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ACUTE INFECTIONS IN THE INTENSIVE CARE UNIT: TRENDS AND CHALLENGES IN THE 21ST CENTURY

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Acute infections in the Intensive Care Unit (ICU) pose a critical threat to patient survival and healthcare systems globally. As we progress through the 21st century, the landscape of infectious diseases in the ICU has evolved dramatically due to changing pathogen profiles, increased antimicrobial resistance (AMR), and heightened patient complexity. This abstract provides an overview of key trends, emerging challenges, and essential strategies for addressing acute infections in critical care settings.

One of the most concerning trends is the rise of multidrug-resistant (MDR) organisms, including carbapenem-resistant Enterobacterales, methicillin-resistant *Staphylococcus aureus* (MRSA), and *Acinetobacter baumannii*. These pathogens complicate empirical treatment choices, increase morbidity and mortality, and place substantial financial strain on hospitals. Additionally, ICU patients often immunocompromised, mechanically ventilated, or catheterized are particularly vulnerable to healthcare-associated infections (HAIs), including ventilator-associated pneumonia (VAP), central line-associated bloodstream infections (CLABSIs), and catheter-associated urinary tract infections (CAUTIs).

New infectious threats have emerged, driven by globalization, climate change, and evolving microbial ecology. Diseases such as COVID-19, avian influenza, and fungal pathogens like *Candida auris* have infiltrated ICUs worldwide, revealing gaps in preparedness and infection control. Critical care clinicians now face not only bacterial but increasingly viral, fungal, and polymicrobial infections, often underpinned by immune dysregulation and sepsis.

The challenges of diagnosing and managing acute infections in the ICU are compounded by delays in microbiologic identification, limitations in predictive biomarkers, and overlapping clinical presentations with non-infectious syndromes. Precision medicine tools, including rapid molecular diagnostics and AI-driven infection prediction models, show promise in guiding timely interventions but require broader implementation and validation.

Strategies for improving outcomes encompass a multifaceted approach, integrating antimicrobial stewardship, enhanced infection prevention measures, and continuous surveillance. Stewardship efforts must tailor empiric therapy to local epidemiology while prioritizing de-escalation based on culture results. Meanwhile, interdisciplinary collaboration including infectious disease specialists, microbiologists, and critical care teams remains vital for comprehensive patient management. Looking forward, the path to combating acute infections in the ICU hinges on innovation, education, and policy support. Prioritizing investments in antimicrobial research, expanding global health security frameworks, and strengthening ICU capacity particularly in low- and middle-income countries will be essential. Ultimately, a combination of technological advancements, clinical vigilance, and public health commitment will determine our ability to face the evolving challenges of infectious diseases in critical care.

Keywords: Infection, ICU, Trends, Challenges.