

Preventing Transmission of Multidrug-Resistant Pathogens in the Intensive Care Unit

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KEYWORDS

• Intensive care unit • Infection control • Transmission • Drug resistance

KEY POINTS

- Multidrug-resistant organisms (MDRO) pose an increasing threat to critically ill patients.
- Patients, healthcare personnel, and the built environment of the intensive care unit are potential reservoirs for transmission of MDRO.
- Meticulous hand hygiene, environmental disinfection, chlorhexidine baths, and other infection control measures can interrupt spread of MDRO.
- Antimicrobial stewardship is an essential tool for improving quality of care and reducing selective pressure that promotes emergence of multidrug resistance.
- While infections with MDRO are becoming more difficult to treat with available antimicrobial drugs, intensive care unit staff can combat their spread by optimizing basic measures that are known to be effective.

INTRODUCTION

Intensive care unit (ICU) beds in the United States are increasing as a proportion of all hospital beds, reflecting increasing need for critical care, particularly among neonates and the elderly.¹ Although nosocomial infections complicate 4% of overall hospital admissions,² 9% to 20% of critically ill patients develop infections while in the ICU.²⁻⁴ Nearly half of all health care-associated infections that occur in hospitals are attributable to the ICU.² At the same time, the proportion of nosocomial infections caused by multidrug-resistant organisms is increasing, limiting treatment options and increasing length of stay, mortality, and cost.⁵ Increasing use of critical care resources and high

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risk of nosocomial infection in the context of increasing antimicrobial resistance make infection prevention a leading priority in the ICU.

Guidelines from the Centers for Disease Control and Prevention (CDC) from 2006,⁶ and the Society for Hospital Epidemiology of America from 2003,⁷ provide infection control guidance to prevent the spread of multidrug-resistant pathogens. This article examines more recent evidence for methods of preventing the transmission of multidrug-resistant pathogens in the ICU.

Importance of Preventing Transmission of Resistant Organisms

ICU patients are highly vulnerable to nosocomial infection because of invasive devices, immune compromise caused by underlying diseases or medications, poor nutritional states, uncontrolled hyperglycemia, and sepsis, which can lead to a paradoxical immune suppression.⁸ Multidrug-resistant pathogens represent a substantial proportion of nosocomial infections in the ICU, including 10% to 16% of US device-related infections.⁹ Infection with multidrug-resistant organisms causes significant mortality in hospitalized patients. Approximately 23,000 persons in the United States die each year from these organisms, most of which are acquired in health care settings.¹⁰ Nosocomial bloodstream infections with resistant gram-negative organisms can have mortality as high as 80% to 85%.^{11,12}

In addition to host susceptibility, the logistics and complexity of critical care medicine put patients at risk of acquiring nosocomial organisms. Invasive procedures and indwelling devices, often essential to providing supportive care to critically ill patients, serve as portals of entry for pathogens. Lifesaving critical care treatment requires the concurrent contributions of many health care team members and the use of many patient care devices, potentially posing additive risk of transmission from personnel or fomites. Infection control precautions may not be the predominant priority in situations in which seconds matter, such as resuscitating patients suffering trauma, sepsis, cardiac arrest, and other emergencies. Antimicrobial use may select out resistant strains that are potentially transmissible from patient to patient.

Transmission of Resistant Organisms in the Intensive Care Unit

Bacterial pathogens of epidemiologic concern in the ICU tend to inhabit specific sites on or in the human body, or in the hospital environment, that serve as reservoirs for transmission. The reservoirs of resistant organisms include niches in the human microbiome. The microbiota of skin, respiratory epithelium, and the gastrointestinal tract are altered within a few days in the hospital. Patients' flora can be deranged by antibiotics, chemotherapy, or acquisition of nosocomial organisms, among other sources. Patients who are colonized with resistant bacteria serve inadvertently as potential reservoirs for transmission. Colonization pressure, or the proportion of patients in a given unit who are colonized with resistant bacteria, is an independent risk factor for transmission.^{13,14} Resistant organisms are generally thought to be transmitted from person to person via the hands of health care personnel, or from contaminated patient care equipment or contaminated surfaces in the health care environment. Antimicrobial stewardship, hand hygiene, and proper disinfection of equipment and hospital surfaces are thus important means of preventing spread.

Hospitals should have policies and procedures in place that outline clear infection control guidelines, along with contingency procedures for special situations. ICU staff must receive periodic training and education in infection control, which should be informed by data on infection rates, hand hygiene rates, and other relevant outcome measures. In addition, compliance with infection control procedures requires

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