

## Antimicrobial Resistance: Negative Impacts of the Silent Pandemic

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### Abstract

Antimicrobial resistance (AMR), a global public health concern, may be natural or acquired. The mechanisms of its development are complex and often liable to mutation. Such factors as antibiotic overuse, misuse and abuse act as triggers in its development. The negative impacts and consequences of AMR are not only in relation to the patients and their families but also the global health system and global economy across the board. Around 750,000 people die every year from drug-resistant infections. By the year 2050, the mortality may zoom to 10 million people/year [6], costing more than USD 100 trillion. The economic setback from AMR is worst in the resource-limited countries. The AMR can be slowed down but cannot altogether be stopped in view of the inherent dynamics of the microorganisms. All that can be done is its containment and control. All nations need to play a significant role in coordinating with the World Health Organization (WHO) and its sister and allied bodies to contain and control AMR at different levels. The issues of antibiotic prudence, alternatives to antibiotics, and development of newer antimicrobials, especially antibiotics, deserve to be addressed urgently.

**Keywords:** Antimicrobial Resistance; Antimicrobial Stewardship; Economy; Health; Multidrug-Resistance; Pandrug-Resistance; Superbugs

### Introduction

The term, antimicrobial resistance (AMR), denotes the ability of the microorganisms (viruses, bacteria, fungi and parasites) to develop resistance to the action of antimicrobial agents that were earlier effective against them [1-4]. The resistance may be natural or acquired [1,2]. Its mode of development is complex, involving variable dynamics, including mutation [2]. The problem of AMR has assumed a colossal magnitude world over. Today, it figures amongst the top ten global public health problems. Now weakened, the ongoing COVID-19 pandemic proved a trigger in worsening the AMR crisis as a result of massive hike in the use, misuse and even abuse of antibiotics [5].

The adverse impact of the AMR is not limited to the health issues (such as ill health, disability, death). The malady badly impacts the economy via prolonged illness, prolonged hospital stays, more expensive medicines and financial challenges for the families. The economic impact is worst in the low-income countries.

This review aims at providing a state-of-the-art update on health, economic and other impacts of the growing menace of AMR.

### AMR and the patient perspectives

It stands established that morbidity and mortality are very high in patients (both children and adults) who are afflicted with AMR pathogens [1]. Compared to non-resistant forms, resistant pathogens are likely to double the chances of developing serious health problems and triple the chances of death. Of course, these negative outcomes are more pronounced as the severity of the resistant infections increases. The susceptibility of the host too plays an important role in this behalf.

### AMR and health

The emergence and spread of drug-resistant pathogens that have acquired new resistance mechanisms, leading to antimicrobial resistance, continues to threaten our health. Increasing AMR has badly impacted our ability to treat common infections, more so the multidrug-resistant (MDR) and pandrug-resistant (PDR) bacteria (“superbugs”) that cause tough-to-treat [6] or even impossible-to-treat infections. According to conservative estimates, about 750,000 people die every year from drug-resistant infections. It is estimated that, by the year 2050, as high as 10 million people shall succumb to AMR every year [6]. This shall cost more than US dollar 100 trillion [7]. Furthermore, AMR means, more expensive treatment, prolonged hospital stay, enhanced burden on the family members and caretakers whose health and fitness also suffers.

### AMR and economy

AMR causes significant economic setback to the nations, more so the low-income countries, adversely impacting the productivity of not only the patients but also the families and other caretakers.

Without effective tools for the prevention and adequate treatment of drug-resistant infections cancer chemotherapy, and organ transplantation, will become more risky.

In the absence of effective antibiotics and other antimicrobials, the success of advanced therapeutics in treating infections shall be at risk. This risk shall apply to major surgical operations as well as cancer chemotherapy.

According to the World Bank [8], by 2050, annual global GDP is likely to fall by 1.1%, relative to a base-case scenario with no AMR effects, The GDP shortfall is likely to exceed USD 1 trillion annually after 2030.

In the high AMR-impact scenario, the world is likely to lose 3.8% of its annual GDP by 2050, with an annual shortfall of US dollar 3.4 trillion by 2030.

Table 1 lists the major impacts of AMR on global economy.

### AMR and dry antimicrobial pipeline

Antimicrobials, especially antibiotics, have becoming increasingly ineffective as drug-resistance spreads globally. The result is inability to treat multidrug resistant infections caused by superbugs. leading to death.

At present the clinical pipeline of new antimicrobials is virtually dry [8-11]. In 2019 WHO identified 32 antibiotics in clinical development that address the WHO list of priority pathogens out of these, only six were classified as innovative. Furthermore, a lack of access to quality antimicrobials remains a major issue. Antibiotic shortages are affecting countries of all levels of development, especially in health-care systems.

- **GDP:** By 2050, annual global GDP would fall by 1.1% in the low-impact AMR scenario and 3.8% in the high-impact AMR scenario. Low-income countries would lose more every year leading up to 2050, with the loss exceeding 5% of GDP in 2050 in the latter scenario.
- **Global poverty:** There would be a pronounced increase in extreme poverty because of AMR. Of the additional 28.3 million people falling into extreme poverty in 2050 in the high-impact AMR scenario, the vast majority (26.2 million) would live in low-income countries. Currently, the world is broadly on track to eliminate extreme poverty (at US dollar 1.90/day) by 2030, reaching close to the target of less than 3% of people living in extreme poverty. AMR risks putting this target out of reach.
- **World trade:** In 2050, the volume of global real exports would shrink by 1.1% in the low-case scenario, and by 3.8% in the high-case scenario.
- **Healthcare costs:** Global increases in healthcare costs may range from \$300 billion to more than US dollar 1 trillion per year by 2050.

*Table 1: Major impacts of AMR on global economy.*

Most importantly, newer antibacterials are urgently needed for treating such infections as by carbapenem-resistant Gram-negative bacterial pathogens. The tragedy is that if irrational use of antibiotics is not restricted to a large extent, even the newer antibiotics shall be at considerable risk to develop resistance, thereby becoming ineffective. To circumvent this problem to some extent, we need to address the following strategic approaches:

1. Prudent use of antibiotics that has three components, namely rational use, adherence to local guidelines and minimizing the upward trends in AMR. Antibiotic prudence should be practiced in veterinary medicine field [12] as well.
2. Exploration of alternative pharmacotherapies such as antibodies, probiotics, bacteriophages (also termed phage and bacterial virus), etc.

Wide use of antimicrobial stewardship [13-15].

All in all, the growing global public health crisis of AMR, though apparently mute, is a matter of grave concern. There is no way to fully get rid of it. All that can be attained is its containment and control through well-designed strategies and development of newer antimicrobial agent. For the first target, it is imperative that all nations fully cooperate and coordinate with the WHO and its endeavours spear-headed by its programme “WHO Action Plan for AMR” that is in operation since 2015 in true letter and spirit on an ongoing basis. There is a need for an urgent focus on innovative AMR-specific interventions that promote and incentivize better stewardship of antimicrobials, including the appropriate use of antibiotics and development of newer antimicrobials as also the alternative strategies. The endeavours have got to be on war-footing with no-holds barred for the concrete outcome as the goal.

### Conclusion

The global public health problem of AMR with huge negative impact on different streams of public health and economy can be slowed down but cannot altogether be stopped. In endeavours aiming at its control, all nations need to play a significant role in coordinating with the WHO and its sister and allied bodies. Else, we shall be in the think of uncontrolled infectious illnesses having a field day with incredible morbidity and mortality worldwide and devastating impact on the economy world over.

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