Forum: Special Conference on Health

Issue: Combatting antimicrobial resistance with special emphasis on the misuse of medications

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Introduction

In recent years, antimicrobial resistance has emerged as one of the most pressing threats to global public health and development. Antimicrobials, such as antibiotics, antifungals, antiparasitics, and antivirals, are medicines whose main goal is to prevent and treat infectious illnesses. Antimicrobial resistance (AMR) comes about when bacteria, fungi, viruses, and parasites cease their responses to antimicrobials. As a result of this resistance, antimicrobials become ineffective in treating harmful infections, thus increasing the spread of disease, disability, and death. AMR is a natural process; it happens with time due to genetic alterations in pathogens. Human activity including the misuse and overuse of antimicrobial medications accelerates its spread (World Health Organization, 2023). The growth of antimicrobial resistance is a threat to decades of progress in medicine. AMR could cause common surgeries, organ transplants, and chemotherapy to have highly dangerous results. In less economically developed countries (LEDCs) and developing countries, AMR has especially harsh consequences. Often referred to as the “Silent Pandemic,” AMR could become the largest cause of mortality worldwide by 2050. In 2019, AMR was directly linked to 1.2 million fatalities. This number is expected to rise to 10 million by 2050 if the necessary precautions are not met (Ahmed et al., 2024). Addressing this crisis calls for coordinated global action, including stricter regulations on the use of antimicrobials, investments in the development of new and more effective drugs, and public awareness campaigns to promote responsible use of antimicrobial medications. Without emergency intervention, AMR could lead to an era where minor infections are once more lethal.

Definition of Key Terms

Antimicrobials

Antimicrobials are medications used to prevent and treat infectious diseases caused by harmful microbes. Types of antimicrobials include antibiotics, antivirals, antifungals, and antiparasitics.

Antimicrobial resistance (AMR)

AMR is the ability of microbes to resist the effects of antimicrobial medications such as antibiotics. AMR can make routine treatments ineffective and infectious diseases harder to treat.

Gene mutations

Gene mutations are permanent alterations in the DNA sequence of a gene. In the case of microbes, said alterations can result in AMR.

Germs

Germs, also known as microbes, are minuscule living organisms. Types of germs include bacteria, parasites, fungi, and viruses.

Horizontal gene transfer

Horizontal gene transfer refers to the process in which microbes share genetic material, including but not limited to resistance genes, with other microbes.

Over-the-counter (OTC) antibiotics

Over-the-counter antibiotics are antibiotics sold without prescription. Low regulation has a significant contribution to AMR, especially in nations that have loose pharmaceutical laws.

Pathogens

In contrast to most germs, pathogens are harmful germs that can cause debilitating infections. Harmful bacteria, fungi, parasites and viruses may be examples of pathogens.

Superbugs

Superbugs are types of bacteria that have gained resistance to multiple antimicrobials.

Background Information

History of antimicrobial resistance

AMR can be traced back to Alexander Fleming's discovery of penicillin in 1928. After his discovery, there was mass production and use of antibiotics grew substantially in the 1940s. However, resistant pathogens started to emerge almost immediately. In 1942, doctors reported the first cases of *Staphylococcus aureus*, a pathogen resistant to penicillin. In 1953, they reported the first instances of tetracycline resistance. The widespread use of antimicrobials like antibiotics in agriculture also resulted in the acceleration of AMR. Methicillin-resistant *Staphylococcus aureus* (MSRA) was first reported in 1961. This was followed by reports of resistance to a variety of antibiotics. In the 1980s, a global epidemic of multidrug-resistant tuberculosis (MDR-TB) emerged and by the 1990s, Escherichia coli and Klebsiella pneumonia–both gram-negative pathogens–developed a resistance to extended-spectrum beta-lactamases (ESBLs). The emergence of multidrug resistance led to a large decrease in the number of effective antimicrobials and the gradual withdrawal of pharmaceutical corporations from antimicrobial research. Today, growing AMR and the lag in the development of new drugs continues to have a negative effect on healthcare systems (Ahmed et al, 2024).

Drugs resistance across bacteria and fungi

Drug resistance exists across a number of different pathogens, including bacteria and fungi The World Health Organization's (WHO) 2022 Global Antimicrobial Resistance and Use Surveillance System (GLASS) report underscores high resistance rates among widespread bacterial pathogens. Median reported resistance rates across 76 countries include 35% for methicillin-resistant *Staphylococcus aureus* and 42% for third generation methicillin-resistant *E. coli*. High levels of antimicrobial resistance were also detected in urinary tract infections caused by *E. coli* and *Klebsiella pneumoniae*. The Organization for Economic Cooperation and Development (OECD) projects a twofold surge in antimicrobial resistance by 2035, compared to 2005. Fungal infections are especially difficult to treat as a result of

drug-drug interaction for patients possessing other infections like HIV. One major example of a multi-drug resistant, invasive fungal pathogen is *Candida auris*.

Drugs resistance across HIV, tuberculosis, malaria and neglected tropical diseases

Changes in the HIV genome that inhibit the ability of antiretroviral (ARV) drugs to block the replication of HIV cause HIV drug resistance (HIVDR). HIVDR can be acquired either at the time of infection or result from insufficient adherence to treatment or drug-drug interactions. HIVDR leads to an increased rate of HIV infections and mortality. Another major contributor to AMR is tuberculosis. MDR-TB is a type of tuberculosis caused by bacteria that give no response to rifampicin and isoniazid, two highly-effective first-line tuberculosis medications. Second-line drugs can be used to treat and cure MDR-TB, but these medications can be expensive and toxic. Additionally, the use of second-line drugs may lead to extensive drug resistance. MDR-TB is deemed a public health crisis by the WHO and a threat to health security. In 2022, only about 40% of people with MDR-TB accessed treatment. The rise of drug-resistant parasites is a significant threat to the control of malaria. Most malaria endemic countries utilize artemisinin-based combination therapies (ACTs) as first-line treatment for *Plasmodium falciparum* malaria. Moreover, drug resistance for neglected tropical diseases (NTDs) is a major threat to programs aimed at eradicating said diseases. Several countries have reported drug resistance in leprosy medicines and anti-helminthics.

Major Countries and Organizations Involved

World Health Organization (WHO)

The World Health Organization (WHO) plays an important role in the worldwide fight against AMR. In 2015, the WHO initiated the Global Action Plan on AMR which highlights five main objectives: building awareness, strengthening surveillance, optimizing the use of antimicrobials, reducing incidences of infection, and investing in new treatments. The WHO also works in coordination with its member states to develop National Action Plans that ensure efforts to fight AMR are adapted by region and aligned with global priorities. In addition, the organization

leads the Global Antimicrobial Resistance and Use Surveillance System (GLASS) with the goal of collecting and sharing data on AMR trends across the globe. The WHO works to contain AMR through policy guidance, international coordination, and public awareness campaigns.

Centers for Disease Control and Prevention (CDC)

The Centers for Disease Control and Prevention (CDC) plays a pivotal role in the United States' efforts to combat AMR. The CDC's Antimicrobial Resistance Solutions Initiative invests in nationwide infrastructure to respond to, detect, and prevent AMR in healthcare environments, underprivileged communities, and agriculture. Supporting all fifty state health departments along with multiple local and territorial agencies, the CDC enables a well-coordinated national response to AMR. Moreover, it leads the Antimicrobial Resistance Laboratory Network which rapidly detects and tracks resistant pathogens. To align with the U.S. National Action Plan for Combating Antibiotic-Resistant Bacteria, the CDC puts forth new containment tactics to prevent the spread of resistance threats.

Timeline of Events

Date	Description of event
28 September 1928	Alexander Fleming discovers penicillin, the first antibiotic.
1945	After mass production during the Second World War, penicillin becomes widely available.
1945	The first case of MRSA is reported in the United Kingdom.
25 May 2015	The WHO officially adopts a Global Action Plan to combat AMR.
29 January 2020	The United Nations declares AMR a major threat to global health.

Relevant UN Resolutions and Other Documents

- Global Action Plan on Antimicrobial Resistance (2016)
- Antimicrobial Resistance: Global Report on Surveillance (2014)
- Global Antimicrobial Resistance and Use Surveillance System Report (2022)

Previous Attempts to Solve the Issue

Several twenty-first century efforts have been made globally to address AMR. In 2015, the WHO initiated their Global Action Plan on AMR, which encouraged member states to develop their own individual National Action Plans with the goal of promoting responsible use of antimicrobials, investing in antimicrobial and AMR research, and strengthening surveillance. In the United States, the CDC's Antimicrobial Resistance Solutions Initiative has sent funds to state programs and created the Antimicrobial Resistance Laboratory Network to detect and prevent AMR threats. The European Union (EU) has implemented the European One Health Action Plan, which emphasizes international and cross-sector collaboration. Moreover, many countries have introduced antibiotic stewardship programs in hospitals to support appropriate prescriptions and reduce misuse. Despite these efforts, AMR is still on the rise. Global cooperation and increased research is essential to combat AMR.

Possible Solutions

Addressing the AMR endemic calls for a globally coordinated response. One key solution could be the increased implementation of antimicrobial stewardship programs in healthcare environments to help ensure responsible use of antimicrobials. Antimicrobials must only be prescribed when necessary and with the proper dosage. Governments and health organizations should invest in AMR research and the development of new vaccines and antimicrobial medications to be a step ahead of evolving MDR pathogens. Public education campaigns are also very important to help raise awareness about the dangers of antimicrobial misuse and the importance of medical prescriptions.

Bibliography

Ahmed, S. K., Hussein, S., Qurbani, K., Ibrahim, R. H., Fareeq, A., Mahmood, K. A., & Mohamed, M. G. (2024). Antimicrobial resistance: Impacts, challenges, and future prospects. Journal of Medicine, Surgery, and Public Health, 2, 100081. https://doi.org/10.1016/j.glmedi.2024.100081

Centers for Disease Control and Prevention. (2023, October 11). What is antimicrobial resistance?. https://www.cdc.gov/antimicrobial-resistance/about/index.html

European Medicines Agency. (n.d.). Antimicrobial resistance. https://www.ema.europa.eu/en/human-regulatory-overview/public-health-threats/antimicrobial-resistance

European Medicines Agency. (n.d.). Antimicrobial resistance in human medicine. https://www.ema.europa.eu/en/human-regulatory-overview/public-health-threats/antimicrobial-resistance/antimicrobial-resistance-human-medicine

Prestinaci, F., Pezzotti, P., & Pantosti, A. (2015). Antimicrobial resistance: A global multifaceted phenomenon. Pathogens and Global Health, 109(7), 309–318. https://doi.org/10.1179/2047773215y.0000000030

World Health Organization. (n.d.). Antimicrobial resistance. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance