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The Role of Pathogenic Bacteria in Healthcare-Associated Infections.

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Introduction

Healthcare-associated infections (HAIs), also known as nosocomial infections, are infections acquired during the course of receiving medical care in a healthcare facility. These infections represent a major global health challenge, contributing to increased morbidity, mortality, and healthcare costs [1, 2].

Among the various causes of HAIs, pathogenic bacteria play a central role, often exploiting compromised host defences, invasive procedures, and contaminated environments to establish infection.These organisms are responsible for a range of infections such as bloodstream infections, surgical site infections, ventilator-associated pneumonia, urinary tract infections, and gastrointestinal infections [3,4].

Pathogenic bacteria associated with HAIs possess several virulence factors that enable them to colonize, invade, and damage host tissues:Many bacteria form biofilms on medical devices (e.g., catheters, ventilators), which protect them from antibiotics and immune responses [5, 6].

Resistance mechanisms such as β-lactamase production, efflux pumps, and target modification allow bacteria to survive antimicrobial treatment.Toxins like hemolysins, enterotoxins, and cytotoxins contribute to tissue damage and immune evasion.These facilitate attachment to host cells and medical surfaces.These traits make pathogenic bacteria formidable adversaries in clinical settings, especially when infection control measures are inadequate [7,8].

Hospital environments are rich in microbial life, and surfaces, equipment, and even healthcare workers can serve as reservoirs for pathogenic bacteria. A study conducted at the University Hospital of Abomey-Calavi in Benin found that 65% of sampled surfaces harbored bacteria, with *S. aureus* being the most prevalent species. Contaminated surfaces can facilitate indirect transmission, especially when hygiene protocols are not strictly followed.Direct contact with infected patients or contaminated surfaces. Airborne spread in poorly ventilated areas. Device-associated transmission via catheters, endoscopes, and surgical instrumentsEffective cleaning, disinfection, and hand hygiene are critical to breaking these transmission chains [9, 10].

Conclusion

According to the CDC, approximately 1 in 31 hospitalized patients in the U.S. acquires an HAI, resulting in over 700,000 infections and 75,000 deaths annually. Globally, the burden is even higher in low- and middle-income countries due to limited resources, overcrowding, and poor infection control infrastructure.HAIs prolong hospital stays, increase antimicrobial use, and elevate healthcare costs. They also contribute to the emergence and spread of antimicrobial resistance (AMR), which is now recognized as a global health emergency.The overuse and misuse of antibiotics in healthcare settings have accelerated the evolution of resistant bacterial strains. Pathogens like MRSA, ESBL-producing *E. coli*, and carbapenem-resistant *K. pneumoniae* are increasingly difficult to treat, often

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requiring last-resort antibiotics with significant side effects. Innovative approaches such as phage therapy, microbiome-based interventions, and targeted vaccines are being explored to combat resistant pathogens.

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