AI reveals critical gaps in global antimicrobial resistance research

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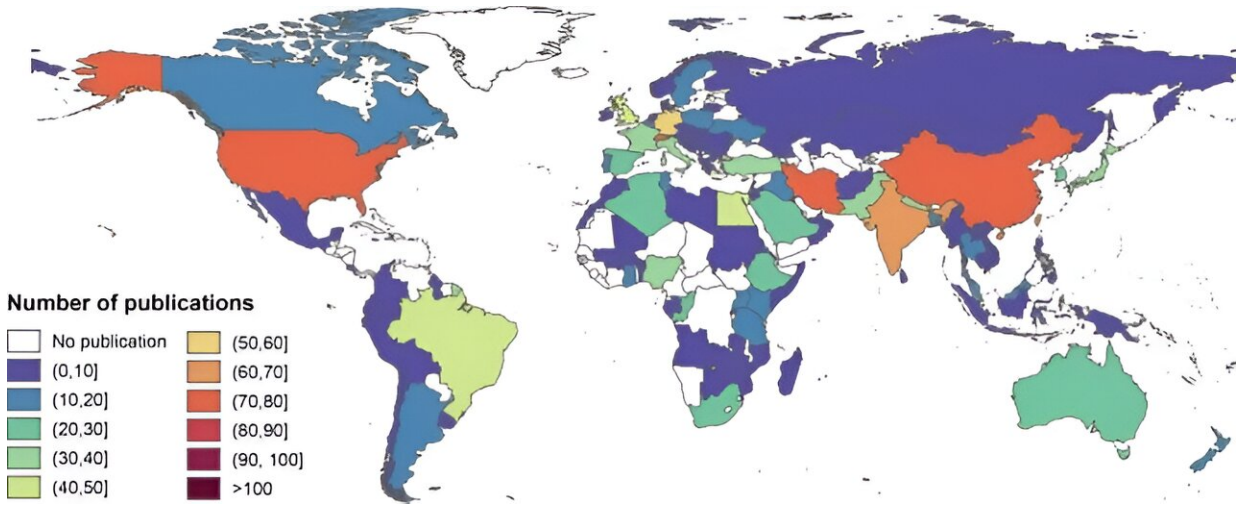

Global mapping of publication numbers related to MRSA. Credit: *Environment International* (2024). DOI: 10.1016/j.envint.2024.108680

Artificial intelligence (AI) has helped identify knowledge, methodological and communication gaps in global antimicrobial resistance (AMR) research.

In a new study carried out by the Chinese Academy of Sciences and Newcastle University under the co-leadership of Professor Yong-Guan Zhu and Professor David W. Graham, respectively, experts compiled a comprehensive database of 254,738 articles spanning two decades,

shedding light on patterns of AMR research worldwide.

They found that the terminology and methods used in AMR research significantly differ across the medical, veterinary, food safety, plant agriculture, and environmental sectors. The semantic and methodological differences result in limited valuation work between sectors and limited cross-sectoral communication, resulting in inconsistent messages to decision-makers.

Through sophisticated AI-based analysis, the team developed global maps showcasing regional, methodological, and sectoral AMR research activities. The findings confirm a stark lack of interdisciplinary collaboration, particularly in low-income countries, where the burden of increasing AMR is most acute.

Published in the journal *Environment International*, the findings explain why solutions to AMR based on One Health are not developing as needed. The results could play a critical role in providing guidance on how and where to better integrate AMR surveillance across sectors and regions worldwide.

Professor David W. Graham, Emeritus Professor of Engineering at Newcastle University, said, "The findings highlight the urgent need for greater coordination in research methods across sectors and regions. For instance, the medical and veterinary communities need information about living AMR infectious pathogens to prioritize decisions, whereas environmental researchers often focus on genetic targets. Our work shows that culturing microbiology and isolate sequencing, and metagenomics must be performed in tandem in all future work, and more context data must be collected to relate results from different sectors.

"Our paper's findings support key messages from UN Environment

Program and World Health Organization that emphasize the best way to mitigate AMR is through prevention and integrated surveillance, which is key to prioritizing solutions."

This is being addressed by the United Nations Quadripartite Technical Group on Integrated Surveillance on Antimicrobial Use and Resistance, of which both Prof Zhu and Graham are members.

Graham continued, "This work was only possible due its novel use of artificial intelligence and natural language processing to intelligently search an extensive and living database, an archive we make openly available for public use and contributions. This paper represents the first in a series of joint manuscripts leveraging AI to guide future AMR and other research agenda."

Professor Yong-Guan Zhu, Professor of Environmental Sciences, Chinese Academy of Sciences, added, "The framework of One Health is of critical importance in safeguarding human and ecosystem health, but it needs roadmaps to implement; this study timely identifies [a] path forward. The study also demonstrates that multidisciplinary and international collaboration is essential in solving global challenges, and we should embrace emerging technologies, such as AI."

Both scientists recommend future research and increased investment in capacity development, especially in low-income countries, to address the pressing AMR challenges in these regions.

More information: Cai Chen et al, Characterising global antimicrobial resistance research explains why One Health solutions are slow in development: An application of AI-based gap analysis, *Environment International* (2024). DOI: 10.1016/j.envint.2024.108680