENT CHARACTERISTICS

Patient Characteristics	Period 1 n=2514 No guideline or rapid mPCR testing	Period 2 n=2082 Guideline available but no rapid mPCR testing	Period 3 n=721 Both guideline and rapid mPCR testing available
Number (%) male	1325 (52.7)	1116 (53.6)	410 (56.9)
Number (%) 0-28 days old	679 (27.0)	676 (32.5)	248 (34.4)
Number (%) 29-60 days old	1207 (48.0)	917 (44.0)	310 (43.0)
Number (%) 61-90 days old	628 (25.0)	489 (23.5)	163 (22.6)

DISCLOSURES: BioFire provided test kits and partial research support.

RESULTS

FIGURE 1: PATIENT POPULATION

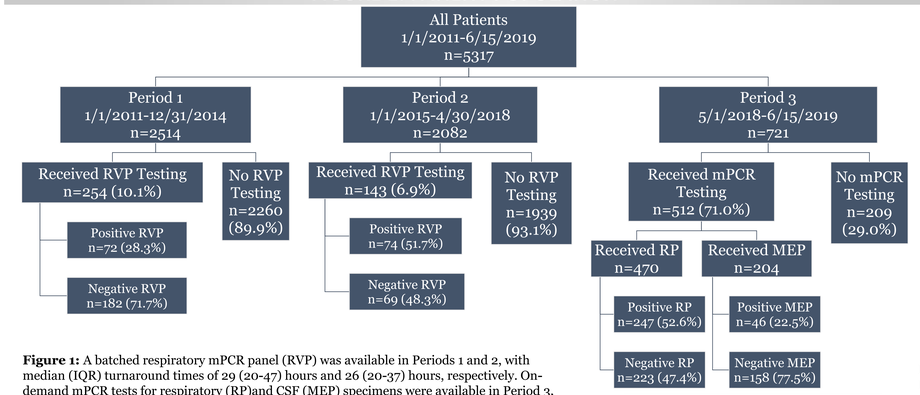


Figure 1: A batched respiratory mPCR panel (RVP) was available in Periods 1 and 2, with median (IQR) turnaround times of 29 (20-47) hours and 26 (20-37) hours, respectively. On-demand mPCR tests for respiratory (RP)and CSF (MEP) specimens were available in Period 3, with median (IQR) turnaround times of 1.6 (1.2-2.4) hours and 3.2 (2.4-6.3) hours, respectively. 162 patients in Period 3 received both the RP and MEP.

FIGURE 2: DETECTED PATHOGENS

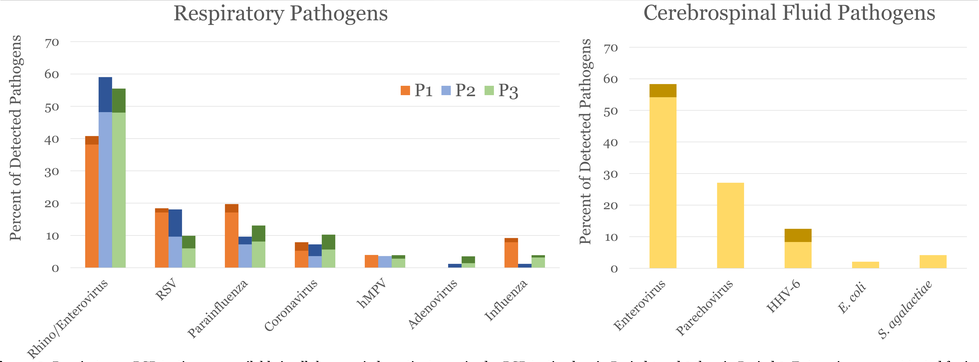
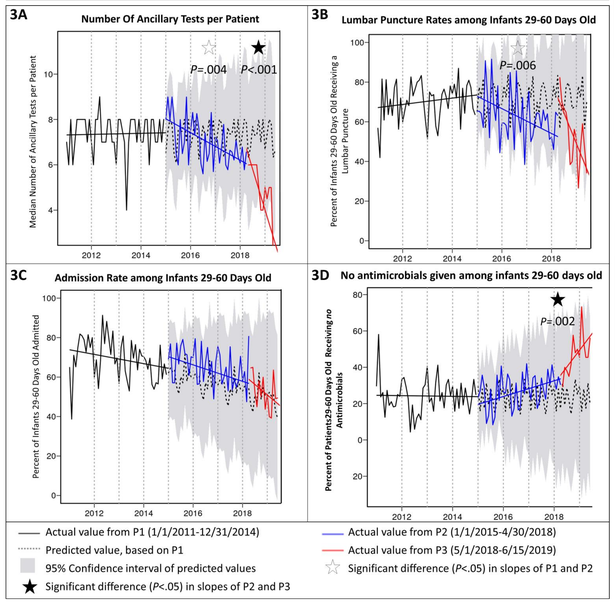


Figure 2: Respiratory mPCR testing was available in all three periods, patients received mPCR testing less in Period 1 and 2 than in Period 3. Enterovirus was not tested for in Periods 1 and 2, but it was co-detected enterovirus in Period 3. Cerebrospinal fluid mPCR testing was available only in Period 3. Darker colors represent co-detected pathogens.

FIGURE 3: INTERRUPTED TIME SERIES ANALYSES



Figures 3A-3D: Interrupted time series graphs displaying temporal trends across the three periods. Vertical dashed grey lines mark each January.
Figure 3A: Mean number of ancillary tests per patient per month over time. Ancillary tests include CBC, BMP, urinalysis, CSF cell count and chemistries, enterovirus PCR, RSV antigen, influenza antigen, HSV PCR, AST, ALT, total and direct bilirubin, and bacterial cultures.
Figure 3B: Percent of patients 29-60 days old per month receiving a lumbar puncture.
Figure 3C: Percent of patients 29-60 days old per month admitted to the hospital.
Figure 3A: Percent of patients 29-60 days old receiving no antimicrobials per month. Antimicrobials include acyclovir, ampicillin, cefepime, cefotaxime, ceftriaxone, gentamicin, oseltamivir, penicillin, and vancomycin.

TABLE 2: OUTCOMES, ALL PATIENTS

Outcomes	Period 1 n=2514	Period 2 n=2082	Period 3 n=721	P-value [a]
Admitted, number (%)	1610 (64.0)	1332 (64.0)	444 (61.6)	.45
Inpatient LOS, days, median (IQR)	1.9 (1.6-2.6)	1.8 (1.3-2.4)	1.7 (1.2-2.3)	<.001 [b,c]
Readmission within 30 days, number (%)	140 (5.6)	89 (4.3)	48 (6.7)	.03 [b,c,d]
Deaths within 30 days, number (%)	1 (0.0)	2 (0.1)	0 (0.0)	.57
Antimicrobial usage				
Received no antimicrobials [e], number (%)	785 (31.2)	674 (32.4)	311 (43.1)	<.001 [b,d]
Received single dose of 1-2 antimicrobials, number (%)	244 (9.7)	284 (13.6)	76 (10.5)	<.001 [b,c,d]
Antibiotic duration , days, median (IQR)	3.5 (2.0-4.2)	2.4 (1.1-3.4)	2.0 (1.0-2.7)	<.001 [b,c,d]
Antiviral duration , days, median (IQR)	1.4 (0.9-1.9)	1.0 (0.6-1.7)	1.0 (0.6-1.6)	<.001 [b,c]
Number of ancillary tests per patient, median (IQR)	7 (4-10)	7 (3-10)	4 (2-7)	<.001 [b,c,d]
Received chest radiograph, number (%)	687 (27.3)	350 (16.8)	77 (10.7)	<.001 [b,c,d]
Received lumbar puncture [f], number (%)	1529 (60.8)	1169 (56.1)	372 (51.6)	<.001 [b,c]

TABLE 3: OUTCOMES, P3 PATIENTS RECEIVING mPCR TESTING

Outcomes	Positive mPCR test	Negative mPCR test	P-value
Admitted, number (%)	166 (60.6)	194 (81.5)	<.001 [d]
Inpatient LOS, days, median (IQR)	1.5 (1.1-2.0)	1.9 (1.4-2.4)	<.001 [d]
Readmission within 30 days, number (%)	12 (4.4)	25 (10.5)	.008 [d]
Antimicrobial usage			
Received no antimicrobials, number (%)	122 (44.5)	51 (21.4)	<.001 [d]
Received single dose of 1-2 antimicrobials, number (%)	44 (16.1)	21 (8.8)	.01 [d]
Antibiotic duration , days, median (IQR)	1.8 (1.0-2.4)	2.4 (1.1-2.8)	<.001 [d]
Antiviral duration , days, median (IQR)	1.0 (0.7-1.3)	1.2 (0.6-1.7)	.41
Number of ancillary tests per patient, median (IQR)	4 (3-7)	6 (4-7)	<.001 [d]
Received chest radiograph, number (%)	40 (14.6)	27 (11.3)	0.28
Received lumbar puncture, number (%)	150 (54.7)	178 (74.8)	<.001 [d]

Tables 2 and 3: [a] P-value shown comparing all 3 periods; [b] Significant difference between all 3 periods, with P-value <.05; [c] Significant difference between P1 and P2, with P-value <.05; [d] Significant difference between P2 and P3, with P-value <.05; [e] % of patients 29-60 days old increased from 27.3% (P2) 47.4% (P3) after mPCR implementation; [f] Among patients 29-60 days old, lumbar puncture use decreased from 69.8% (P1) to 62.5% (P2) to 52.3% (P3); deaths not shown in table stratified by mPCR result because there were no deaths in Period 3.

CONCLUSIONS

- Among infants ≤90 days with fever or hypothermia, use of mPCR testing PLUS a clinical practice guideline provides more benefit than use of a guideline alone
  - Reduction in ancillary test and antimicrobial usage
  - Greatest benefit among infants 29-60 days old
- Infants with positive mPCR tests have shorter LOS, and fewer admissions, antimicrobials, ancillary tests, and LP's than those with negative mPCR tests.