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Comparable Detections of Viral Pathogens in Lower Respiratory Tract Specimens with the BioFire Respiratory Panel 2 and the BioFire Pneumonia Panel

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Multiplex PCR panels are powerful tools for rapid pathogen identification in patients with respiratory tract (RT) infections (1–6). In particular, analysis of upper respiratory tract (URT) specimens with the BioFire Respiratory Panel 2 (BRP2), which primarily targets viruses, decreases time to pathogen detection, duration of antibiotic use, and hospital length of stay (7, 8). In addition, many clinical laboratories have validated the BRP2 on lower respiratory tract (LRT) specimens (9, 10). Recently, the BioFire Pneumonia Panel (BPN) was shown to accurately identify viruses as well as a broader array of bacteria in LRT specimens (11, 12). Clinical laboratories must now determine if the BRP2 or the BPN or both should be included in the test menu for LRT specimens, but data comparing of these assays in this context are not available. Here, we evaluate the performance of the BRP2 and the BPN on LRT samples from adults at a tertiary care academic medical center.

To assess the performance of the BRP2 and the BPN, each assay was run on 200 consecutively available LRT specimens collected at a tertiary care academic medical center from July 2018 through November 2018 (Table 1). These samples were evaluated retrospectively, and results were not reported to clinicians. Positive percent agreement (PPA) and negative percent agreement (NPA) were calculated using the BRP2 as the predicate method. Confidence intervals were constructed

TABLE 1 Patient demographics and specimen information[a]

Parameter	Value(s)[b]
Patient demographics	
Median age in yrs (IQR)	60.0 (39.7–80.3)
Male	125
Female	74
Clinical information	
Immunocompetent	160
Immunocompromised	40
Spontaneous breathing	129
Mechanical ventilation	71
Intensive care unit	180
Emergency department	13
Other hospital floor	7
Specimen type	
Bronchoalveolar lavage	59
Bronchial wash	11
Sputum	54
Tracheal aspirate	76

[a]Patient sex was not specified for one specimen. IQR, interquartile range.
[b]Data represent numbers of patients except where otherwise specified.

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TABLE 2 BRP2 and BPN agreement[a]

Class	Target	No. of specimens				PPA (95% CI)	NPA (95% CI)
		BRP2 positive BPN positive	BRP2 positive BPN negative	BRP2 negative BPN positive	BRP2 negative BPN negative		
Viruses	Adenovirus	0	0	0	200	NA	100 (98–100)
	Coronavirus[b]	3	0	0	197	100 (44–100)	100 (98–100)
	Human metapneumovirus	3	0	0	197	100 (44–100)	100 (98–100)
	Human rhinovirus/enterovirus	6	1	3	190	86 (49–99)	98 (96–100)
	Influenza A virus	5	2	1	192	71 (36–95)	99 (97–100)
	Influenza B virus	4	0	0	196	100 (51–100)	100 (98–100)
	Parainfluenza virus	2	0	0	198	100 (18–100)	100 (98–100)
	Respiratory syncytial virus	4	1	0	195	80 (38–99)	100 (98–100)
Atypical bacteria	*Chlamydia pneumoniae*	0	0	0	200	NA	100 (98–100)
	Mycoplasma pneumoniae	1	0	0	199	100 (5–100)	100 (98–100)
Overall	Viruses	27	4	4	1,565	87 (71–95)	100 (99–100)
	Atypical bacteria	1	0	1	598	100 (5–100)	100 (99–100)

[a]BRP2, BioFire Respiratory Panel 2; BPN, BioFire Pneumonia Panel; PPA, positive percent agreement; NPA, negative percent agreement; NA, not applicable.
[b]Includes coronavirus HKU1, NL63, 229E, and OC43.

using the modified Wilson method implemented in DescTools package v0. 99.30 in R v3.5.2 (13–16).

Regarding pathogens included on both panels and aggregating results by class, the PPA was 87% for viral targets (95% confidence interval [CI], 71% to 95%) and 100% for atypical bacterial targets (95% CI, 5% to 100%) (Table 2). The NPA was 100% for both viral and atypical bacterial targets (95% CI, 99% to 100%). In addition, 151 typical bacterial species were identified by the BPN but not the BRP2 (of note, these targets are included only on the BPN).

With respect to discordant results, influenza A virus was solely detected by the BRP2 in two specimens and by the BPN in one. All three of these specimens were positive for influenza A virus by the Cepheid Xpert Xpress Flu/RSV PCR assay, although cycle threshold (C_T) values were near the limit of detection, suggesting low viral loads (Table 3) (17). Respiratory syncytial virus (RSV) was detected solely by the BRP2 in one specimen, which could not be evaluated by Flu/RSV PCR due to multiple invalid assay results. Rhinovirus/enterovirus was detected solely by the BRP2 in one specimen and by the BPN in three.

Here, we report that the BPN assay identified more typical bacterial pathogens in adult LRT specimens than the BRP2 while retaining comparable performance for viral targets. While agreement was also high among atypical bacterial targets, additional studies are needed given the small number of positive specimens. Overall, our results suggest that the BPN should be prioritized in the evaluation of LRT specimens and that simultaneous testing using both the BPN and the BRP2 is unlikely to result in clinically significant diagnostic gains.

TABLE 3 Specimens with discordant results[a]

Subject ID	Target	BRP2 result	BPN result	Specimen	Location	Cepheid Xpert Xpress FLU/RSV	C_T	
							Flu A1	Flu A2
WU006	Influenza A virus	Negative	Positive	Bronchoalveolar lavage fluid	Non-ICU	Positive	37.8	39.8
WU109	Influenza A virus	Positive	Negative	Tracheal aspirate	ICU	Positive	38.7	0
WU136	Influenza A virus	Positive	Negative	Tracheal aspirate	ICU	Positive	34.8	0
WU038	Rhinovirus/enterovirus	Negative	Positive	Bronchoalveolar lavage fluid	ICU	Not tested	NA	NA
WU052	Rhinovirus/enterovirus	Negative	Positive	Sputum	ICU	Not tested	NA	NA
WU154	Rhinovirus/enterovirus	Negative	Positive	Sputum	ICU	Not tested	NA	NA
WU054	Rhinovirus/enterovirus	Positive	Negative	Sputum	ICU	Not tested	NA	NA
WU014	RSV	Positive	Negative	Tracheal aspirate	ICU	Invalid	NA	NA

[a]ID, identifier; BRP2, BioFire Respiratory Panel 2; BPN, BioFire Pneumonia Panel; C_T, cycle threshold; Flu A1, influenza A virus target 1; Flu A2, influenza A virus target 2; ICU, intensive care unit; NA, not applicable; RSV, respiratory syncytial virus.

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