

## Antimicrobial Resistance: Threat, consequences and options

Antimicrobial agents, especially antibiotics, have saved millions of lives in the 20th century alone. Apart from treating infections in vulnerable populations of children, women and older persons, antibiotics are critical in complex surgeries and management of various diseases. However, misuse and overuse of these medicines in humans and animals have facilitated the acquisition and spread of resistance among pathogens, and made most of them ineffective against many infectious diseases.<sup>1</sup>

This phenomenon, called antimicrobial resistance (AMR), has been rapidly increasing. Long-term neglect of this problem has caused multidrug-resistant variants of pathogens to arise. These are often called 'superbugs' because they cannot be treated with most of the existing medicines.

Till a few years ago, most community-acquired infections, such as gonorrhoea and typhoid fever, could be cured with affordable and effective drugs. However, these infections have now become resistant to multiple classes of drugs. More people than ever are dying in healthcare facilities because of infections with resistant pathogens. Unless immediate and effective measures are taken, this number is likely to increase dramatically.

Every year, AMR kills an estimated 700 000 people worldwide, most of these in developing countries. It is estimated that by 2050, this number may increase to 10 million. That is more than the number of people who currently die from cancer and eight times more than the number who die from road accidents.<sup>2</sup>

AMR will have severe adverse effects on the global economy. If not addressed now, the world's gross production may decrease by US\$ 8 trillion per year by 2050, and a cumulative US\$ 100 trillion will be wiped off the world's production over the next 35 years.<sup>2</sup> The world's gross domestic product could fall by as much as 3.5%.<sup>3</sup>

Economic losses will be far greater in developing countries than in developed ones. Many more individuals will fall in debt traps in countries where a large proportion of the money spent on healthcare comes from out-of-pocket expenditure of patients or their families. The poor will be hit the hardest.

The consequences of AMR will be felt by individuals, healthcare institutions and the society at large. Patients infected by resistant pathogens have longer hospital stays, undergo additional laboratory investigations and are sources of infection that can spread to healthy people. Second-line treatments for such patients are less effective, more costly, more toxic and sometimes extremely difficult to administer. Many are also in short supply. The technical and financial challenges that will be felt by health systems for effective management of these patients are enormous.<sup>1</sup>

It is estimated that the increase in cost for management of a patient with a resistant pathogen can be as much as 30%.<sup>4</sup> It is well established that the cost of treating one patient with multidrug-resistant tuberculosis is more than that of treating non-resistant tuberculosis in 100 patients.<sup>5</sup> Accordingly, costs to individuals as well as national health services could be great. This situation will force countries to divert scarce resources towards the health sector and thus neglect developmental activities.

AMR will impede efforts to achieve universal health coverage (UHC), which has been called the single most powerful concept that public health has to offer.<sup>6</sup> UHC is a critical component of sustainable development and reduction in poverty, and a key element for reducing social inequities. AMR hits at the core of this ambitious concept. Medicines, especially antibiotics, are an essential component of UHC. AMR can make existing antibiotics ineffective and new ones unaffordable.

AMR has the potential to hamper global efforts for development as articulated in the UN Sustainable Development Goals (SDGs). The SDG declaration reads: 'We will equally accelerate the pace of progress made in fighting malaria, HIV/AIDS, tuberculosis, hepatitis, Ebola and other communicable diseases and epidemics, including by addressing growing AMR and the problem of unattended diseases affecting developing countries'—SDG Declaration, Para 26.<sup>7</sup>

Like the Millennium Development Goals, several SDGs will depend on the sustained availability of affordable antibiotics. Antibiotics are one of the 13 life-saving products listed by the report 'Every Woman Every Child'.<sup>8</sup> Maternal mortality rates and deaths of newborns owing to bacterial infections continue to be high in most developing countries. Currently, 2.7 million neonatal deaths occur every year, with 99% of these in Africa and South Asia and 36% of these deaths result from sepsis, diarrhoea or pneumonia.<sup>9</sup> Most of

these are likely to be caused by resistant bacterial strains. These numbers will increase if AMR continues to spread.

Between 2016 and 2030, as part of the 2030 Sustainable Development Agenda, the target is to reduce the global maternal mortality ratio to <70/100 000 live-births.<sup>7</sup> This will require preserving the efficacy of antibiotics. As with newborn mortality, these numbers will escalate in a scenario where AMR is not effectively contained.<sup>10</sup>

Antimicrobial therapy is the mainstay of the three biggest public health programmes—HIV, tuberculosis and malaria. In tuberculosis and malaria, drug resistance has already emerged as a critical issue that is seriously threatening to undo the achievements made by the global community, even after investments of billions of dollars of national and international resources.

Patients with non-communicable diseases (NCDs) or trauma, those with a cardiac disease requiring surgery, and those undergoing transplantation or receiving chemotherapy for cancer have greater chances of acquiring infections. Effective management of these infections is a prerequisite to realizing the full benefit of specific NCD management tools.

In the absence of sustained, global and effective measures to combat AMR and the continuous addition of new classes of antibiotics, the likely scenario of the near future will be that few antimicrobial agents may be available to treat infectious diseases. Apart from health and economic issues, ethical and social challenges may arise from the need of the world to share limited resources. AMR may have severe negative impacts on development and the global economy. At the same time, with limited availability of effective antibiotics, it will be difficult for health systems to prioritize their use, especially where infectious diseases are rampant and likely to increase as AMR continues to spread.

The options are clear. We must either develop new classes of antibiotics or effective alternatives faster than the emergence of resistance or preserve the ones we have. It is unlikely that many new classes of antibiotics will be available in the near future, on account of a limited pipeline and the cost and complexities of developing them.<sup>1</sup> Although we must create new tools, we also need to preserve the efficacy of available medicines through appropriate use, reducing the burden of communicable diseases through safe water, a clean environment, improved sanitation, and vaccines and other infection prevention tools, using a multisectoral approach.

A global response needs to be mounted immediately to prevent the further emergence and spread of AMR. WHO's Global Action Plan for AMR has been endorsed by the World Health Assembly, Food and Agriculture Organization, and World Organization of Animal Health.<sup>11–13</sup> It must now be adapted to national contexts and implemented aggressively.

Antibiotic resistance is a cross-sectoral issue that affects everyone. It needs to be addressed by all. It is a critical issue with profound effects on all developmental activities. It requires a proactive and aggressive approach.

The moment has come to fight AMR and to stop it from growing further. The cost of action now will be only a fraction of the cost of responding to an even greater crisis that will threaten the entire global development agenda.

*Conflicts of interest.* None declared

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