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Epidemiology of Antibiotic Resistance in Healthcare Facilities: A Public Health
Perspective

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1.0 Prevalence of the Problem:

Antimicrobial resistance (AMR) is one of the most severe worldwide public health issues of this century (Salam et al., 2023). Due to the increased use and misuse of these drugs throughout the medical field, resistance to numerous antibiotic treatments has emerged, and continues to emerge more rapidly, than ever. Where once these were reliable types of medical treatment, they are now no longer so, due to widespread antibiotic-resistant strains of bacteria around the world (rates of morbidity, mortality and healthcare costs will continue to increase).

In healthcare settings, such as hospitals and other facilities with intensive care units, the high amount of antibiotic use, the number of vulnerable patients, the increased number of invasive procedures carried out within the facilities and the close proximity between patients and healthcare providers are all factors that create an ideal environment for the emergence or spread of resistant pathogens. Examples of commonly found antibiotic-resistant pathogens that have been identified in these healthcare settings are methicillin-resistant *Staphylococcus aureus* (MRSA), *vancomycin-resistant Enterococcus* (VRE), *carbapenem-resistant Enterobacteriaceae* and multidrug-resistant *Acinetobacter baumannii* (Abban et al., 2023).

According to the latest global estimates, millions of infections each year are caused by antimicrobial resistance, leading to many deaths every year (Antimicrobial Resistant Collaborators, 2022). Research indicates that resistant bacteria may cause healthcare-associated infections that prolong hospital stays, complicate treatment protocols, and create additional financial costs to the healthcare system. In developing countries where infection control infrastructure is inadequate and antibiotics are not regulated, the distribution of resistant pathogens is even worse.

With antibiotic resistance on the rise in healthcare settings, there is an urgent need for epidemiologic studies that assess resistance patterns, identify contributing factors, and assess the implications for the public's health due to this growing threat (Scaglione et al., 2022).

2.0 Introduction and Literature-Based Background

Since the mid-20th century, antibiotics have been vital to modern healthcare, substantially lowering the chances of dying from infectious disease, enabling advanced medical procedures, including organ transplants, chemotherapy treatments, and major surgeries (Lawani, 2024). Regrettably, growing rates of antibiotic resistance threaten these drugs' effectiveness.

Antibiotic resistance happens when a bacteria develops new mechanisms to survive exposure to drugs that would usually stop its growth or kill it (Li et al., 2023). While the ability to develop antibiotic resistance occurs through genetic mutation and the transfer of genes between different bacteria, human actions, particularly the inappropriate use of antibiotics within the field of medicine, agriculture, and communities, have greatly accelerated the pace of acquiring this ability.

In the context of antibiotic resistance, healthcare facilities are functionally and epidemiologically critical as a setting in which antibiotic-resistant pathogens can be rendered more virulent and allowed to be transmitted from person to person (Endale et al., 2023). Intensive care units (ICUs), surgical wards, and emergency departments are among the most affected healthcare settings in terms of antibiotic resistance. These environments include large amounts of antibiotics being administered, invasive procedures being performed, and a large number of immune-compromised individuals, all of which pose a high-risk of HAIs. ICUs are a hotbed for multi-drug resistant organisms, such as MRSA, VRE, and carbapenem-resistant bacteria, primarily because patients stay longer in hospitals and are given more antibiotics.

Despite the potential for healthcare-specific environments to be the focal point of research on antibiotic resistance epidemics, issues in developing countries (e.g., agriculture, water supply, population growth, etc.) exacerbate the spread of resistant pathogens (i.e., poor infection control practices; a lack of stewardship programs for antibiotics; overcrowding at healthcare facilities; and the inappropriate use of antibiotics.) As such, healthcare-specific environments are critical to evaluating the epidemiology of antibiotic resistance in general. Many patients who enter the hospital have weakened immune systems and/or other pre-existing illnesses and are therefore more likely to become infected (Quiros et al., 2024). High levels of antibiotics administered in hospitals create an environment where resistant bacteria are favored and proliferate due to the constant application of a strong selective force.

The number of antibiotic resistant bacteria is increasing in healthcare facilities around the globe, and numerous studies have documented this alarming trend (Alara, 2024). Some of the most important examples of antibiotic resistant bacteria causing healthcare associated infections include methicillin resistant *Staphylococcus aureus*, which remains the single largest cause of such infections, and the growing emergence of carbapenem-resistant gram negative bacteria, which poses an urgent threat to patients in intensive care units (ICU). Pathogens that are resistant

to multiple antibiotic classes have severely limited treatment options for the patient and medical community alike (MacNair et al., 2024).

Many variables affect the epidemiology of antibiotic resistance, such as prescribing practices, infection prevention/control practices, infrastructure of health care facilities and demographics of the patients in the facility (Abalkhail & Alslamah, 2022). Therefore, inadequate antimicrobial stewardship programs and suboptimal infection control measures can also support the easy spread of resistant pathogens in health care facilities.

With the increasing threat posed by antimicrobial resistance, numerous global health organizations have outlined public health strategies that are designed to enhance global surveillance of antibiotic resistance patterns, promote the appropriate use of antibiotics and strengthen the infection prevention and control measures (Harun et al., 2022). To effectively address the growing problem of antibiotic resistant bacteria, monitoring of antibiotic resistance patterns in health care facilities is vital for establishing treatment protocols, informing public health policy and controlling the transmission of resistant bacteria.

Antimicrobial resistance is becoming more widely known as an issue around the world, yet significant knowledge gaps remain about how antibiotic resistance spreads and how it affects public health (Aijaz et al., 2023). For this reason, this research will look at antibiotic-resistant microorganisms occurring in healthcare environments from a public health perspective to understand what factors influence the spread of antibiotic resistance and propose possible ways to reduce antibiotic resistance.

3.0 Rational of the Study

The emergence of antibiotic-resistant organisms presents a considerable threat to global health security and undermines the many decades of advancements in medicine (Chis et al., 2022). As infections become increasingly resistant to current antibiotics, there is a dramatic decrease in the effectiveness of currently available antibiotics, leading to more complex infections, an increase in length of hospitalization, and higher mortality rates.

Healthcare facilities are the primary sites for the emergence and transmission of antibiotic resistant microorganisms. The high rate of antibiotic use, the high frequency of patient-to-patient contact, and the presence of many vulnerable patient populations, all create a perfect environment for the emergence and transmission of antibiotic resistant bacteria (Akber et al., 2025). It is, therefore, imperative that we understand the epidemiological patterns of antibiotic resistance in healthcare settings to develop effective interventions.

There is immense potential to learn about the emergence of antibiotic resistant bacteria in healthcare through public health research. Through public health epidemiological studies, we can gain insights into the transmission patterns of antibiotic resistant organisms and how healthcare systems can more effectively control their emergence. These studies will identify which healthcare environments, patient populations, and factors contribute to the emergence of antibiotic resistance.

By conducting research on antibiotic resistance, we can improve our understanding of antibiotic resistant bacteria and develop antimicrobial stewardship programs, improve infection control practices, and make sound public health policy geared towards reduction of the impact of antibiotic resistant microorganisms. This research is essential for supporting evidence-based decision-making within healthcare systems, and ultimately contributes to the global fight against antimicrobial resistance

4.0 Aim of the Research:

To analyze the epidemiology of antibiotic resistance in healthcare facilities, particularly hospitals and intensive care units, with a focus on developing countries.

5.0 Objectives:

1. To evaluate the incidence of antibiotic-resistant infections within healthcare facilities.
2. To identify the main contributing factors leading to antibiotic resistance and its spread in hospitals.
3. To assess the impact of antimicrobial resistance on public health in healthcare facilities.
4. To develop potential interventions for improving antimicrobial stewardship and infection control.

6.0 Research Question:

What are the epidemiological and public health impacts of antibiotic resistance in healthcare facilities?

7.0 Methodology for Research

7.1 Design for Research

The systematic literature review research design will be employed to identify the literature related to the epidemiology of antibiotic resistance in relation to the health care environment. Systematic literature reviews are an efficient method for synthesizing available evidence and developing an understanding of trends, patterns, and gaps within the existing literature.

7.2 PICO

- Population: Patients in health care environments (e.g., hospitals, outpatient clinics and intensive care units)
- Intervention: Antibiotic resistant bacterial infections
- Comparison: Non-resistant infections (where appropriate)
- Outcomes: How common is antibiotic resistance and its associated risk factors, and how does it impact the public's health?

7.3 Literature Sources

Examples of major academic databases that will be searched for relevant literature are as follows:

- PubMed
- Scopus
- Web of Science
- Google Scholar

Access to research articles that have been peer-reviewed on the topic of the epidemiology of bacteriological (i.e., resistant or not) infections (e.g., antibiotic resistance) and the public's health can be searched in these databases.

7.4 Searching

Other terms to refine the searches will include key words such as:

- Antibiotic resistance
- Antimicrobial resistance
- Hospital infections
- Health care-associated infections
- Epidemiology of antimicrobial resistance
- Multidrug-resistant bacteria

Using Boolean operators (e.g., AND, OR) will further limit searches performed based on keyword combinations.

7.5 Inclusion Criteria

- Published between 2015-2025
- Published in peer reviewed journals
- Written in English

- Related to antibiotic resistance in health care settings

7.6 Exclusion Criteria

- Studies that meet the following criteria will be excluded
- Focused on animals only
- Not peer reviewed
- Do not measure health care related antibiotic resistance

8.0 Data Analysis

The studies included in this review will be analyzed with thematic analysis, which should allow for the discovery of common themes (and patterns) in the documented evidence regarding the epidemiology of antibiotic resistance. Common themes could include prevalence trends/pathways, risk factors, transmission pathways, and public health efforts related to antibiotic resistant infections.

9.0 Ethical Consideration

The research in this work will use solely previously published materials and will not include any face-to-face contact with participants. Because of this, the study will not collect any type of confidential or personal information. On the other hand, ethical standards with regards to maintaining academic integrity will be adhered to strictly. All of the references used for this study will be published in a way that conforms to the rules for citing using the Harvard style to maximize transparency and to reduce the risk of plagiarism. All of the data will come from peer-reviewed sources, thereby ensuring that they are valid for academic use. Additionally, steps will be taken to ensure that when summarizing and/or paraphrasing the works of other researchers, they do so in an accurate manner with no distortion and/or bias.

Research Implications

In order to develop successful approaches for addressing the increasing issue of antimicrobial resistance, it is important to understand the epidemiology of antibiotic resistance within healthcare systems. The results of this study will provide increased awareness to both healthcare professionals and policymakers regarding the extent and consequences of antibiotic resistance.

This study will help identify the important elements associated with the existences of resistant microorganisms. The identification of such components may assist in developing improved infection control strategies and antimicrobial stewardship programs in the healthcare system. The results may also provide information for the implementation of effective public health strategies to

promote the reduction of inappropriate uses of antibiotics and the enhancement of surveillance systems for resistant infection.

In summary, this study will have the potential to support evidence-based decision-making and contribute to global efforts to reduce the impact of antimicrobial resistance.

GHANTT CHART:

In order to achieve the desired objectives of the study, the work plan was divided into different phases in a tabular form.

Activity in Weeks				
	1-8	8-12	12-14	15-16
Data Collection				
Data Analysis and interpretation				
Thesis write- up and submission				

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