Evaluation of polymerase chain reaction respiratory panel testing in antibiotic decision making

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INTRODUCTION

- Diagnostic testing is widely used to limit the time from presentation to appropriate treatment.
- Polymerase chain reaction (PCR) respiratory panel is used in practice to determine a bacterial or viral etiology of a patient's respiratory illness.
- The BioFire FilmArray PCR rapidly detects 20 common viral and bacterial respiratory pathogens as an in-house lab which results in ~1 hour.
- The Diatherix PCR detects 31 viral and bacterial respiratory pathogens as a send-out lab which results in ~8 hours.
- The objective of this study was to evaluate the clinical utility in antibiotic (ABX) decision making based on the BioFire FilmArray Respiratory Panel compared to Diatherix PCR.

METHODS

- A retrospective chart review was conducted using the electronic EHR at a large community hospital from January 1, 2019 to June 30, 2019.
- Patients greater 18 years old were included if they had a BioFire FilmArray PCR ordered and resulted during study period.
- Participants who were pregnant, from outside hospitals, had inappropriate sources or sample amounts, or died during admission were excluded
- Data collected included demographics, diagnosis, length of stay, 30 day readmission, physician specialty, collection source, and PCR results.
- Records were analyzed to determine if an BioFire results were utilized to change therapy
- Examples of an appropriate test utilization include:
  - PCR positive for viral pathogen prompts antibiotic discontinuation
  - PCR positive for atypical bacteria prompts initiation or continuation of a macrolide, fluoroquinolone or tetracycline.
  - Negative PCR prompts appropriate antibiotics continued for non-respiratory panel result reasons
- Results were compared to historical data collected on Diatherix TEM-PCR to evaluate if there were differences in type of test on action taken
- Chi-squared test was used, a *p*-value <0.05 was considered significant

RESULTS

- A total of 274 BioFire and 195 Diatherix Respiratory Panels were ordered during pre-specified study periods
  - After exclusions were made, a total of 251 BioFire and 118 Diatherix Respiratory Panels were evaluated.
- With the implementation of BioFire, the percentage of appropriate source collection significantly improved (p=0.033).
- Collectively, ID (p=0.134) and non-ID providers (p=0.265) had a similar pattern of PCR utilization.
- After transitioning from Diatherix to BioFire, there was a decrease in the utilization of test results (44.1%, 34.7%, respectively). This result was not statistically significant.
- Of the panels evaluated (n=369), PCR results were not utilized in 230 (62.3%) cases.

DISCUSSION

- We anticipated BioFire to improve antibiotic decision making and clinical outcomes as compared to Diatherix due to the oversight of in-house testing.
- The implementation of BioFire significantly improved appropriate source collection for PCR respiratory testing
- Based on the results of this study, the transition to BioFire testing did not improve utilization
- The overall utilization of respiratory PCR testing to drive antibiotic decision making at our facility was 37.7%. This low percentage of action based on PCR results was an unexpected finding of this evaluation.
- An evaluation of best practices with regard to PCR respiratory testing is needed to achieve better utilization among providers
- Additionally, a cost effectiveness analysis is warranted based on the results of this evaluation.

Respiratory panel **PCR results** were used to **guide antibiotic decision-making** in **one-third** of patients.

TABLE OF RESULTS

	Diatherix	BioFire	*p*-value
Total Number Ordered	n=195	n=274	
Physician Specialty			
Infectious Disease	40 (20.5%)	84 (30.7%)	
Nurse Practitioner	20 (10.3%)	72 (26.3%)	
Internal Medicine	7 (3.6%)	75 (27.4%)	
Hospitalist	61 (31.3%)	20 (7.3%)	
Resident Physician	35 (17.9%)	5 (1.6%)	
Pulmonology/Critical Care	17 (8.7%)	16 (5.8%)	
Other	15 (7.7%)	2 (0.7%)	
Appropriate Source	180 (92.3%)	265 (96.7%)	0.033
Total Number Excluded	77	23	
Outside hospital	39 (50.6%)	12 (52.2%)	
Inappropriate source/sample	15 (19.5%)	10 (43.5%)	
Death	23 (29.9%)	1 (4.3%)	
Total Number Evaluated	118	251	
Test results utilized	52 (44.1%)	87 (34.7%)	0.082
Test results not utilized	66 (55.9%)	164 (65.3%)	
Number Evaluated by Specialty			
Infectious Disease	27	78	
Test results utilized	13 (48.1%)	25 (32.1%)	0.134
Test results not utilized	14 (51.9%)	164 (65.3%)	
Non-infectious disease	91	173	
Test results utilized	39 (42.9%)	62 (35.8%)	0.265
Test results not utilized	52 (57.1%)	111 (64.2%)	
Sig. Diff. by Test & Provider Type	*p*=0.627	*p*=0.559	

DISCLOSURES

Authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

REFERENCES

- Keske, Ş., Ergönül, Ö., Tutucu, F., Karaaslan, D., Palaoğlu, E., & Can, F. (2018). The rapid diagnosis of viral respiratory tract infections and its impact on antimicrobial stewardship programs. *European Journal of Clinical Microbiology & Infectious Diseases*, *37*(4), 779–783. doi: 10.1007/s10096-017-3174-6. [cited 25 Sept. 2019].
- Azadeh, N., Sakata, K. K., Saeed, A., Mullon, J. J., Grys, T. E., Limper, A. H., & Binnicker, M. J. (2018). Comparison of Respiratory Pathogen Detection in Upper versus Lower Respiratory Tract Samples Using the BioFire FilmArray Respiratory Panel in the Immunocompromised Host. *Canadian Respiratory Journal*, *2018*, 1–6. doi: 10.1155/2018/2685723. [cited 25 Sept. 2019].
- Huang, H.-S., Tsai, C.-L., Chang, J., Hsu, T.-C., Lin, S., & Lee, C.-C. (2018). Multiplex PCR system for the rapid diagnosis of respiratory virus infection: systematic review and meta-analysis. *Clinical Microbiology and Infection*, *24*(10), 1055–1063. doi: 10.1016/j.cmi.2017.11.018. [cited 25 Sept. 2019].
- Leber, A. L., Everhart, K., Daly, J. A., Hopper, A., Harrington, A., Schreckenberger, P., … Kensinger, B. (2018). Multicenter Evaluation of BioFire FilmArray Respiratory Panel 2 for Detection of Viruses and Bacteria in Nasopharyngeal Swab Samples. *Journal of Clinical Microbiology*, *56*(6). doi: 10.1128/jcm.01945-17. [cited 25 Sept. 2019].
- Gardiner, B., Parker, C., Rabson, A., Snydman, D., & Doron, S. (2018). Evaluation of a two-stage testing algorithm for the diagnosis of respiratory viral infections. *Diagnostic Microbiology and Infectious Disease*, *91*(4), 319–323. doi: 10.1016/j.diagmicrobio.2018.03.007. [cited 25 Sept. 2019].