PIONEERING DIAGNOSTICS

EXCLUSIVE

LEARNING LOUNGE EXCLUSIVE:

Using Identification and Antimicrobial Susceptibility Testing to Reinvigorate Antimicrobial Stewardship

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Have we reached a new tipping point in the fight against antimicrobial resistance (AMR)?

In the early stages of the COVID-19 pandemic, there was a significant degree of uncertainty as the virus rapidly spread and manifested itself with varying signs and severity across healthcare centers. Subsequently, healthcare providers were overwhelmed with increased patient volumes and workflow challenges. Left with limited resources and treatment options, many clinicians tried an "anything and everything" approach in handling COVID-19 – one that likely led to the overprescribing and/or misuse of antibiotics. In 2020, it was reported that outpatient antibiotic use increased to ~54% compared to 2019. At least one antibiotic was prescribed for 91.04%, 83.05%, and 73.52% of COVID-19 outpatients during 2020, 2021, and the first half of 2022, respectively.[1] Luckily, as we continue to emerge from the pandemic, antibiotic use has slightly declined from 71.1% in 2020 to 62.1% in 2022.[2]

The magnitude of which the pandemic has negatively impacted public health efforts to combat AMR has likely not yet peaked and is still being evaluated across healthcare centers. However, it is almost inevitable that the rate of emerging AMR has significantly increased in comparison to pre-pandemic levels. If we are to course correct and attempt to offset this unavoidable increase, reprioritizing antimicrobial stewardship (AMS) efforts in healthcare systems and utilizing proven diagnostic solutions to support better antibiotic prescribing is imperative.

Faced with a limited novel antibiotic development pipeline, rapid identification and antibiotic susceptibility tests (ID/AST) can improve diagnosis and help decide the right antibiotic for the right patient at the right time and for the right duration.

An Opportunity For Change

While resources were likely redirected from ID/AST programs to focus on alleviating the burden and strain caused by COVID-19, recent studies serve as a prominent reminder of the proven value and need of ID/AST for healthcare professionals in diagnosing and advancing patient care. A systematic review and meta-analysis found that the overall prevalence of bacterial co-infections within the context of COVID-19 was 11% (95% CI 8%-16%). However, within this study, empiric antibiotic usage was determined to be 62% (95% CI 8%-16%). The authors noted that in their search analysis, there was little information associated with stewardship measures and practices; and thus, concluded that there was a need for clinical guidelines to promote ID/AST in patients admitted to the hospital with severe COVID-19. Simply put, bacterial co-infections with COVID-19, while important, are quite infrequent.[3] Another publication noted a correlation between multi-drug resistant bacterial co-infections and admission to the ICU and advocated for more attention and caution in prescribing antibiotics for COVID-19 patients. However, during the pandemic, there was likely an overuse of empiric antibiotics. It is reasonable to assume that better clinical diagnostics and antimicrobial susceptibility testing could have potentially reduced the overuse of antibiotics.[4]

Theoretically, determining the right antibiotic at the right time could enable clinicians to rapidly switch from empiric, i.e. broad spectrum antibiotics, to more tailored narrow spectrum antibiotics.

Faster Diagnosis. Optimized Treatment. Improved Outcomes.

Through the increased sensitivity and specificity of ID/AST, healthcare professionals can ideally achieve better patient outcomes. By taking a syndromic approach and using MALDI-TOF (matrix-assisted laser desorption ionization–time of flight mass spectrometry) and/or multiplex PCR (polymerase chain reaction) technologies, clinicians can often receive faster and more precise results. The benefits provided by integrating robust ID/AST programs within clinical practices, especially via a team approach, helps contribute to more efficient workflows that deliver timely results, leading to more accurate diagnoses, and optimized treatment for improved patient outcomes. Banerjee and colleagues compared rapid multiplex PCR testing alone to a combination approach of multiplex PCR in conjunction with an antimicrobial stewardship (AMS) model achieved via traditional AST. Although the rapid multiplex PCR provided faster clinical results, employing a team approach of both rapid multiplex PCR *plus* an AMS model provided faster, tailored antimicrobial therapy for improved patient care.[5]

See Figure 2 below, adapted from Banerjee et al, 2015[5]:

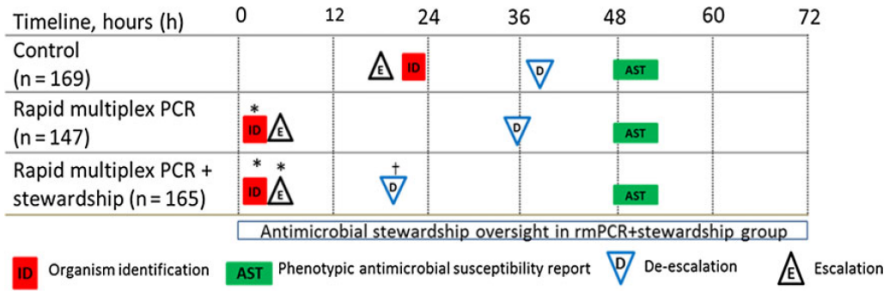

Figure 2. Comparison of time to organism identification, availability of phenotypic antimicrobial susceptibility results, and first appropriate modification of antimicrobial therapy for the subset of study subjects with organisms represented on the rapid multiplex polymerase chain reaction (rmPCR) panel (n = 481). Time 0 is when the positive Gram stain result was reported. Median time in hours (interquartile range [IQR]) to organism identification: control 22.3 (17–28), both rmPCR and rmPCR + stewardship 1.3 (0.9–1.6); de-escalation: control 39 (19–56), rmPCR 36 (22–61), rmPCR + stewardship 20 (6–36); escalation: control 18 (2–63), rmPCR 4 (1.5–24), rmPCR + stewardship 4 (1.8–9). *$P < .05$ vs control; †$P < .05$ vs control and rmPCR groups.

Additionally, Cybulski et al, conducted a multicenter prospective study comparing the BIOFIRE® FILMARRAY® Gastrointestinal (GI) Panel with a conventional stool culture. Patients diagnosed utilizing the BIOFIRE GI Panel were more likely to receive targeted, rather than empirical, therapy compared to those diagnosed by culture only (P = .0148). The BIOFIRE GI Panel markedly improved clinical sensitivity in patients with acute diarrhea, identified cases with clinical acuity comparable to identification by culture, and enabled clinicians to make more timely and targeted therapeutic decisions.[6]

The use of diagnostic solutions such as ID/AST can help lead to shorter hospital stays, and potentially fewer adverse-related effects from mis-use of antibiotic therapy; or inappropriate antibiotic therapy.[5-7]

The Economic Value

Effective ASP and implementation of new or improved diagnostic solutions requires going beyond evaluation of clinical outcomes and presenting economic advantages as well. For example, Beal et al, showed improved healthcare costs with a multiplex PCR gastrointestinal syndromic panel. Unnecessary antibiotic and testing costs were avoided, resulting in an approximate cost savings of $291 per patient.[7]

Moon et al, conducted a retrospective observational study to assess the relationship between diagnostic methods (traditional work-up [TW], multiplex PCR panel with, <12 target pathogens [PCR<12], or multiplex PCR panel with >12 target pathogens [PCR12]), diagnostic yield, healthcare resource use (HRU), and cost in adult outpatients visiting U.S. hospitals for acute infectious gastroenteritis (AGE). The authors found that large multiplex PCR panels were associated with lower 30-day AGE-related follow-up costs and risk of AGE-related hospitalization, and increased diagnostic yield compared to TW.[8]

Another study by Gilbert et al, involved the comparison of a multi-test bundle (MTB) versus the BIOFIRE® FILMARRAY® Pneumonia (PN) Panel in patients admitted for community acquired pneumonia (CAP). The primary endpoint was the percentage of potential pathogens detected using the MTB (8 viral and 6 bacterial targets) versus the BIOFIRE PN Panel (8 viral and 18 bacterial targets). Results indicated a cost savings of $58.50 per patient utilizing the BIOFIRE PN Panel approach, partially because three nasal swab PCRs and the two urine antigen tests would no longer be needed.[9]

Stewardship Is Rooted In Collaboration

While traditional diagnostic testing methods often remain the default, the overall benefits of innovative ID/AST solutions offer greater improvements and stronger, more reliable results to inform clinical decision-making and impact AMS programs. AMS, by most definitions, is a team approach fueled by coordinated interventions, and combining ID/AST with rapid pathogen identification, such as MALDI-TOF and/or PCR, further demonstrates and advances this concept. Through optimization of diagnostics, more targeted patient therapy becomes possible, leaving less opportunity for resistance to arise, thereby reducing overuse or misuse of antibiotics, and ideally leading to better patient outcomes.

Chris Groke, PharmD, BCPS, BCIDP *is a clinical infectious diseases pharmacist with over 30 years of experience in pharmacy practice and management. He earned a Bachelor of Science in Pharmacy from Auburn University, and completed his hospital pharmacy residency at Richland Memorial Hospital in Columbia, SC. He then completed his Doctor of Pharmacy at the Medical University of South Carolina in Charleston, SC, where his research focused on unit-specific antimicrobial susceptibility patterns and he was active in developing one of the first unit-specific antibiograms for the infectious diseases service.*

Dr. Groke is a senior medical science liaison at bioMérieux. He is Board Certified in Pharmacotherapy and Infectious Diseases, has held numerous practice and leadership roles, and is an active member of multiple professional pharmacy societies, having served as president of the South Carolina Society of Health-System Pharmacists and delegate of the American Society of Health-System Pharmacists.

Stephen Vella, PhD *earned a Bachelor of Science in Microbiology from Indiana University and went on to study bacterial cell wall synthesis in Streptococcus pneumoniae. He then completed his PhD in Microbiology at the University of Georgia, where he studied the parasitology of toxoplasmosis and coauthored 13 publications.*

Dr. Vella is a medical science liaison at bioMérieux, specializing in molecular biology and serving as US-lead for the BIOFIRE® FILMARRAY® Joint Infection (JI) Panel, with a supporting role for the BIOFIRE® FILMARRAY® Gastrointestinal (GI) Panel and bioMérieux's cloud-based NGS platform, EPISEQ® CS.

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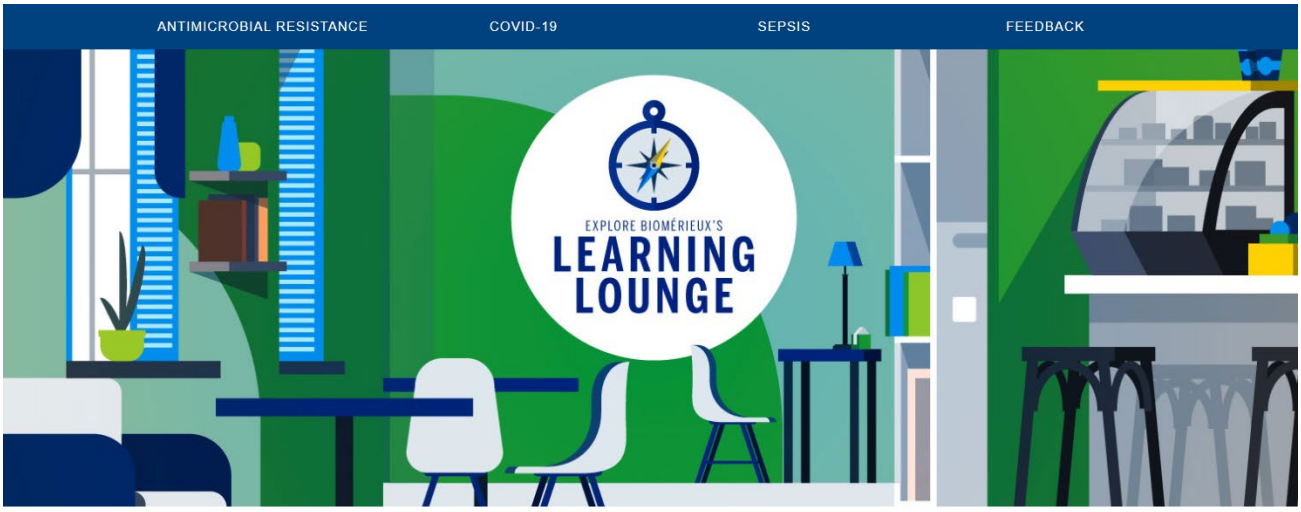

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