Antibiotic Resistance- The Silent Pandemic

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Introduction

In 1928, Dr. Alexander Fleming made a groundbreaking discovery upon returning from a vacation to find that a mold, later identified as Penicillium notatum, had contaminated a petri dish and was inhibiting the growth of the bacteria around it [1]. This accidental observation led to the cultivation of the mold and the realization of its extraordinary antibiotic properties, marking the discovery of penicillin [1]. This event ushered in the golden era of antibiotics, which revolutionized the treatment of diseases. In his 1945 Nobel Prize acceptance speech, Alexander Fleming cautioned about the potential for antibiotic misuse to lead to resistance [2]. His foresight was confirmed when, by 1948, the first cases of penicillin resistance were documented [2]. Antimicrobial medications have since become essential in both common and complex medical interventions, ranging from treating common illnesses to enabling major surgeries such as organ transplants, to chemotherapy [3]. Beyond human medicine, antibiotics have been utilized extensively in both animal husbandry and production. However, the combination of antibiotic misuse, slow development of new antibiotics, and escalation of antibiotic resistance poses a significant threat to global healthcare.

Rise of Antimicrobial Resistance

At times, a bacteria's normal characteristics result in immunity to certain antibiotic mechanisms of effect. This is known as intrinsic resistance and is not affected by misuse of antibiotics [2]. In contrast, some bacteria may acquire resistance to an antibiotic either by evolving a new characteristic through gene mutation, or by the transfer of genetic information amongst bacterial species [2]. Mutations may enable bacteria to produce enzymes or inactivate antibiotics through hydrolysis of the antibiotic or by adding a chemical group to the drug [4]. A common example of enzymatic activation is by the β-lactamase, which is produced by bacteria and inactivates penicillin [4]. Furthermore, mutations may alter the cell target that antibiotics attack or reduce permeability to antibiotics via downregulation of porins [4]. Other ways include the ablation of efflux pumps that export antibiotics outside the bacteria [2].

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While antibiotic resistance is a natural process, the overuse and misuse of antibiotics has accelerated the speed at which resistance mechanisms form. According to an analysis of the IMS Health Midas database which estimates antibiotic consumption based on volume of antibiotics sold, approximately 22 doses of antibiotics were prescribed per person in the United States of America in 2010 [4]. Aside from overprescription, overuse is another leading factor that worsens antibacterial resistance heavily. A survey by the World Health Organization (WHO) highlighted that many people use antibiotics for the wrong reasons [6]. More than 30% of respondents reported using antibiotics for illnesses that do not require them [6]. Furthermore, 43% thought that antibiotics were effective against viruses [6]. The results of antibiotic overuse and overprescription have been deadly. In the European Union, approximately 25,000 patients die every year from infections caused by multi-resistant bacteria [7]. Given the current trend, it is predicted that the death will grow up to 390,000 by the year 2050 [8]. This rate is estimated to cause 10 million extra deaths worldwide by 2050 [8]. Reduction in population impacts the economic security of countries. This global threat is estimated to reduce the world Gross Domestic Product by 100 trillion USD by 2050 [8].

Looking Forward

As we navigate the complexities of antibiotic resistance, the interconnection between the roles of individuals, healthcare professionals, and policymakers becomes increasingly critical. Everyone has a part to play in this silent pandemic. Patients need to adhere strictly to prescribed antibiotic regimens and not share or reuse antibiotic medication. Healthcare providers and hospitals must prioritize infection control, rigorously apply antibiotic stewardship programs, and educate patients about the judicious use of antibiotics. Policy should aim to enhance surveillance of antibiotic use and resistance, regulate, and monitor the prescription of antibiotics, and invest in public health initiatives, to steer us towards a sustainable path. Moreover, fostering innovation and supporting the research and development of new treatments and antibiotics are critical steps toward outpacing the rapid evolution of resistant bacteria.

The recommendations from WHO stand as a clear and urgent call to action; however, these guidelines are just the starting point. Innovative approaches, such as the development of bacteriophage therapy and novel antibiotic treatments are on the horizon [9]. These advancements paired with shared antibiotic responsibility could provide substantial aid in this crisis. The clock is ticking; without meaningful action, the toll of antibiotic-resistant infections will continue to climb, undermining decades of medical progress and threatening the very foundations of modern healthcare.

Competing interests
The author declare that they have no competing interests.

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