

Highlight report: Tackling antibiotic resistance during the COVID-19 era in developing countries

Soha Nabil¹, Nourelhoda Hassanen¹, Hend Saqawa¹, Raghed Sayed¹, Abdelmonem Siddiq¹, Abdallah Anwar¹, Maha M. F. Tekrony^{2*}

¹ Egypt scholars Lab-8 student, Egypt Scholar Organization, Egypt.

² Faculty of Veterinary Medicine, Alexandria University, Alexandria, Egypt.

*Corresponding author: mahatekrony@gmail.com (M.M.F.T).

Keywords: COVID-19; Antibiotic Resistance; Developing Countries

Antimicrobial Resistance (AMR) has emerged and increased every day since the first antimicrobial innovation (Ferri et al., 2017). This phenomenon resulted from the incorrect usage of antimicrobials in different fields due to the lack of appropriate awareness. Microorganisms developed various mechanisms to combat antimicrobial drugs, making the treatment ineffective (Chew-Li et al., 2020). The emergence of COVID-19 resulted in many incorrect practices and information circulating about the virus, to the degree that people have tried to use antimicrobials without following any proper guidelines regarding dose and/or duration. The COVID-19 has already developed its footprint in antimicrobial resistance phenomenon. Also, more efforts should be exerted, especially in developing countries, to tackle this problem (Rawson, Moore, et al., 2020; Rawson, Ming, et al., 2020; Lucien et al., 2021).

According to many researches, low-and-middle-income countries (LMICs) have higher rates of antimicrobial resistance (AMR) (Morrison & Zembower, 2020). That may be due to the attitudes of health care providers and patients as well as the uncontrolled antimicrobial supply chains in the environment (Ayukeybong et al., 2017). Antibiotic treatment in the developing countries has gone through trial and error and overusing the few available antibiotics due to the lack of well-trained staff, equipment, and financial resources (Sartelli et al., 2016; World Health Organization, 2014). The lack of clinical laboratory capacities, reliance on therapy through observation, and poor infection control enable the rising AMR spread in the LMICs (Lucien et al., 2021).

Studies revealed that the COVID-19 patients living in developing countries are subjected to different risk factors for the same pathogen and

different antimicrobial susceptibility (Lucien et al., 2021). Weak health systems and medicine control in the LMICs withhold the proper antimicrobial access (Knight et al., 2021). Latin American countries allowed direct sales of antibiotics online without a prescription, but COVID-19 has forced them to build rational antibiotic-use programs to restrict public health threats (Álvarez-Moreno et al., 2021). Moreover, the socio-behavioral measures such as social distancing are considered sparse practices in the LMIC with high-density populations. So an effective strategy may rely on community-based programs instead of pharmaceutical development (Rodríguez-Baño et al., 2021). In Africa, several gaps had also existed before the pandemic in the fight against AMR. There was an inefficient implementation of interventions against AMR in the continent due to the accessibility of over-the-counter antibiotic use. Only a few countries, such as South Africa, have a national surveillance system for AMR involving specific representative data on antimicrobial use (Iwu et al., 2020). However, the rapid spread of the virus in Ghana is considered a motivating call for effective testing for antimicrobial susceptibility in health care facilities (Egyir et al., 2020).

Controlling AMR in developing countries has always been an enormous obstacle. (Godman et al., 2021). Inefficient healthcare systems influence the overuse of broad-spectrum antibiotics as a desperate measure to lower the risk of COVID-19 secondary infections (Getahun et al., 2020). Lack of COVID-19 testing kits and investigations resulted in misdiagnosis from healthcare professionals, especially in respiratory-associated diseases, like tuberculosis (TB) or upper respiratory tract infections (Egyir et al., 2020). Moreover, the low vaccination rate against other

diseases in many developing countries due to COVID-19 cases represents a burden on health care systems as a whole (Hossain et al., 2020; Lucien et al., 2021).

To tackle these challenges governments, and individuals should follow the following approaches. Maintaining proper hygiene and sanitation is the first step in combating infectious diseases, as their improvement reduces the spread of resistant organisms (Smith et al., 2004). Also, an efficient vaccination program may prevent the spread of infectious diseases, thus reducing their severity (Hinman & Orenstein, 2007). Furthermore, implementing antimicrobial stewardship programs (ASPs) among LMICs can reduce the excessive use of antibiotics. Raising public awareness about stewardship as well as applying the guidelines of the World Health Organization (WHO) are essential approaches to put an end to improper antibiotic prescriptions (Mazdeyasna et al., 2020; Lucien et al., 2021; Godman et al., 2021).

Restricting exacerbated antibiotic resistance during the COVID-19 pandemic demands the strict prevention of the health care ill-practices. Antibiotic therapy for COVID-19 should be administered only for those with severe complications or avoiding it together through infection control measures. Also, microbiological screenings in the developing countries needs more improvement to eliminate any concurrent bacterial infections in the COVID-19 patients and to prevent empirical antibiotic treatment (Lucien et al., 2021). Laws and regulations by the authorities should prohibit pharmacy-staff malpractice (Ansari, 2017). Monitoring the usage of antiseptics and disinfectants during this pandemic as their overuse may contribute to AMR's spread through biocidal agents (Kampf, 2018). Controlling AMR in developing countries is not only confined by legislative action; it continues further as more research and data resurfaces regarding the unfortunate lack of resources to enforce these strategic plans on mass populations (Ayukekbong et al., 2017).

Conflict of Interest

The authors declare no conflict of interest.

References

Álvarez-Moreno, C., Valderrama-Beltrán, S., & Rodríguez-Morales, A. J. (2021). Implications of Antibiotic Use

- during the COVID-19 Pandemic: The Example of Associated Antimicrobial Resistance in Latin America. *Antibiotics*, 10(3), 328 .
- Ansari, M. (2017). Evaluation of community pharmacies regarding dispensing practices of antibiotics in two districts of central Nepal. *PLOS ONE*, 12(9), e0183907 .
- Ayukekbong, J. A., Ntemgwa, M., & Atabe, A. N. (2017). The threat of antimicrobial resistance in developing countries: Causes and control strategies. *Antimicrobial Resistance & Infection Control*, 6(1), 47 .
- Chew-Li, M., Shun-Kai, Y., Khatijah, Y., Mokrish, A., Warren, T., Aisha, A., Swee-Hua-Erin, L., & Kok-Song, L. (2020). Mechanisms of Antimicrobial Resistance (AMR) and Alternative Approaches to Overcome AMR. *Current Drug Discovery Technologies*, 17(4), 430–447.
- Egyir, B., Obeng-Nkrumah, N., & Kyei, G. B. (2020). COVID-19 pandemic and antimicrobial resistance: Another call to strengthen laboratory diagnostic capacity in Africa. *African Journal of Laboratory Medicine*, 9(1), 4 .
- Ferri, M., Ranucci, E., Romagnoli, P., & Giaccone, V. (2017). Antimicrobial resistance: A global emerging threat to public health systems. *Critical Reviews in Food Science and Nutrition*, 57(13), 2857–2876.
- Getahun, H., Smith, I., Trivedi, K., Paulin, S., & Balkhy, H. H. (2020). Tackling antimicrobial resistance in the COVID-19 pandemic. *Bulletin of the World Health Organization*, 98(7), 442–442A.
- Godman, B., Egwuenu, A., Haque, M., Malande, O. O., Schellack, N., Kumar, S., Saleem, Z., Sneddon, J., Hoxha, I., Islam, S., Mwita, J., do Nascimento, R. C. R. M., Dias Godói, I. P., Niba, L. L., Amu, A. A., Acolatse, J., Incoom, R., Sefah, I. A., Opanga, S., ... Seaton, R. A. (2021). Strategies to Improve Antimicrobial Utilization with a Special Focus on Developing Countries. *Life*, 11(6), 528.
- Hinman, A. R., & Orenstein, W. A. (2007). Adult Immunization: What Can We Learn from the Childhood Immunization Program? *Clinical Infectious Diseases*, 44(12), 1532–1535.
- Hossain, Md. M., Abdulla, F., Karimuzzaman, Md., & Rahman, A. (2020). Routine Vaccination Disruption in Low-Income Countries: An Impact of COVID-19 Pandemic. *Asia Pacific Journal of Public Health*, 32(8), 509–510.
- Iwu, C. J., Jordan, P., Jaja, I. F., Iwu, C. D., & Wiysonge, C. S. (2020). Treatment of COVID-19: Implications for antimicrobial resistance in Africa. *The Pan African Medical Journal*, 35.(119)
- Kampf, G. (2018). Biocidal Agents Used for Disinfection Can Enhance Antibiotic Resistance in Gram-Negative Species. *Antibiotics*, 7(4), 110.
- Knight, G. M., Glover, R. E., McQuaid, C. F., Oлару, I. D., Gallandat, K., Leclerc, Q. J., Fuller, N. M., Willcocks, S. J., Hasan, R., van Kleef, E., & Chandler, C. I. (2021). Antimicrobial resistance and COVID-19: Intersections and implications. *ELife*, 10, e64139.
- Lucien, M. A. B., Canarie, M. F., Kilgore, P. E., Jean-Denis, G., Fénélon, N., Pierre, M., Cerpa, M., Joseph, G. A., Maki, G., Zervos, M. J., Dely, P., Boney, J., Sati, H., Rio,

- A. del, & Ramon-Pardo, P. (2021). Antibiotics and antimicrobial resistance in the COVID-19 era: Perspective from resource-limited settings. *International Journal of Infectious Diseases*, 104, 250–254.
- Mazdeyasna, H., Nori, P., Patel, P., Doll, M., Godbout, E., Lee, K., Noda, A. J., Bearman, G., & Stevens, M. P. (2020). Antimicrobial Stewardship at the Core of COVID-19 Response Efforts: Implications for Sustaining and Building Programs. *Current Infectious Disease Reports*, 22(9), 23.
- Morrison, L., & Zembower, T. R. (2020). Antimicrobial Resistance. *Gastrointestinal Endoscopy Clinics of North America*, 30(4), 619–635.
- Rawson, T. M., Ming, D., Ahmad, R., Moore, L. S. P., & Holmes, A. H. (2020). Antimicrobial use, drug-resistant infections and COVID-19. *Nature Reviews Microbiology*, 18(8), 409–410.
- Rawson, T. M., Moore, L. S. P., Castro-Sanchez, E., Charani, E., Davies, F., Satta, G., Ellington, M. J., & Holmes, A. H. (2020). COVID-19 and the potential long-term impact on antimicrobial resistance. *Journal of Antimicrobial Chemotherapy*, 75(7), 1681–1684.
- Rodríguez-Baño, J., Rossolini, G. M., Schultsz, C., Tacconelli, E., Murthy, S., Ohmagari, N., Holmes, A., Bachmann, T., Goossens, H., Canton, R., Roberts, A. P., Henriques-Normark, B., Clancy, C. J., Huttner, B., Fagerstedt, P., Lahiri, S., Kaushic, C., Hoffman, S. J., Warren, M., ... Plant, L. (2021). Key considerations on the potential impacts of the COVID-19 pandemic on antimicrobial resistance research and surveillance. *Transactions of The Royal Society of Tropical Medicine and Hygiene*, trab048.
- Sartelli, M., Weber, D. G., Ruppé, E., Bassetti, M., Wright, B. J., Ansaloni, L., Catena, F., Coccolini, F., Abu-Zidan, F. M., Coimbra, R., Moore, E. E., Moore, F. A., Maier, R. V., De Waele, J. J., Kirkpatrick, A. W., Griffiths, E. A., Eckmann, C., Brink, A. J., Mazuski, J. E., ... Viale, P. (2016). Antimicrobials: A global alliance for optimizing their rational use in intra-abdominal infections (AGORA). *World Journal of Emergency Surgery*, 11(1), 33.
- Smith, M. A., Garbharran, H., Edwards, M. J., & O'Hara-Murdock, P. (2004). Health Promotion and Disease Prevention through Sanitation Education in South African Zulu and Xhosa Women. *Journal of Transcultural Nursing*, 15(1), 62–68.
- World Health Organization (Ed.). (2014). *Antimicrobial resistance: Global report on surveillance*. World Health Organization.

Acknowledgement

The authors thank [Egypt Scholars](#), especially Egypt Scholar Labs for their effort.

About Egypt Scholars

[Egypt Scholars](#) is an independent, non-profit organization founded on the principle of volunteerism. The organization includes volunteers with expertise in various fields ranging from scientific research and entrepreneurship to law, humanities and the social sciences. Arising from its strong belief in the infinite benefits of volunteerism, the members collaborate on a voluntary basis to facilitate the exchange of scientific and professional knowledge, skills and expertise both within Egypt and internationally. [Egypt Scholars](#) is a 501c-3 tax-exempt non-profit organization registered in California.

This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

