



LEARNING LOUNGE EXCLUSIVE:

Sepsis Care Diminished by Antimicrobial Resistance



Editorial by :

Sébastien Spinali, MD

Vice President, Global Marketing – Microbiology Solutions
bioMérieux

The escalating threat of antimicrobial resistance (AMR) presents a significant challenge to the effective and timely treatment of sepsis, a life-threatening condition resulting from a dysregulated response to infection.¹ As AMR continues to rise, the options for viable antimicrobial therapies diminish, leading to increased mortality rates among patients with critical infections. The standard practice of administering broad-spectrum antibiotics quickly — often before a definitive diagnosis is made — creates tension between urgent sepsis management and the principles of antimicrobial stewardship (AMS), which seeks to optimize antibiotic use to prevent further resistance. To navigate this complex landscape, there is an urgent need for innovative diagnostic tools and refined treatment protocols that enable healthcare providers to achieve optimal patient outcomes while adhering to AMS guidelines, balancing prompt treatment of septic infections with judicious antibiotic use.

Current State of Sepsis Management

Sepsis remains a critical global health challenge, responsible for approximately 11 million deaths annually worldwide.² The urgent nature of septic infections necessitates timely intervention, often encouraging the use of broad-spectrum antibiotics. In countries such as the United States, current guidelines emphasize prompt action, recommending the administration of antimicrobials within one hour of sepsis recognition.³ This approach, while potentially lifesaving, requires careful consideration to balance immediate patient needs with long-term public health implications. Of significant concern is the development of multidrug-resistant organisms (MDROs), which can occur even when these resistant pathogens were not initially present.⁴ This phenomenon is part of the broader issue of AMR, where bacteria evolve to resist the effects of antibiotics, thereby reducing viable treatment options and increasing the risk of disease spread, severe illness, and mortality.⁵



There is no singular solution for the diagnosis of sepsis, where a diverse array of pathogens can underlie septic infections, each potentially requiring different treatment approaches. Consequently, healthcare professionals must navigate a complex decision-making process, weighing the urgency of immediate broad-spectrum antibiotic administration against the need for more targeted therapy once the causative pathogen is identified. Advancements in clinical diagnostic techniques, structured de-escalation protocols, and multidisciplinary collaboration are being implemented to optimize antibiotic use in sepsis patient management.

Due to the urgent nature of sepsis, some patients may begin treatment despite the lack of immediate need.¹ To address this conflict and limit antibiotic use in non-infective cases, several strategies can be implemented.

Recommendations For Balancing Sepsis Management and Antimicrobial Stewardship

1. **Integration of Better Diagnostic Tools.** Enhance sepsis quality improvement initiatives by incorporating fast and actionable diagnostic tools, such as polymerase chain reaction (PCR) and procalcitonin assays, to promptly distinguish non-bacterial infections and reduce unnecessary antibiotic utilization.
2. **Antibiotic De-escalation Protocols.** Implement protocols for antibiotic de-escalation within 48 to 72 hours, guided by patient response and diagnostic test results, to optimize and narrow the spectrum of antibiotic therapy.
3. **Evidence-Based Shortened Antibiotic Courses.** Adopt guidelines advocating for abbreviated antibiotic courses, complemented by automated clinical decision support reminders, to facilitate judicious reduction of antimicrobial treatment duration.
4. **Clinical Decision Support Systems.** Implement clinical decision support systems incorporating comprehensive sepsis management pathways, which include critical junctures for reassessing the necessity of ongoing antimicrobial therapy, supported by multidisciplinary team evaluations.
5. **Continuous Education and Feedback.** Institute continuous educational programs on AMS principles, coupled with systematic audits of antibiotic utilization patterns and provision of regular, constructive feedback to clinicians, to ensure optimal implementation of updated protocols in clinical practice.
6. **Utilize Regional Microbial Patterns.** Integrate comprehensive evaluation of local microbial epidemiology and antibiotic susceptibility patterns to inform empirical antibiotic selection to optimize therapeutic efficacy and mitigate antimicrobial resistance.

The implementation of these evidence-based recommendations aims to strike a crucial balance between effective sepsis management and adherence to AMS principles. This multifaceted approach underscores the importance of a dynamic, data-driven strategy in addressing the complex challenges posed by sepsis management in the context of global AMS efforts.

Diagnostics Can Help Mitigate AMR Risks in Sepsis Patients

In the realm of sepsis management, the emergence of AMR poses a significant challenge to effective treatment. Traditional diagnostic methods such as blood cultures, while still considered the standard of care, are limited by their prolonged turnaround time and potential lack of accurate sensitivity testing.¹ This delay may lead to inappropriate antibiotic use which is associated with a significant increased mortality risk in sepsis cases, particularly in the presence of resistant organisms.⁶



Recent advancements in diagnostic technologies are revolutionizing sepsis and especially bloodstream infections management by enabling faster and more precise identification of pathogens and their resistance profiles, allowing for targeted treatments.⁷ Innovative Antimicrobial Susceptibility Testing (AST) solutions such as VITEK® REVEAL™ and multiplex PCR panels such as BIOFIRE® BCID 2 are at the forefront of this diagnostic evolution. For instance, the VITEK REVEAL system can provide results in less than 6 hours⁽⁸⁾ while the BIOFIRE BCID 2 panels can deliver results within one hour.⁹ These fast and accurate diagnostics allow for more targeted patient therapy to potentially reduce unnecessary use of broad-spectrum antibiotics, help combat resistance development, and minimize adverse effects.

While high-income countries are adopting these advanced technologies, low- and middle-income countries (LMICs) face unique challenges in implementing such systems. However, there are strategies to improve sepsis and bloodstream infections diagnosis in resource-limited settings while maintaining AMS principles. These include standardizing blood culture collection protocols to reduce contamination, enhancing laboratory infrastructure with cost-effective systems, and providing targeted medical training for healthcare professionals.¹⁰

As technologies continue to evolve, they promise to transform the landscape of sepsis management, offering hope for improved patient outcomes while simultaneously addressing the growing concern of AMR. The integration of these innovative diagnostic tools into clinical practice represents a crucial step in the ongoing battle against sepsis and antimicrobial resistance.

Economics and Policy Change

The economic impact of sepsis is substantial, with hospital-wide costs exceeding \$32,000 (USD) per patient in high-income countries.¹¹ This significant financial burden, coupled with increasing costs and diminishing economic viability of antimicrobial drug development, has led to a concerning trend of major pharmaceutical companies withdrawing from the field.¹ These factors underscore the urgent need for policy changes and innovative approaches to address the challenges of sepsis management in the context of rising AMR.

In response to these challenges, initiatives such as the PASTEUR Act in the United States have been proposed to incentivize investment in antimicrobial drug development while establishing grant programs to support AMS action plans.¹² Such policies aim to create a more sustainable ecosystem for antibiotic development and use, addressing both the economic hurdles faced by pharmaceutical companies and the public health need for effective antibiotics. By combining incentives for drug development with support for stewardship programs, these initiatives strive to balance the need for new antibiotics with the imperative to preserve the effectiveness of existing ones.

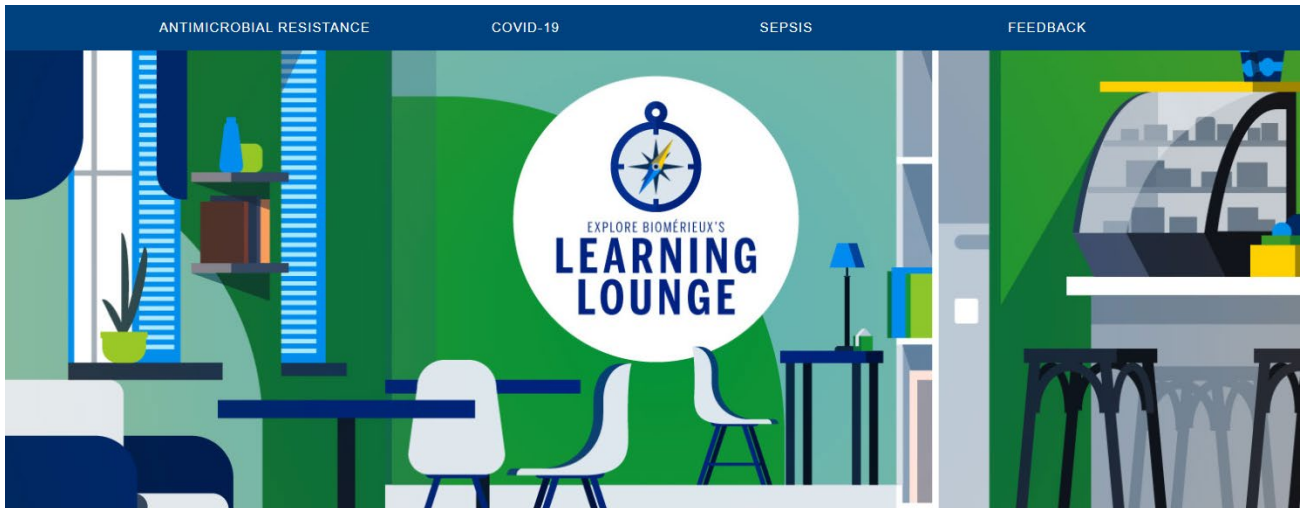
Conclusion

The intersection of sepsis management and AMR presents a level of complexity that requires a multifaceted approach. The integration of fast and actionable diagnostics, refined treatment protocols, and innovative policy measures offers a promising path forward. As healthcare professionals, we must remain vigilant in our efforts to balance prompt sepsis treatment with judicious antibiotic use. By embracing technological advancements, implementing robust AMS programs, and supporting policies that incentivize drug development, we can work towards a future where sepsis care is not diminished by AMR.



References

- ¹ Kumar NR, Balraj TA, Kempegowda SN, Prashant A. Multidrug-resistant sepsis: A critical healthcare challenge. *MDPI*. January 4, 2024. <https://www.mdpi.com/2625634>
- ² Allen M, Allen M. Deadly sepsis and antibiotic-resistant bacteria are in Europe's crosshairs. *Horizon Magazine*. November 16, 2023. <https://projects.research-and-innovation.ec.europa.eu/en/horizon-magazine/deadly-sepsis-and-antibiotic-resistant-bacteria-are-europes-crosshairs>
- ³ Evans L;Rhodes A;Alhazzani W;Antonelli M;Coopersmith CM;French C;Machado FR;Mcintyre L;Ostermann M;Prescott HC;Schorr C;Simpson S;Wiersinga WJ;Alshamsi F;Angus DC;Arabi Y;Azevedo L;Beale R;Beilman G;Belley-Cote E;Burry L;Cecconi M;Centofanti J;Coz Yataco . Surviving sepsis campaign: International guidelines for management of sepsis and septic shock 2021. *Intensive Care Medicine*. October 2, 2021. <https://pubmed.ncbi.nlm.nih.gov/34599691/>
- ⁴ Maia M de O, da Silveira CDG, Gomes M, et al. Multidrug-resistant bacteria on critically ill patients with sepsis at hospital admission: Risk factors and effects on hospital mortality. *Infection and Drug Resistance*. March 23, 2023. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10042244/>
- ⁵ Murugaiyan J, Kumar PA, Rao GS, et al. Progress in alternative strategies to combat antimicrobial resistance: Focus on antibiotics. *Antibiotics* (Basel, Switzerland). February 4, 2022. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8868457/>
- ⁶ Daneman N, Fridman D, Johnstone J, Langford BL, Lee SM, MacFadden DM. Antimicrobial resistance and mortality following *E. coli* bacteremia. *eClinical Medicine*. February 2023. [https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370\(22\)00510-7/fulltext](https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(22)00510-7/fulltext)
- ⁷ Bradley Z, Bhalla N. Point-of-care diagnostics for sepsis using clinical biomarkers and microfluidic technology. *Science Direct*. May 1, 2023. <https://doi.org/10.1016/j.bios.2023.115181>
- ⁸ Tibbetts R, George S, Burwell R, et al. Performance of the reveal rapid antibiotic susceptibility testing system on gram-negative blood cultures at a large Urban Hospital. *Journal of Clinical Microbiology*. June 15, 2022. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9199398/>
- ⁹ Senok A, Dabal LA, Alfaresi M, et al. Clinical impact of the BIOFIRE Blood Culture Identification 2 panel in adult patients with bloodstream infection: A multicentre observational study in the United Arab Emirates. *Diagnostics* (Basel, Switzerland). July 21, 2023. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10378530/>
- ¹⁰ Ombelet S, Barbé B, Affolabi D, et al. Best practices of blood cultures in low- and middle-income countries. *Frontiers in Medicine*. June 18, 2019. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6591475/>
- ¹¹ Sepsis. *World Health Organization*. May 3, 2024. <https://www.who.int/news-room/fact-sheets/detail/sepsis>
- ¹² Text - S.2076 - 117th Congress (2021-2022): Pasteur Act of 2021 | Library of Congress. *Congress.gov*. 2021. <https://www.congress.gov/bills/117th-congress/senate-bill/2076/text>



Explore bioMérieux's Learning Lounge

On-demand information and insights on the latest diagnostic advancements in patient care for Antimicrobial Resistance, Sepsis, and COVID-19.

go.biomerieux.com/LearningLounge

Never Miss An Update

Subscribe to the [Learning Lounge Highlights](#) quarterly email today!

