Antibiotic resistance as a global epidemiological threat.

Salimova S,Malikova M,Saydiyeva D,Boynazarov S.
Clinical Residents in Epidemiology,
Samarkand State Medical University,
Department of DKTF
Samibaeva Umida Xurshidovna
Assistant, PhD
Department of Infectious Diseases,
Samarkand State Medical University,
Department of DKTF

ANNOTATION

Antibiotic resistance is one of the most serious global threats to modern public health, significantly impacting morbidity, mortality, and the economic burden on healthcare systems. The spread of antimicrobial-resistant microorganisms significantly limits the effective treatment of infectious diseases and complicates the provision of medical care. This article provides an overview of current data on the state of antibiotic resistance, analyzes the epidemiological mechanisms of resistance development, and examines the hospital- and community-acquired aspects of the spread of resistant pathogens. Particular attention is paid to key control and prevention strategies, including the rational use of antimicrobials, the development of epidemiological surveillance systems, and the implementation of antimicrobial stewardship programs. The need for a comprehensive and interdisciplinary approach to containing antibiotic resistance at the national and international levels is emphasized.

Key words: *antibiotic resistance, antimicrobial drugs; infectious diseases; epidemiological surveillance; hospital infections; rational use of antibiotics; public health.*

Introduction.

Antibiotic resistance (AR) has transformed from a local clinical problem into a global public health threat in recent decades. The global spread of resistant

microorganisms significantly reduces the effectiveness of antimicrobial therapy, complicates the treatment of infectious diseases, and increases mortality rates. According to international experts, the rise in antibiotic resistance could lead to significant demographic and economic losses, especially in countries with limited healthcare resources.The urgency of the problem is due to a combination of biological, social and medical factors, including the widespread and often unjustified use of antibiotics, insufficient epidemiological surveillance and globalization, which contributes to the rapid spread of resistant strains.The current state of antibiotic resistance.

Currently, antibiotic resistance affects virtually all groups of clinically significant microorganisms. Of particular concern is the growing resistance to last-resort antibiotics, including carbapenems , glycopeptides , and polymyxins . The spread of multidrug-resistant and panresistant strains significantly limits clinicians' therapeutic options . Epidemiological data indicate significant variability in resistance levels depending on region, healthcare structure, and antimicrobial policy. In low- and middle-income countries, the problem is exacerbated by easy access to antibiotics and inadequate monitoring of their use.

Epidemiological mechanisms of resistance development. The development of antibiotic resistance is a complex evolutionary process involving genetic mutations and horizontal transfer of resistance genes. Plasmids , transposons , and integrons play a key role , enabling the rapid spread of resistance determinants between different microbial species. From an epidemiological perspective, the key factor is the selective pressure arising from the irrational use of antibiotics. Prescribing drugs without indications, non-compliance with dosages, and non-compliance with treatment duration create favorable conditions for the selection of resistant strains, which then circulate within the population. The development and spread of antibiotic resistance is a complex, multi-layered process involving biological, environmental, and social mechanisms. From an epidemiological perspective, microbial resistance arises and becomes established in the population under the selective pressure of antimicrobial agents and spreads through

various transmission routes.The primary epidemiological mechanism for the development of resistance is selective pressure created by the widespread and often irrational use of antibiotics. Prescribing antimicrobials without strict indications, using sub therapeutic doses, and prematurely discontinuing therapy facilitate the survival and proliferation of resistant microorganisms. As a result, susceptible strains are displaced by resistant ones, which gradually dominate microbial populations. Horizontal gene transfer plays a key role in the epidemiology of resistance.

Microorganisms are capable of transmitting resistance genes via plasmids , transposons , and integrin's , enabling the rapid spread of resistance both within a single species and between different bacterial species. This mechanism is particularly dangerous in the high-density microbial populations typical of healthcare facilities. In addition to genetic exchange, clonal spread of resistant microorganisms plays a significant role. In hospitals and other organized settings, certain clones of bacteria with multidrug resistance circulate . Such strains are capable of causing outbreaks of hospital-acquired infections and spreading rapidly between patients and healthcare staff.Biofilm formation is an important epidemiological mechanism that facilitates the survival of microorganisms in adverse conditions. Bacteria within biofilms exhibit significantly higher resistance to antibiotics and disinfectants, complicating the treatment of infections and contributing to chronic carriage of pathogens.

The spread of antibiotic resistance extends beyond the clinical environment. The use of antibiotics in livestock and agriculture creates conditions for the development of resistant microorganisms in the environment. These microorganisms can be transmitted to humans through food, water, and soil, forming a so-called environmental reservoir of resistance. Poor sanitary and hygienic practices, low public awareness, and self-medication with antibiotics significantly accelerate the spread of resistant strains. International travel and population migration facilitate the cross-border transfer of resistant microorganisms, making the problem of antibiotic resistance global.Thus, the epidemiological mechanisms of antibiotic resistance development represent a combination of biological processes and social factors that facilitate its emergence,

persistence, and spread within the population. Understanding these mechanisms is key to developing effective epidemiological control and prevention strategies. Hospital and community-based aspects.

Antibiotic resistance manifests itself both in hospital and community settings. Hospital-acquired infections caused by resistant microorganisms are characterized by severe illness, high mortality, and prolonged hospitalization. Healthcare facilities become hotbeds for the accumulation and spread of resistant strains due to the high antibiotic load. In the community, uncontrolled antibiotic use by the general public, as well as the use of antimicrobials in veterinary medicine and agriculture, play a significant role. These factors contribute to the development of resistant microorganisms that can be transmitted to humans through food and the environment.

Control and prevention strategies. Combating antibiotic resistance requires a comprehensive and interdisciplinary approach. A key area is the implementation of antibiotic stewardship programs (antimicrobial stewardship), aimed at optimizing the prescription of antimicrobial drugs.Equally important is the development of epidemiological surveillance systems that enable the timely detection of changes in resistance patterns. The development of new antimicrobial agents, alternative treatments, and infectious disease vaccination remain promising areas.Antibiotic resistance is a dynamic and multifaceted problem that extends beyond clinical medicine. Addressing it requires coordinated efforts at the national and international levels, as well as the active participation of healthcare professionals, researchers, and public health authorities.Raising public awareness and fostering responsible antibiotic use are particularly important. Without systematic measures, growing resistance could negate the achievements of modern medicine. Antibiotic resistance is one of the key threats of the 21st century, significantly impacting the epidemiological situation worldwide. Effectively containing its spread is only possible through the implementation of comprehensive strategies based on the rational use of antibiotics, the strengthening of the epidemic, and the prevention of antibiotic use.

References:

1. World Health Organization. Global action plan on antimicrobial resistance. Geneva: WHO; 2015.

2. World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva: WHO; 2014.

3. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. Review on Antimicrobial Resistance. London; 2016.

4. Laxminarayan R, Sridhar D, Blaser M, Wang M, Woolhouse M. Achieving global targets for antimicrobial resistance. Science. 2016 ;353 (6302):874–875.

5. Prestinaci F, Pezzotti P, Pantosti A. Antimicrobial resistance: a global multifaceted phenomenon. Pathogens and Global Health. 2015 ;109 (7):309–318.

6. Ventola CL. The antibiotic resistance crisis: causes and threats. Pharmacy and Therapeutics. 2015 ;40 (4):277–283.

7. Holmes AH, Moore LSP, Sundsfjord A, et al. Understanding the mechanisms and drivers of antimicrobial resistance. The Lancet. 2016 ;387 (10014):176–187.

8. Davies J, Davies D. Origins and evolution of antibiotic resistance. Microbiology and Molecular Biology Reviews. 2010 ;74 (3):417–433.

9. Tacconelli E, Carrara E, Savoldi A, et al. Discovery, research, and development of new antibiotics: the WHO priority list. The Lancet Infectious Diseases. 2018 ;18 (3):318–327.

10. Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States. Atlanta : CDC; 2019.