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HOSPITAL-ACQUIRED (NOSOCOMIAL) INFECTIONS: GLOBAL, SOUTH ASIAN, AND CENTRAL ASIAN PERSPECTIVES

Sharma Namrata

namusharma13@gmail.com

Asia International University

Abstract: Background; Hospital-acquired infections (HAIs) are infections acquired during hospital stay that were not present at admission. They are a major cause of morbidity, mortality, prolonged hospitalization, and increased healthcare costs, with a higher burden in low- and middle-income countries, particularly South Asia and Central Asia.

Objective; To summarize the global burden, major types, microbial profile, antimicrobial resistance, and prevention strategies of HAIs with regional focus on South Asia and Central Asia.

Methods; A narrative review was conducted using published global reports and peer-reviewed literature, comparing high-income and low- and middle-income country settings.

Results; HAIs affect millions of patients annually, with prevalence ranging from 5–10% in high-income countries and >15% in LMICs. Major infections include CLABSI, CAUTI, VAP, and SSI. Multidrug-resistant organisms, especially ESKAPE pathogens, are common. In South and Central Asia, rising antimicrobial resistance (ESBL and carbapenem resistance), weak surveillance, and limited infection prevention and control practices worsen outcomes.

Conclusion; HAIs remain a major but preventable global health problem. Strengthening infection prevention and control, antimicrobial stewardship, and surveillance systems is essential, particularly in South Asia and Central Asia.

Keywords; Hospital-acquired infections; Nosocomial infections; Infection control; Antimicrobial resistance;

Introduction

Hospital-acquired infections are infections that develop 48 hours or more after hospital admission and were not present or incubating at the time of admission (1). HAIs are a major indicator of healthcare quality and patient safety. According to global estimates, hundreds of millions of patients are affected annually, with higher incidence rates in LMICs compared to high-income countries (2). South Asia and Central Asia face unique challenges including overcrowding, limited resources, inadequate surveillance systems, and high rates of antimicrobial resistance, all of which contribute to increased HAI prevalence (3,4).

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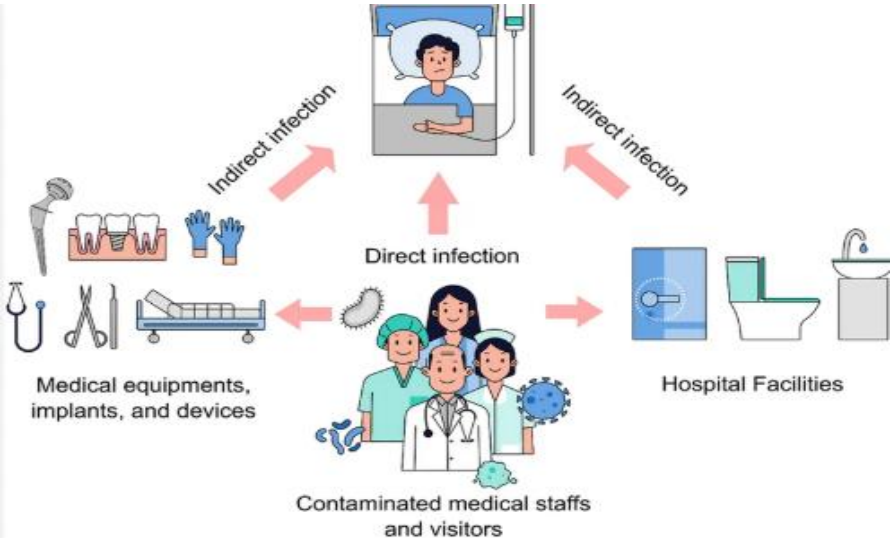

Epidemiology and Global Burden

The global prevalence of HAIs varies widely, ranging from 5–10% in high-income countries to over 15% in LMICs (2). Intensive care units (ICUs) bear the highest burden due to invasive procedures and critically ill patients. In South Asia, studies report high rates of device-associated infections, particularly ventilator-associated pneumonia (VAP) and catheter-associated infections (5). Similarly, in Central Asia, emerging data indicate significant HAI rates, though surveillance remains inconsistent (6). The economic burden of HAIs is substantial, including increased hospital stay, additional diagnostic and therapeutic interventions, and indirect costs related to lost productivity (7).

Major Types of Hospital-Acquired Infections

1. Central Line–Associated Bloodstream Infections (CLABSI); CLABSI occurs due to contamination of central venous catheters. Common pathogens include Staphylococcus aureus, coagulase-negative staphylococci, and Gram-negative bacilli (8).

2. Catheter-Associated Urinary Tract Infections (CAUTI); CAUTI is one of the most common HAIs and is associated with prolonged catheter use. The predominant organisms include Escherichia coli, Klebsiella spp., and Enterococcus spp. (8).

3. Ventilator-Associated Pneumonia (VAP); VAP develops in patients receiving mechanical ventilation for more than 48 hours. It is commonly caused by Pseudomonas aeruginosa, Acinetobacter baumannii, and Staphylococcus aureus (9).

4. Surgical Site Infections (SSI); SSI occurs at the site of surgery within 30 days or up to one year if implants are used. Risk factors include poor surgical technique, inadequate sterilization, and patient-related factors such as diabetes (10).

HAI Type	Definition	Common Pathogens	Key References
CLABSI	Infection from central venous catheter	S. aureus, CoNS, Gram-negative bacilli	(8)
CAUTI	Infection due to urinary catheter	E. coli, Klebsiella, Enterococcus	(8)
VAP	Pneumonia after >48h ventilation	Pseudomonas, Acinetobacter, S. aureus	(9)

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HAI Type	Definition	Common Pathogens	Key References
SSI	Infection at surgical site	S. aureus, Gram-negative bacilli	(10)
CDI	Antibiotic-associated diarrhea	Clostridioides difficile	(3,8)

Fig; Major Types of Hospital-Acquired Infections

Microbial Profile and Antimicrobial Resistance

A major concern in HAIs is the increasing prevalence of antimicrobial resistance. The ESKAPE pathogens (Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter spp.) are responsible for a large proportion of nosocomial infections (4).

In South Asia and Central Asia, extended-spectrum beta-lactamase (ESBL)-producing organisms and carbapenem-resistant bacteria are increasingly reported, limiting treatment options (4,5) Antibiotic misuse, lack of regulation, and inadequate stewardship programs further accelerate the emergence of resistance (3).

Risk Factors

HAIs are influenced by multiple factors:

- Patient-related: age, comorbidities, immunosuppression
- Device-related: catheters, ventilators
- Hospital-related: overcrowding, staffing shortages, poor hygiene practices

In LMICs, additional factors such as limited access to clean water and sanitation further increase risk (3).

Prevention and Control Strategies

1. Infection Prevention and Control (IPC); WHO recommends a multimodal strategy including surveillance, hand hygiene, sterilization, and staff training (3).

2. Hand Hygiene; Hand hygiene is the single most effective intervention to prevent HAIs (3). Alcohol-based hand rubs and adherence to WHO's "Five Moments for Hand Hygiene" are essential.

3.Device-Associated Infection Prevention; Implementation of care bundles has significantly reduced CLABSI, CAUTI, and VAP rates in many settings (8,9).

4.Antimicrobial Stewardship; Rational antibiotic use is critical to reducing AMR. Stewardship programs focus on appropriate selection, dosing, and duration of antimicrobial therapy (4).

5. Environmental Measures; Adequate sanitation, sterilization of equipment, and proper waste management are essential components of HAI prevention.

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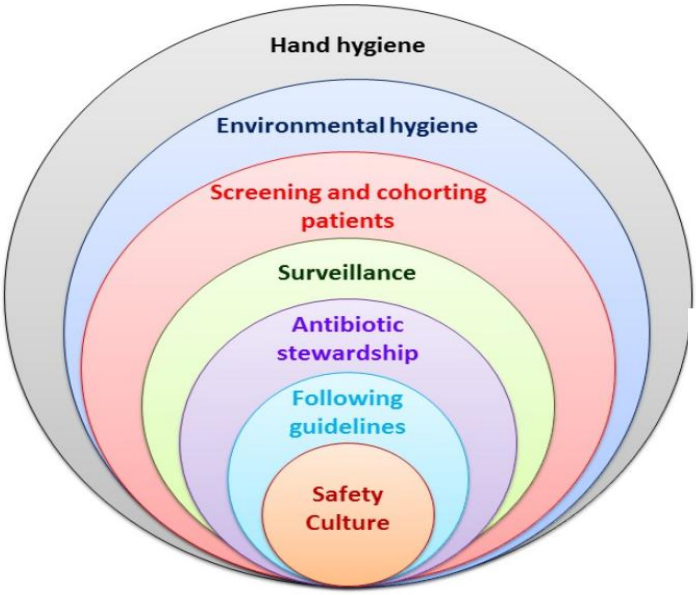

Fig; Strategies to prevent healthcare-associated

Regional Perspectives

South Asia; South Asia has one of the highest burdens of HAIs due to high patient load, limited resources, and widespread antibiotic misuse. However, increasing awareness and implementation of IPC guidelines are improving outcomes (5).

Central Asia; In Central Asia, HAI surveillance systems are developing, and international collaborations are helping improve infection control practices. However, challenges remain in infrastructure and AMR monitoring (6).

Parameter	High-Income Countries	South Asia	Central Asia	References
HAI Prevalence	5–10%	10–20%	8–15%	(2,6)
CLABSI Rates	Low (bundle-controlled)	High	Moderate	(5,6)
VAP Rates	Declining	High	Moderate-high	(5,9)
AMR Burden	Moderate	Very high	Increasing	(4,5)
Surveillance	Strong	Variable	Developing	(3,6)

Future Directions; Key priorities for reducing HAIs include:

- Strengthening surveillance systems
- Expanding IPC programs
- Enhancing antimicrobial stewardship
- Investing in healthcare infrastructure
- Promoting research in LMIC settings

Integration of digital health tools and international collaboration can further improve HAI control strategies.

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Conclusion

Hospital-acquired infections remain a significant global health challenge, particularly in South Asia and Central Asia. While effective prevention strategies exist, their implementation remains inconsistent. Strengthening infection control practices, improving antimicrobial stewardship, and enhancing healthcare infrastructure are essential steps toward reducing the burden of HAIs worldwide.

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