



Letter to the editor

Bidirectional effect of poverty and treatment-resistant diseases: The case of antimicrobial resistance in middle and low-income countries



Dear editor.

Antimicrobial resistance (AMR) poses a substantial risk to World Health because it makes it harder to treat bacterial, viral, fungal, and parasitic infections [1]. Like human, bacteria undergo evolutionary changes throughout time to efficiently reproduce and increase their population. Bacteria exhibit survival by adapting to their surroundings. The widespread utilization of antibiotics has resulted in the rescue of many lives. However, the excessive application of antibiotics to address any infection, regardless of its severity or whether a virus causes it, has contributed to the escalation of AMR. Antibiotics specifically focus on bacteria, although distinguishing between viral and bacterial diseases can be challenging without expensive tests. Proactively prescribing antibiotics is frequently more efficient and economical since it saves time and costs compared to taking precautions and prescribing only the appropriate treatment. A further concern regarding AMR is the lack of ability to monitor the consumption of antibiotics by patients effectively. Antibiotic dosages are specifically formulated to eliminate entire populations of pathogens. Incomplete adherence to the prescribed course of antibiotics can lead to the adaptation of pathogenic bacteria to low doses of antibiotics, resulting in the development of a population that is fully resistant to the antibiotic, regardless of the dosage. Antibiotic usage is not limited solely to humans. Antibiotics are administered daily to livestock and fish as a preventive measure against infections. Unrestrained utilization of antibiotics, akin to excessive usage in humans, generates a reservoir of bacteria that can develop resistance, rendering the antibiotic ineffective. Due to the increasing population density in cities, individuals are constantly exposed to more pathogens. Hospitals and clinics are experiencing an increasing number of patients with illnesses, and it is not always feasible to control the transmission of a pathogen within a population. Identifying, isolating, or treating all infectious diseases is frequently impractical, leading to the introduction of additional pathogens into the local community. When combined with inadequate hygiene and substandard sanitation, urban centers create an optimal environment for bacterial proliferation. Another significant aspect contributing to AMR is the lack of novel formulated antibiotics. After a remarkable surge in antibiotic discoveries over the past four decades, the rate of identifying new antibiotics has reached its lowest point ever. Society is rapidly depleting its treatment choices for diseases due to the lack of new treatments to counter the growing problem of AMR [2]. AMR also occurs when microbes develop genetic mutations that make them resistant to

antimicrobials, medicines used to treat infections. It can lead to more prolonged illnesses; the presence of more serious infections is associated with an elevated risk of mortality. Poverty is a significant driver of AMR. People living in poverty may have less access to clean water and sanitation, which can increase their risk of exposure to microbes. They may also have less access to healthcare, including access to antimicrobials. It can lead to people taking antimicrobials when they are unnecessary or not taking them long enough, which can contribute to the development of AMR. The rise of multidrug-resistant bacteria, exemplified by carbapenem-resistant strains, has become a significant concern in healthcare.

Gram-negative bacteria are paramount. There has been an uptick in illnesses that cannot be cured since these pathogenic microbes are resistant to many antimicrobials. New antimicrobials, especially antibiotics, are needed to treat multidrug- and pan-resistant microbial communities. However, the development of new antimicrobials is declining worldwide. AMR is due to several factors, including the high development cost and the absence of financial rewards for pharmaceutical corporations to develop novel antibiotics. The gap between the demand and supply of antimicrobials is one of the significant factors contributing to AMR. If this gap is not addressed, AMR will continue to threaten global health seriously.

Drug-resistant microorganisms are prevalent in several organisms, including people, plants, animals, and the surrounding environment. Moreover, these microorganisms can rapidly disseminate among individuals and between humans and animals. The main factors that drive AMR include overuse and misuse of antimicrobials, lack of sanitation and hygiene, inaccessibility to high-quality and affordable antimicrobials, unregulated production of antimicrobials, lack of awareness and knowledge about AMR, and premature termination of antimicrobial therapy due to cost. These factors have a more significant impact on people living in poverty-stricken areas. The World Health Organization (WHO) has concluded that poverty significantly facilitates the proliferation of antimicrobial resistance to AMR [3].

AMR is a significant worldwide challenge but disproportionately impacts low- and middle-income countries (LMICs). This phenomenon may be attributed to several poverty-related issues, such as the exorbitant expenses associated with healthcare, limited availability of healthcare services of satisfactory quality, and insufficient knowledge of antimicrobial resistance. In LMICs, individuals experiencing poverty may postpone seeking medical attention or resort to self-administration of antibiotics due to financial constraints

that prevent them from accessing professional healthcare services. However, self-medicating with antibiotics can lead to misuse and overuse, a significant driver of AMR. Another poverty-driven factor that contributes to AMR in LMICs is the purchase of antibiotics without a prescription. This problem is common in many LMICs, where antibiotics are widely available over the counter. Zoonotic tuberculosis (TB) is a type of TB that is transmitted from animals to humans. There is a significant correlation between this phenomenon and socioeconomic disadvantage and inadequate sanitation practices. Individuals living in impoverished circumstances are more likely to inhabit densely populated environments characterized by inadequate sanitary infrastructure. This circumstance amplifies their susceptibility to zoonotic tuberculosis (TB) transmission. [4]. Several prior studies have examined the correlation between poverty and susceptibility to antibiotic resistance [5].

The emergence of the COVID-19 pandemic worldwide has shed light on the fundamental vulnerabilities within several countries' healthcare systems. It has also diverted resources from existing programs, including those fighting AMR. Additionally, the COVID-19

pandemic has significantly impacted global health and economies. The susceptibility of COVID-19 patients to secondary infections often results in extended hospitalization periods, increased admissions to intensive care units, and additional burdens on healthcare systems, ultimately contributing to escalated antibiotic use. The extensive use, improper application, and failure to adhere to established protocols regarding antibiotics may have long-lasting implications for antimicrobial resistance. A number of studies have shown an increase in AMR cases during the pandemic, despite the fact that numerous actions have been taken in response to COVID-19, such as a greater focus on personal and environmental hygiene, adherence to social distancing protocols, and a significant decrease in hospital admissions. [6].

AMR cases are more common in older people than younger adults, especially in LMICs. The reason is that older people are more likely to have infectious diseases, and the concurrent use of various drugs might elevate the likelihood of drug interactions and contribute to the growth of AMR. Older people may also have changes in their body composition and organ function, which can affect the way

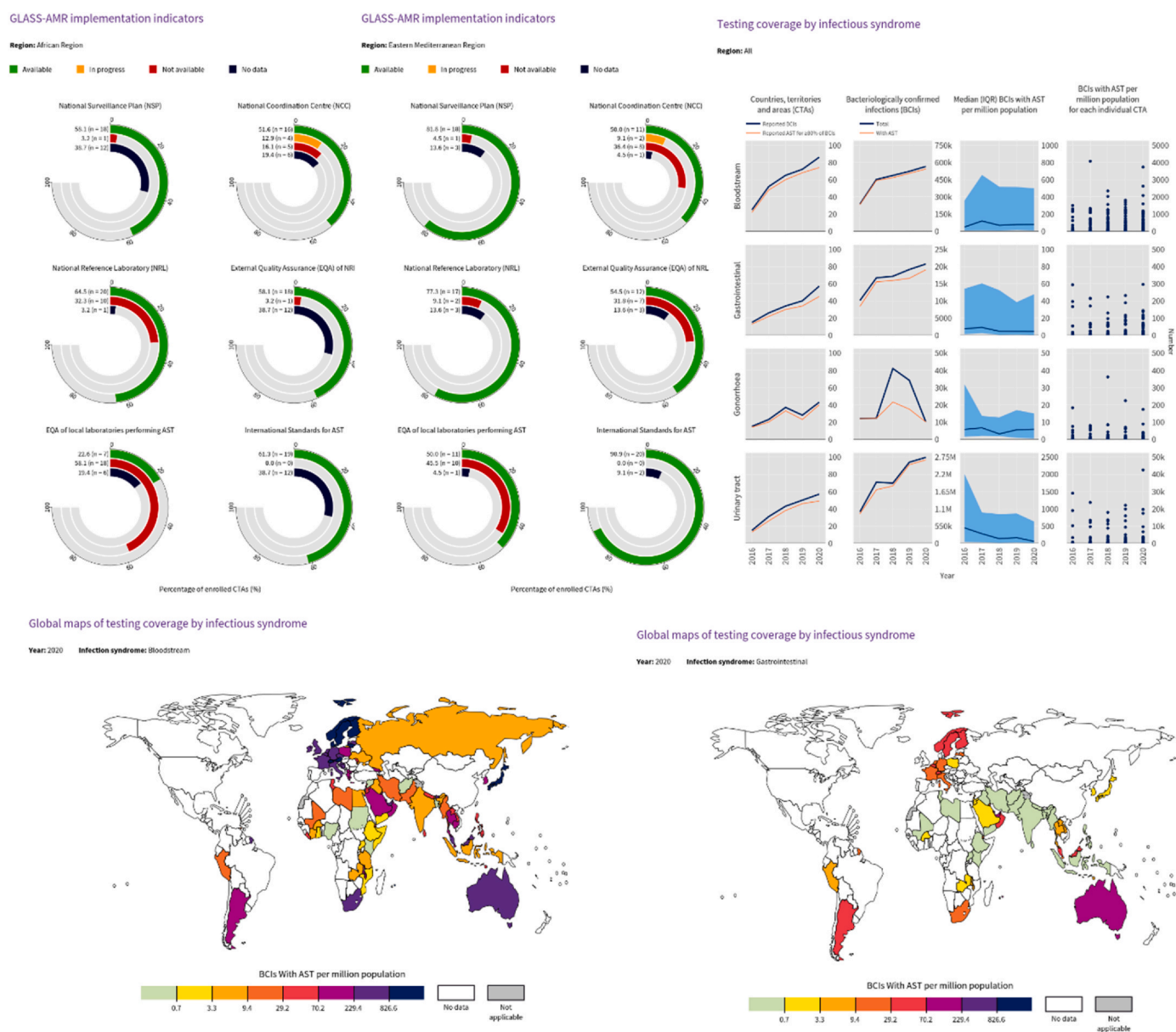


Fig. 1. Examines the state of implementation, quality assurance, and adherence to standards of national AMR surveillance systems during the 2021 data call for countries reporting to the GLASS-AMR.

that antibiotics are processed and eliminated from the body. Choosing the right antibiotic and dose for older patients can make it more challenging. As a result of these factors, thoroughly evaluating the potential dangers and benefits is necessary before prescribing antibiotics to elderly individuals. Interventions have been proposed to improve the appropriateness and safety of antimicrobial prescriptions in older patients. Also, several countries in the LMICs have experienced war, which has led to challenges with increasing AMR [7]. The relationship between AMR and poverty is believed to be bidirectional. It is clear how poverty affects AMR, but the question is how antimicrobial resistance can affect poverty [8]. In LMICs, poverty is a significant factor contributing to AMR because people in LMICs often have difficulty accessing affordable and high-quality medications, and they may have to rely on unregulated or sub-standard medications. Additionally, poverty can lead to people sharing medications, using leftover antibiotics, or stopping their antibiotic therapy early to save money.

The lack of comprehensive data on antibiotic resistance rates at the national level, particularly in (LMICs, can be attributed to the limited progress made in establishing or improving surveillance systems, as outlined by the Global Antimicrobial Resistance Surveillance System (GLASS) initiative [9]. According to the latest report on AMR isolates for seven LMICs, the majority of national AMR surveillance systems in LMICs have not yet met the GLASS requirements, which helps to explain, at least partially, the relatively small number of tested isolates [10]. The utilization of data produced by the Global Antimicrobial Resistance Surveillance System (GLASS) facilitates a more comprehensive comprehension of the extent of progress in national antimicrobial resistance (AMR) surveillance, which is mostly reliant on routine sampling of patients. The majority of nations (75.7%) participating in GLASS-AMR have established national strategies for AMR surveillance. This statistic emphasizes the significance of AMR as a public health concern and effectively showcases the dedicated efforts to manage and mitigate its impact. Similarly, the necessary elements required for the construction of efficient surveillance systems, namely the national coordinating center and the national reference laboratories, have been either strategically planned or already established in the majority of cases (60.4% and 77.5% respectively) (Fig. 1). These features play a vital role in enhancing data management and diagnostic capabilities at the national level, as well as facilitating the reporting of activities to GLASS.

While some studies are on the socioeconomic and behavioral factors behind AMR, more studies are needed, especially those focusing on poverty-driven practices. This study is essential for fully understanding the problem of AMR in middle- and low-income countries and developing effective interventions to combat it. AMR is a growing problem, and experts have recommended ways to reduce it. One standard recommendation is to limit the use of antibiotics, especially for minor infections. However, our study suggests that more than this recommendation may be needed for the poorest people in developing countries. It is because they may be exposed to antibiotics through their environment, even if they are not taking them themselves. We must find ways to reduce this environmental exposure to antibiotics to protect the poorest people from AMR.

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