Antimicrobial Resistance

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DRUG-RESISTANT DISEASES MOUNT A RAPIDLY GROWING THREAT

Any time antibiotics and other antimicrobials are used—whether in patients, livestock or agriculture—they can contribute to the acceleration of existing and new patterns of antimicrobial resistance (AMR): germs developing the ability to defeat the drugs designed to kill them. Yet global consumption of prescribed antibiotics increased by 46% globally between 2000 and 2018, with even larger increases seen in low- and middle-income countries.

AMR's threat is consequently mounting across the world. Antimicrobial-resistant infections have emerged as the third leading cause of death globally according to a 2022 study that provided the first comprehensive global picture of its lethality. The study estimated that AMR was associated with 4.95 million deaths worldwide in 2019 and about 1.7 million deaths were directly attributable to antimicrobial-resistant infections, establishing the magnitude of AMR's threat as "at least as large as major diseases such as HIV and malaria, and potentially much larger."

A United Nations report has provided a harrowing prediction, estimating the number of deaths caused by drug-resistant diseases could climb to 10 million globally per year by 2050 "under the most alarming scenario if no action is taken." For comparison, the COVID pandemic took about 5.5 million lives worldwide between its onset in 2020 and the end of 2021.

In the US, nationwide investments in AMR prevention led to an 18% reduction in deaths caused by drug-resistant infections between 2013 and 2019, translating to 10 thousand lives saved per year by the end of this period. Through globally coordinated efforts to prevent the spread of AMR, hundreds of thousands of lives can be saved.

EXPERTS BREAK BOUNDARIES TO GENERATE SOLUTIONS

A new and unlikely collaboration shows promise for coordinating global action. The Antimicrobial Resistance Global Working Group is a band of experts and scholars in pediatrics, adult infectious disease, preventive medicine, civil and environmental engineering, anthropology, computational biology, statistics and more, all jumpstarting a landmark collaboration in the race against AMR. The group was formalized and awarded three years of comprehensive support and seed funding through Northwestern University's Roberta Buffett Institute for Global Affairs. The Buffett Institute's Global Working Groups undertake ambitious, collaborative projects that leverage different forms of expertise across the sciences, social sciences and humanities to address the world's most challenging problems.

The group's lead researchers, who hail from Northwestern University's Feinberg School of Medicine and McCormick School of Engineering, have established a partnership with the Aga Khan University Medical College in Karachi,

Pakistan, forming the first of their internationally coordinated efforts to better understand the rapid spread of AMR. Currently, the researchers are involved in several projects that leverage the research infrastructure they have established to evaluate AMR in two disparate health care systems and gain critical insights into how health care providers are making decisions around prescribing antibiotics and antifungals. The group aims to use these insights to help coordinate responses to AMR among academic, political, pharmaceutical and medical institutions.

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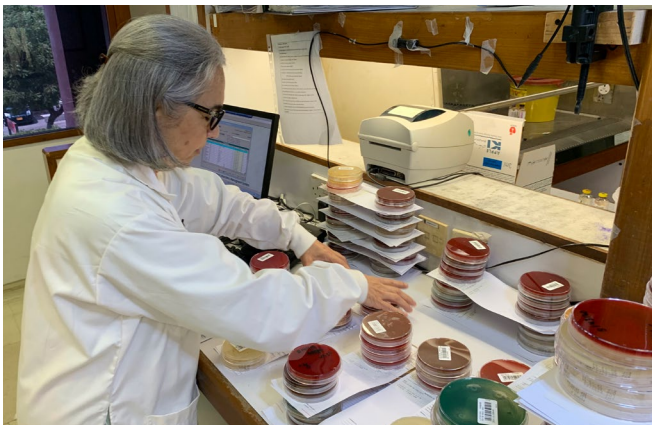
EARLY FINDINGS

In 2021, the Antimicrobial Resistance Global Working Group was awarded a $2.5 million grant by the Centers for Disease Control and Prevention (CDC) to undertake an antifungal focus in their efforts. Fungal infections can range from mild to life-threatening, such as those associated with immune compromise due to cancer or organ transplant. But comparatively less is known about drug-resistant fungi than bacterial pathogens. The grant has since been monitoring fungal pathogens in Pakistan—surveillance which may have revealed one pathogen's misclassification and another potentially novel pathogen emerging in humans. These findings, which may be published in the coming year, underscore the importance of the group's approach to forecasting and detecting the emergence of AMR.

In the Midwestern US, the group completed a cross-sectional study on the prevalence of multi-drug resistant bacteria in Chicago mothers and infants and published a pre-print of their findings. The study shows that 14 percent of otherwise healthy mothers and 7 percent of babies are carriers of this highly-resistant bacteria—the highest known prevalence in developed countries. Group members are currently analyzing the data for a longitudinal study, which will continue to monitor infants in the cohort.



Clinical bacterial cultures and antibiotic resistance testing in the Clinical Microbiology Laboratory at Aga Khan University Hospital in Karachi, Pakistan

DEVELOPMENTS TO FOLLOW

In the coming year, the Antimicrobial Resistance Global Working Group plans to expand its work to Kenya and build on its established relationship with the National Institute of Health in Pakistan to conduct a nationwide qualitative assessment of prescriber behaviors related to antibiotics. The researchers will use insight from this study to model decision-making in the prescribing process, enabling them to identify perverse incentives or time/cost tradeoffs and design interventions to generate systemic changes.

Thanks to the group's interdisciplinary expertise, their work stands to generate groundbreaking new insights into AMR and solutions to combat its spread, including a forecasting system to detect and prevent the emergence of AMR across the globe, identify new patterns in AMR, suggest new prescription practices and predict future emergences of antimicrobial-resistant pathogens.lished in the coming year, underscore the importance of the group's approach to forecasting and detecting the emergence of AMR.