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PONTIFICIA UNIVERSIDAD
CATÓLICA DE CHILE



Antimicrobial resistance: a multidimensional global threat

Eduardo A. Undurraga

Pontificia Universidad Católica de Chile

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What is antimicrobial resistance (AMR)?

Antimicrobials, especially antibiotics, are cornerstones of modern medicine

AMR occurs when pathogens no longer respond to treatment

Resistance is a natural process, but accelerated by human activity

AMR is a top global public health threat, affecting all countries

Ho, C. S. et al. Antimicrobial resistance: a concise update. *The Lancet Microbe* 6, (2025).

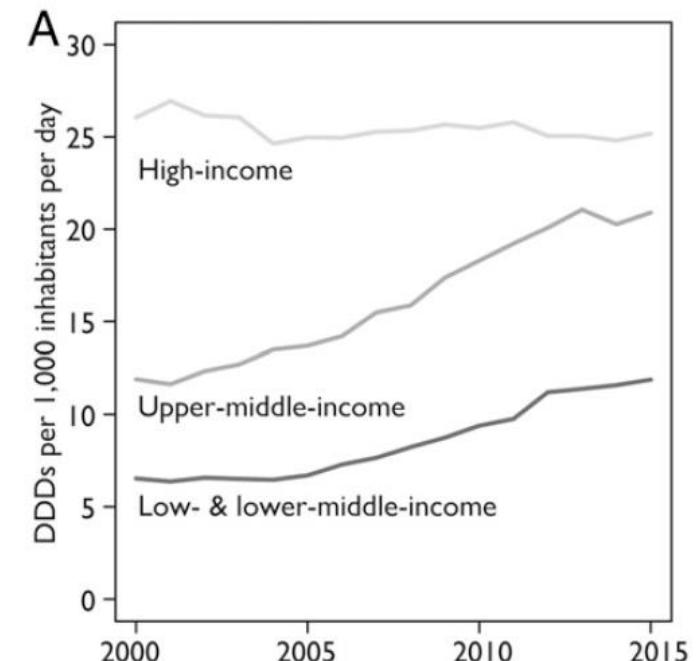
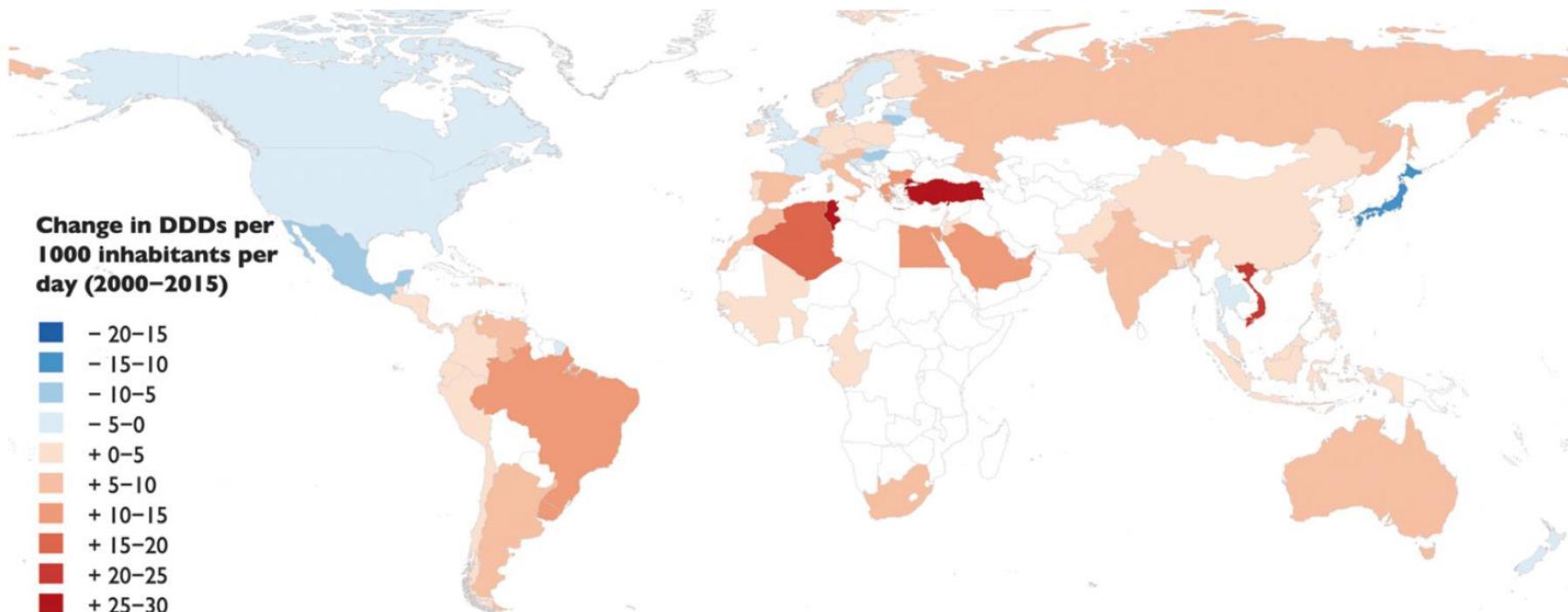
World Health Organization. Key Facts, Antimicrobial Resistance. Updated 21 November 2023, <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance>

The challenge of AMR

Causes



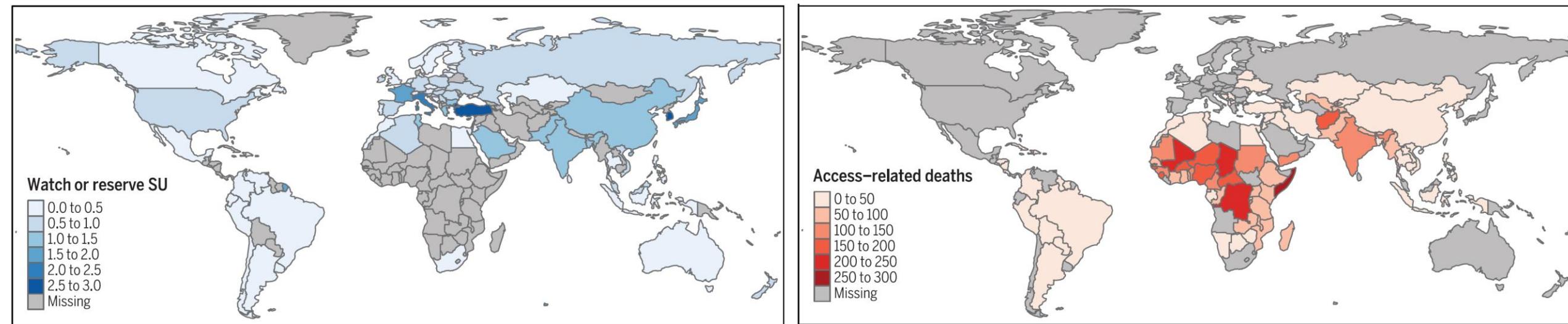
Increase in antibiotic consumption



Klein, E. Y. et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proceedings of the National Academy of Sciences* 115, E3463-E3470, (2018).

Klein, E. Y. et al. Assessment of WHO antibiotic consumption and access targets in 76 countries, 2000–15: an analysis of pharmaceutical sales data. *The Lancet Infectious Diseases* 21, 107-115, (2020).

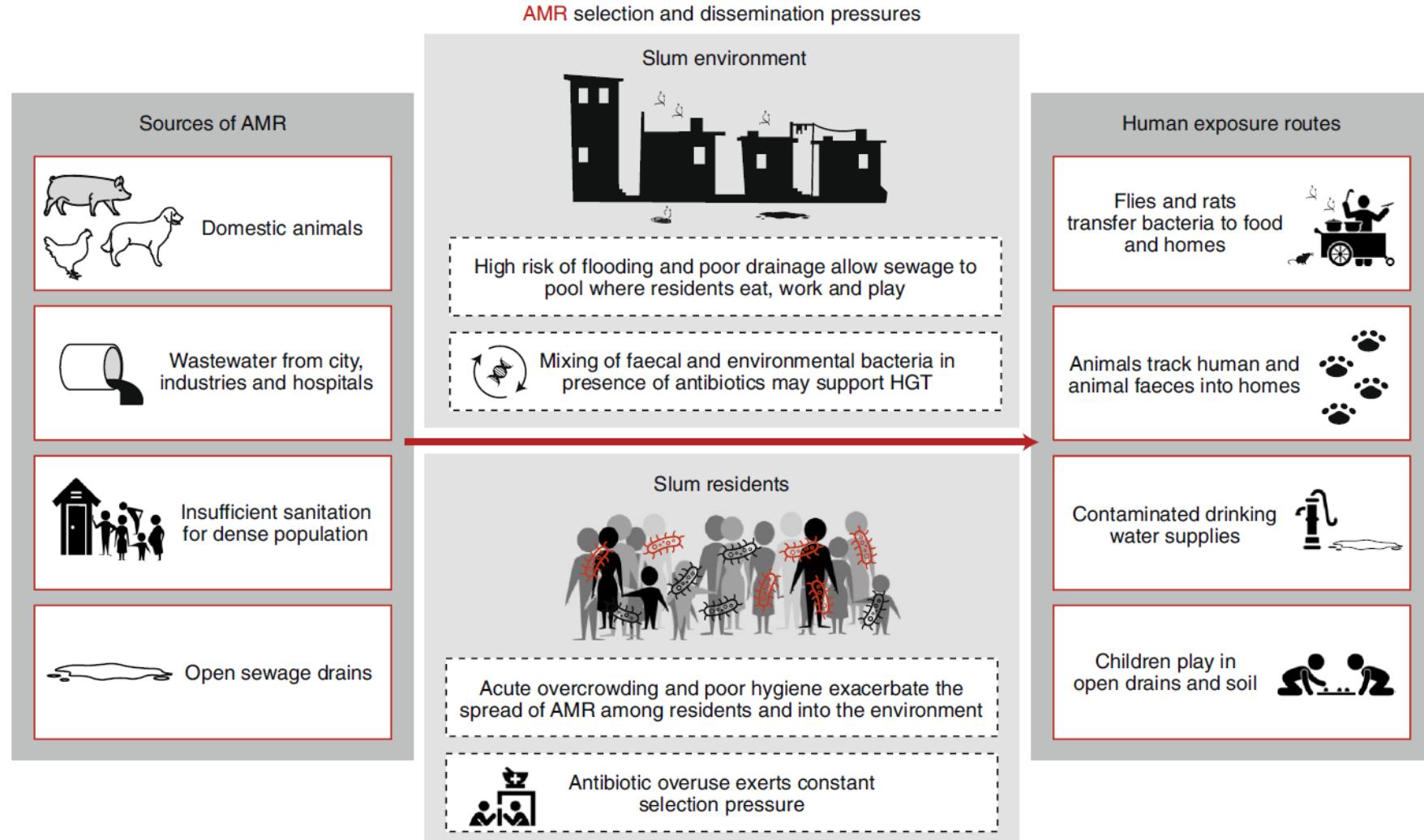
Double challenge: excess and access



Roope, L. S. J. et al. The challenge of antimicrobial resistance: What economics can contribute. *Science* 364, eaau4679, (2019).

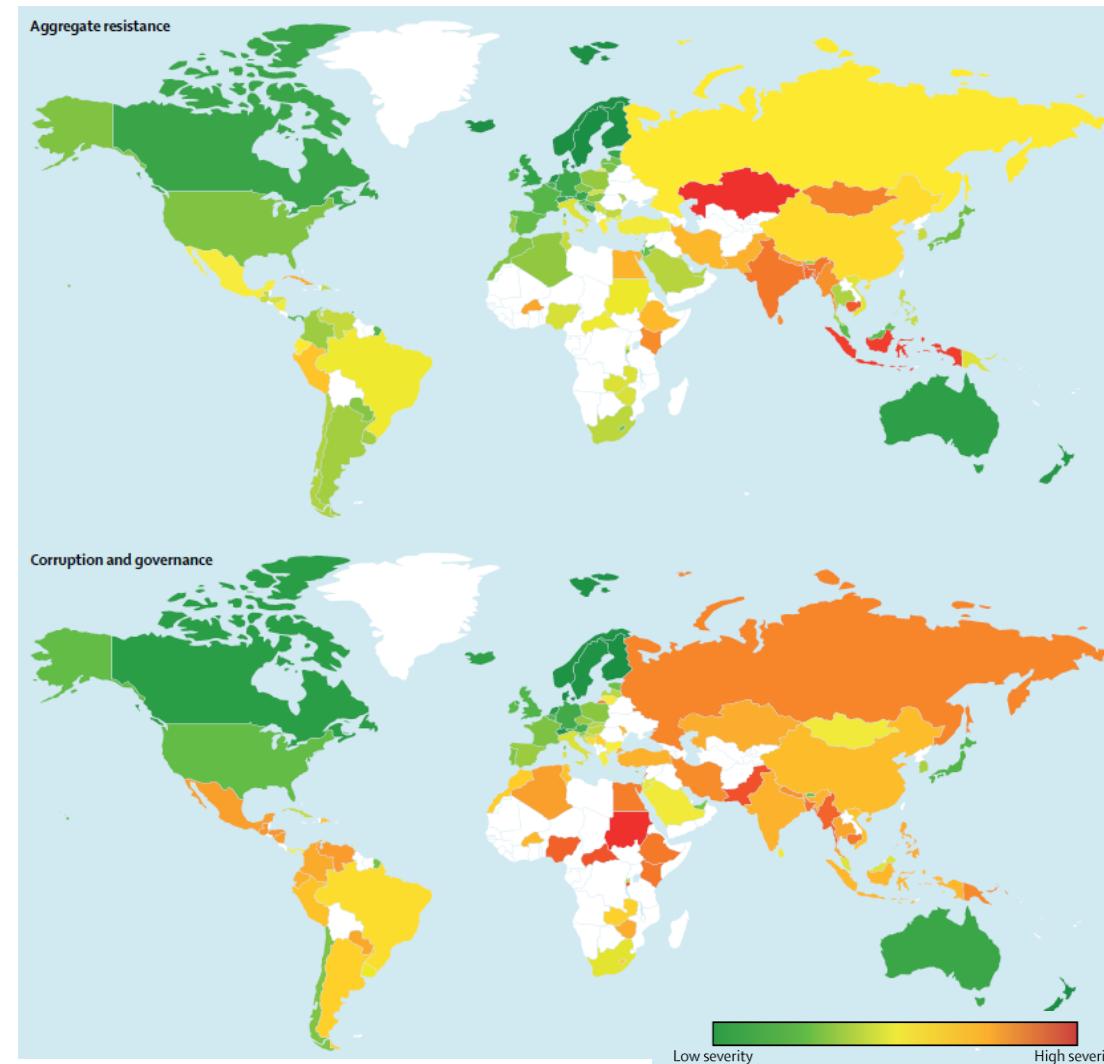
Mendelson, M. et al. Maximising access to achieve appropriate human antimicrobial use in low-income and middle-income countries. *The Lancet* 387, 188-198, (2016).

Drivers of AMR exacerbated by poverty and socioeconomic factors



Nadimpalli, M. L. et al. Urban informal settlements as hotspots of antimicrobial resistance and the need to curb environmental transmission. *Nature Microbiology* 5, 787-795, (2020).
Li, W. et al. Changing climate and socioeconomic factors contribute to global antimicrobial resistance. *Nature Medicine* (2025)

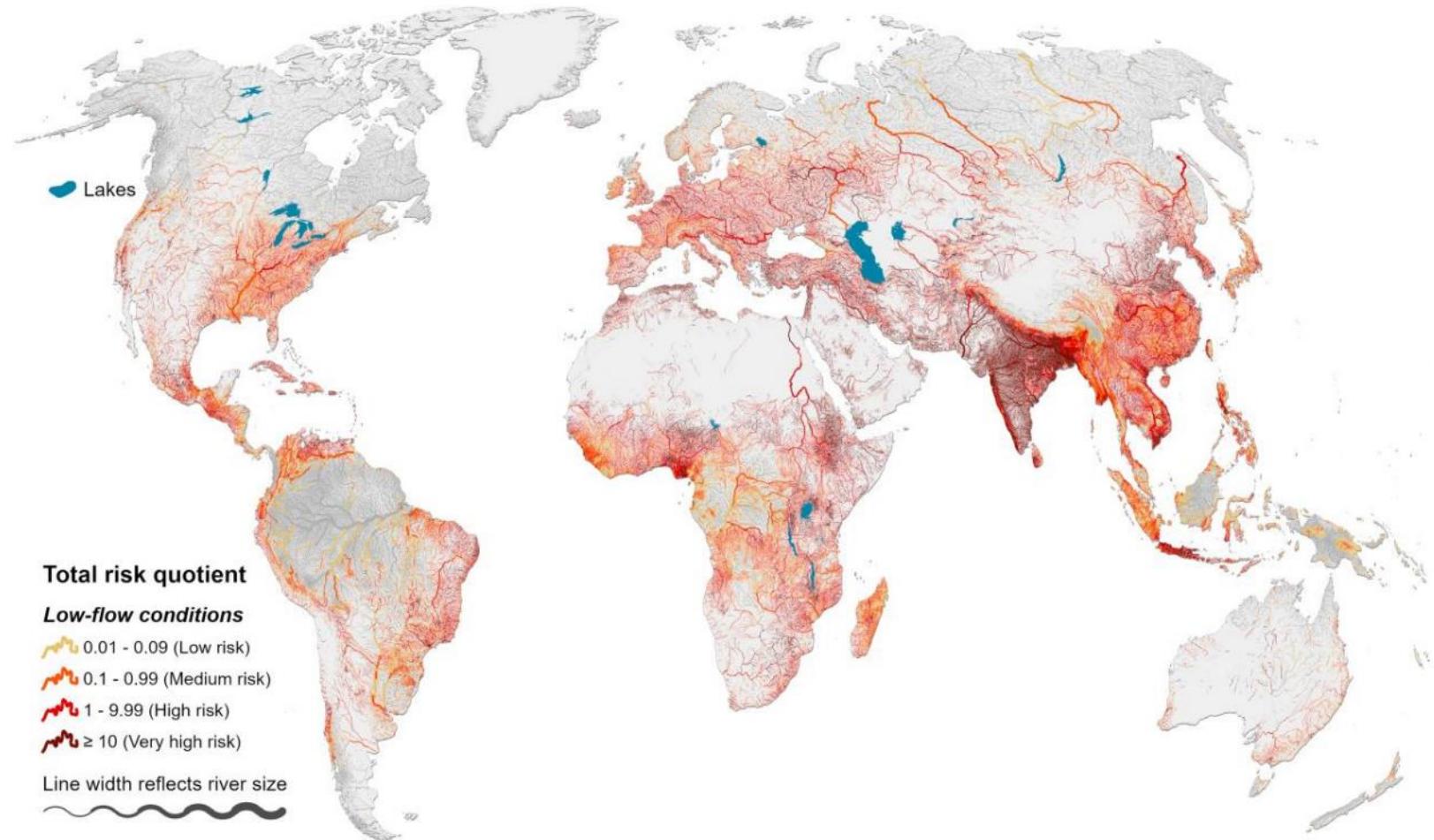
Drivers of AMR exacerbated by limited state capacity



Collignon, P. et al. Anthropological and socioeconomic factors contributing to global antimicrobial resistance. *The Lancet Planetary Health* 2, e398-e405, (2018).
Collignon, P. et al. Antimicrobial resistance: the major contribution of poor governance and corruption to this growing problem. *PLoS One* 10, e0116746, (2015).

AMR spread through surface waters

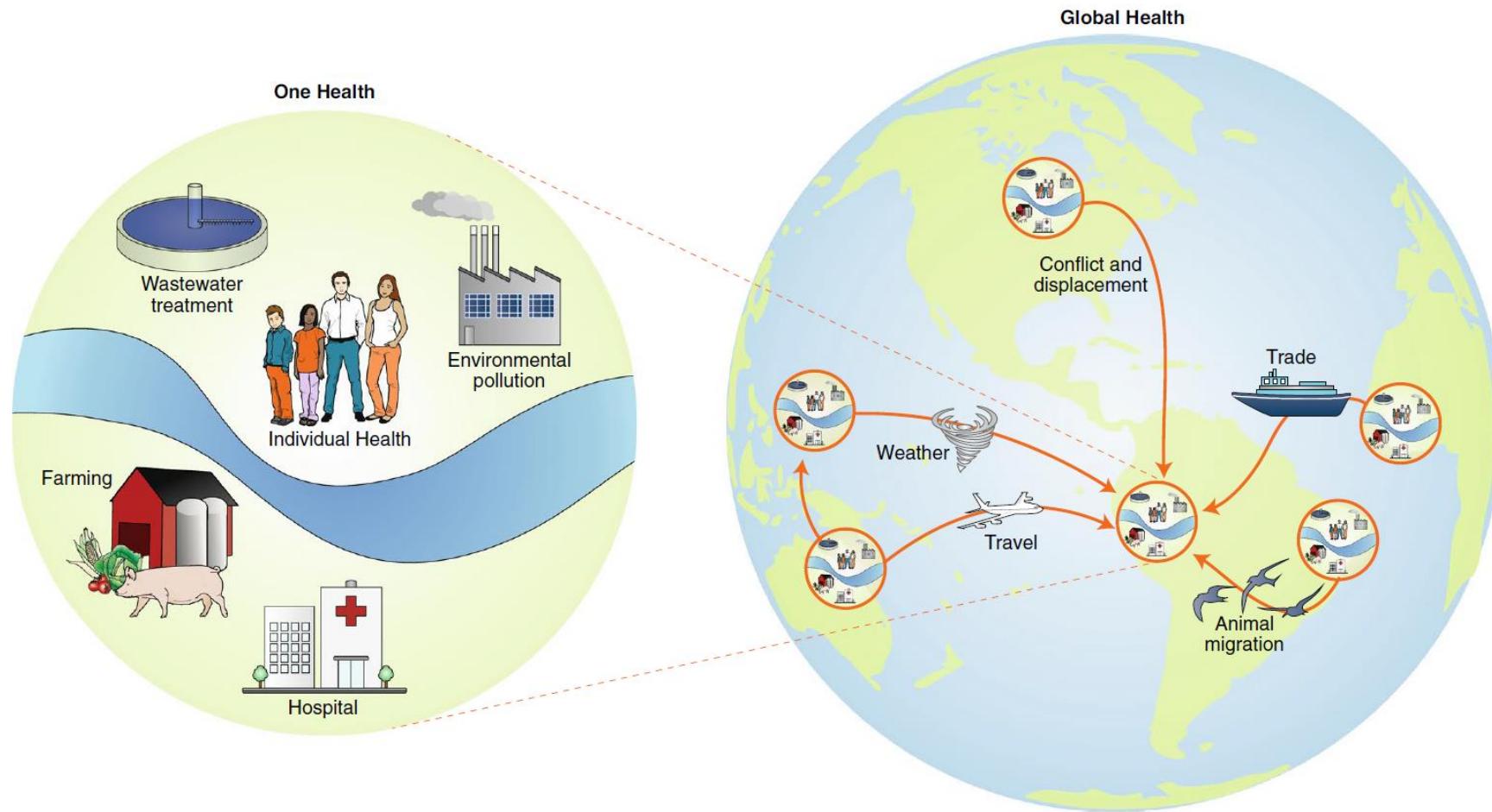
Environmental exposure
levels of antibiotics in
global rivers



Macedo, H. E. et al. Antibiotics in the global river system arising from human consumption. *PNAS Nexus* 4, (2025).

Wilkinson, J. L. et al. Pharmaceutical pollution of the world's rivers. *Proceedings of the National Academy of Sciences* 119, e2113947119, (2022).

One Health and Global Health perspectives



Hernando-Amado, S. et al. Defining and combating antibiotic resistance from One Health and Global Health perspectives. *Nature Microbiology* 4, 1432-1442, (2019).

The burden of AMR

Global burden of AMR

Global estimates for 2019 (GBD):

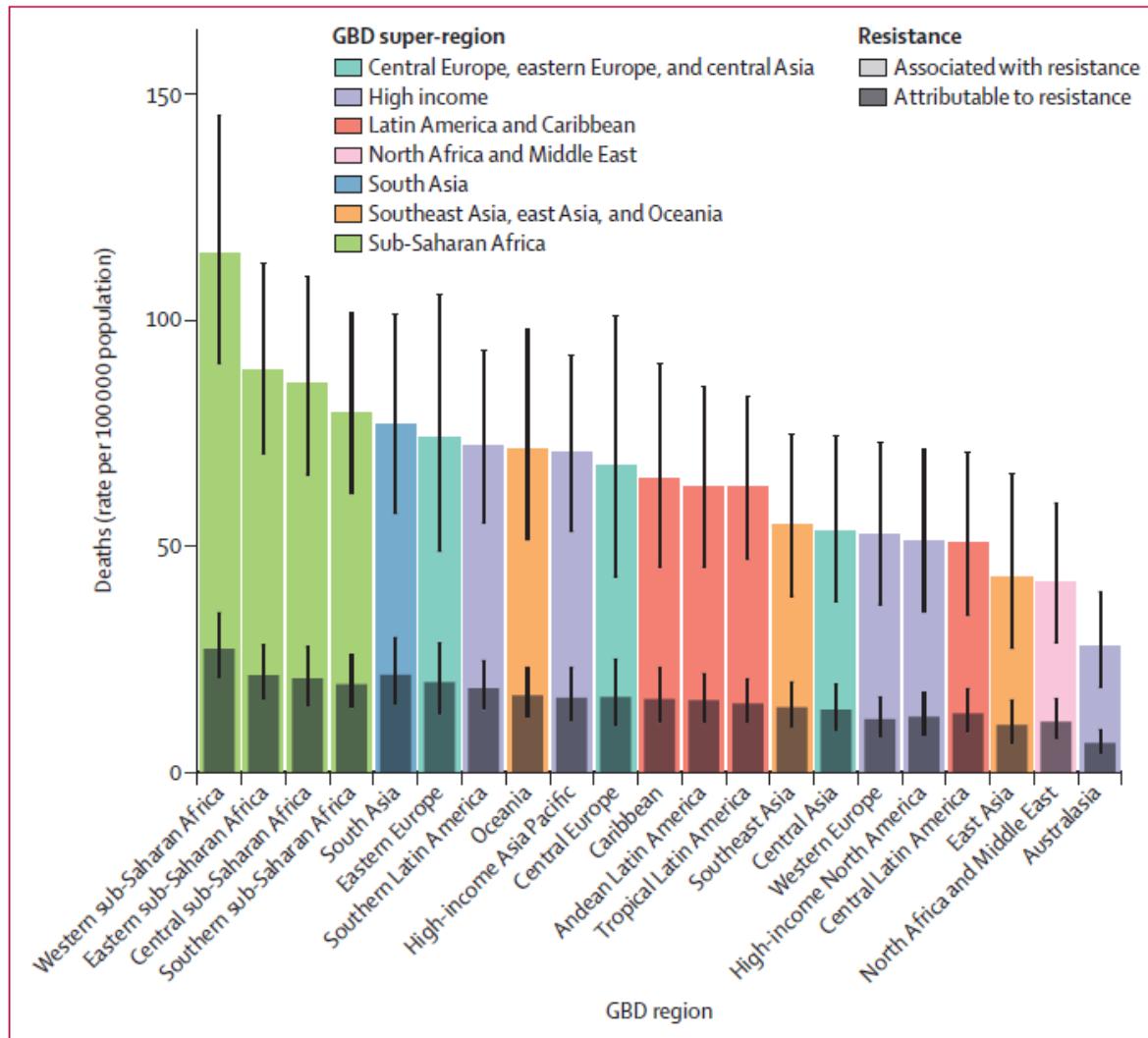
Caused **1.27 million** deaths

Contributed to **4.95 million** deaths

Cost estimates to the global economy in 2030:

USD 1.0-3.4 trillion annual losses

(low and high AMR-impact scenarios)

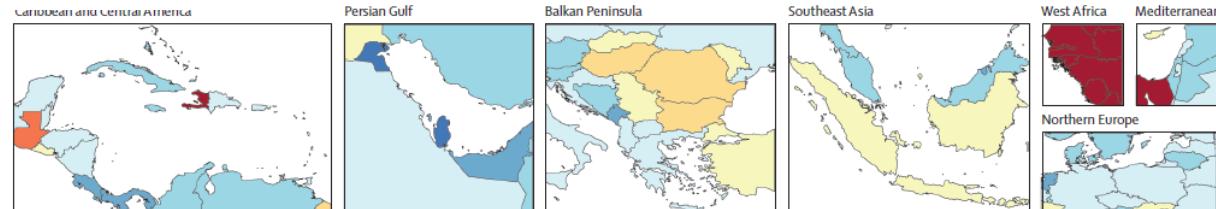
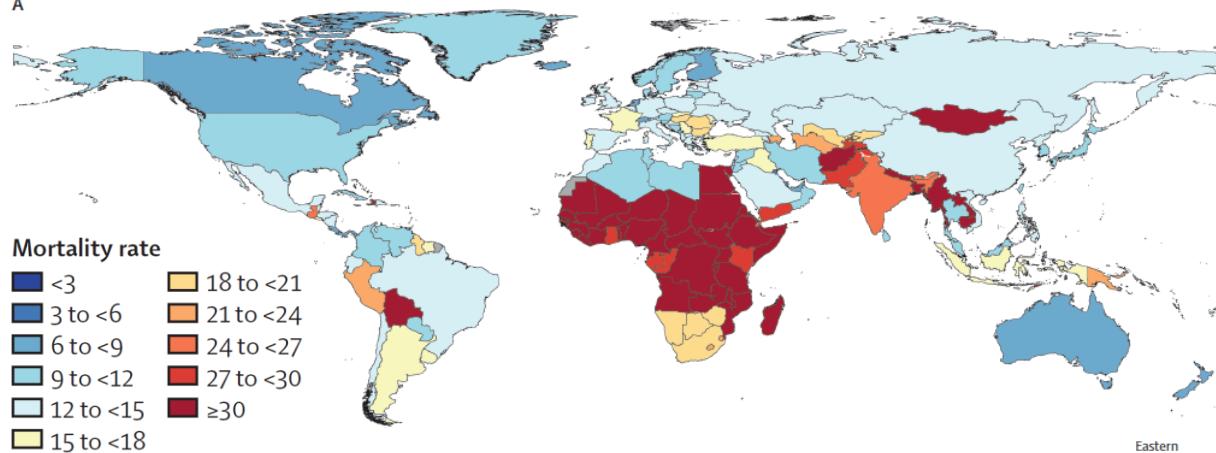


Murray, C. J. L. et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *The Lancet* 399, 629-655, (2022).

Jonas O.B., Drug-resistant infections: a threat to our economic future, final report. HNP/Agriculture Global Antimicrobial Resistance Initiative, Washington, D.C., World Bank Group

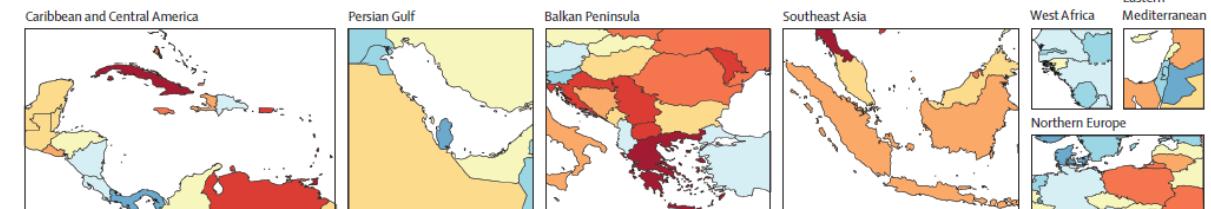
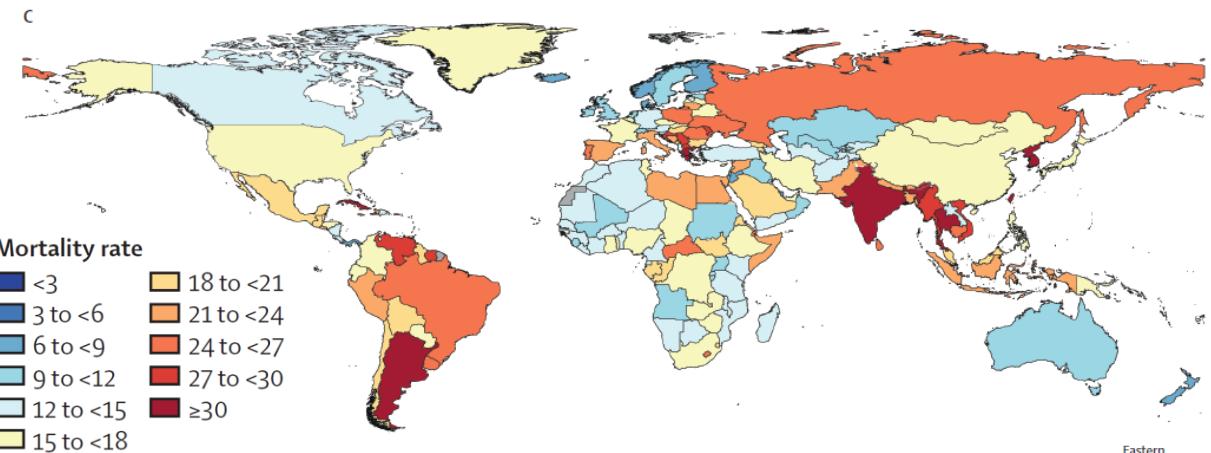
Global burden of AMR 1990 and 2050

A



Death rate attributable to AMR, all ages, 1990

C



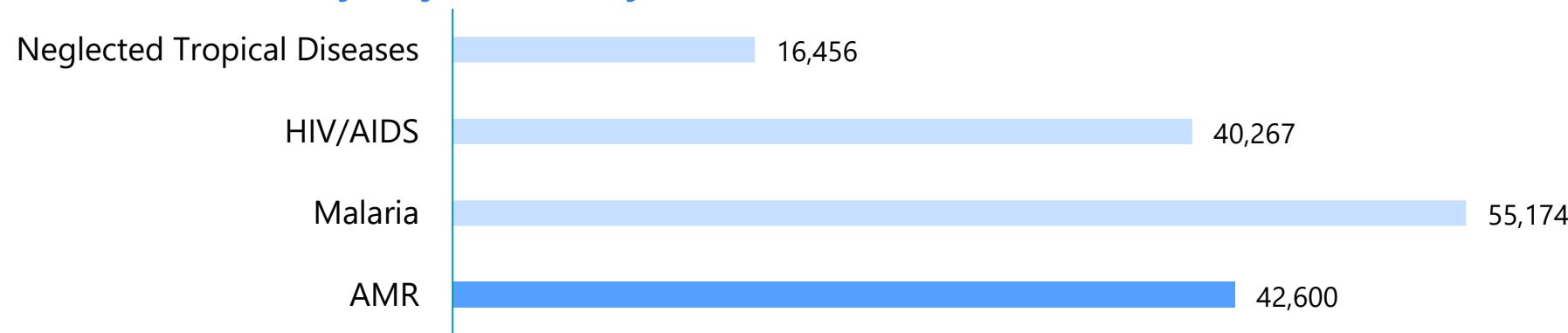
Death rate attributable to AMR, all ages, 2050

Global Burden of AMR

Attributable deaths (thousands), 2021



Estimated disability-adjusted life years (thousands), 2021



Naghavi, M. et al. Global burden of bacterial antimicrobial resistance 1990-2021: a systematic analysis with forecasts to 2050. *The Lancet* 404, 1199-1226, (2024).

Ferrari, A. J. et al. Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990-2021. *The Lancet* 403, 2133-2161, (2024).

Mitigation strategies

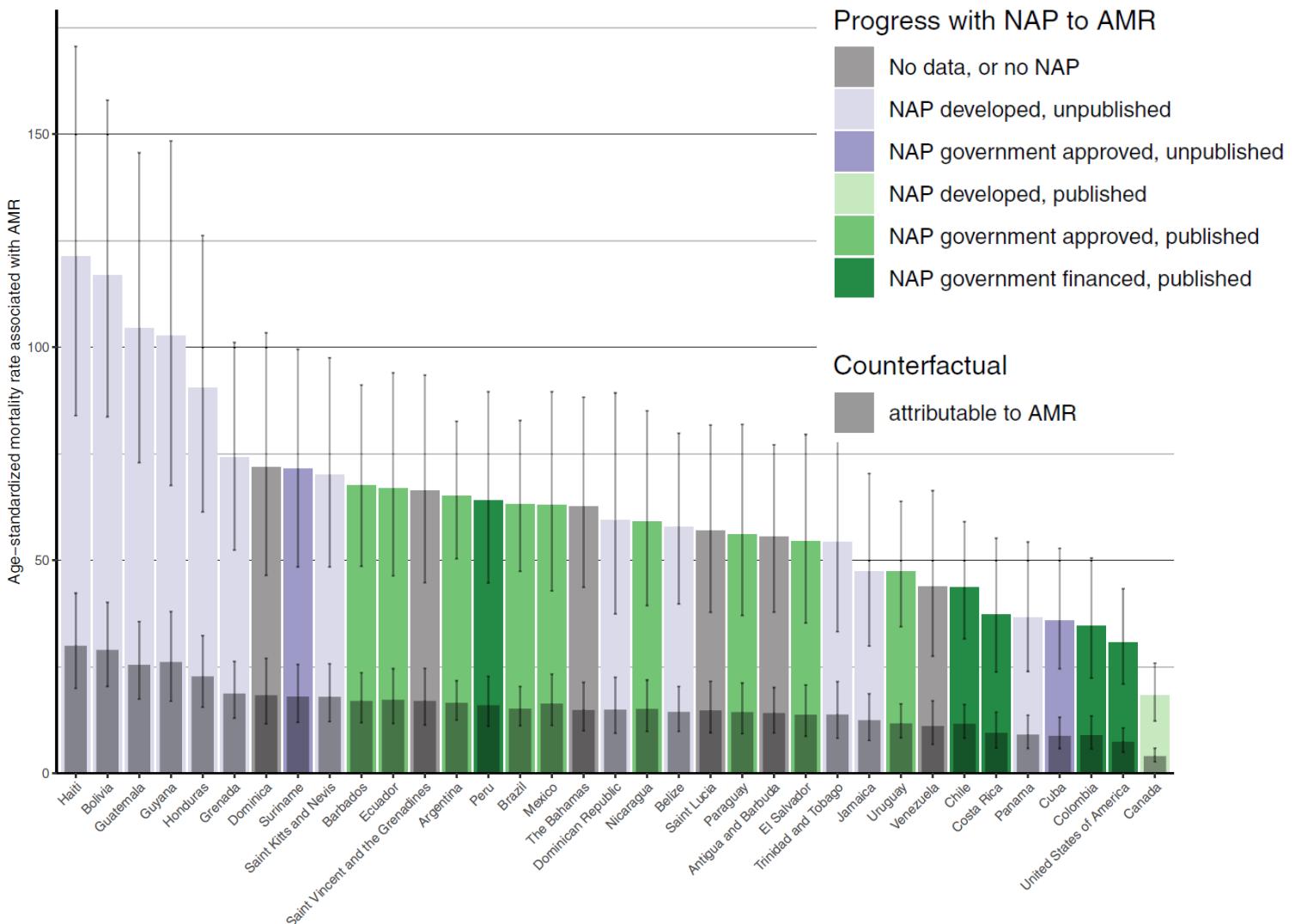
National Action Plans against AMR

Self reported government engagement (2018-2021)

NAP: 178 countries

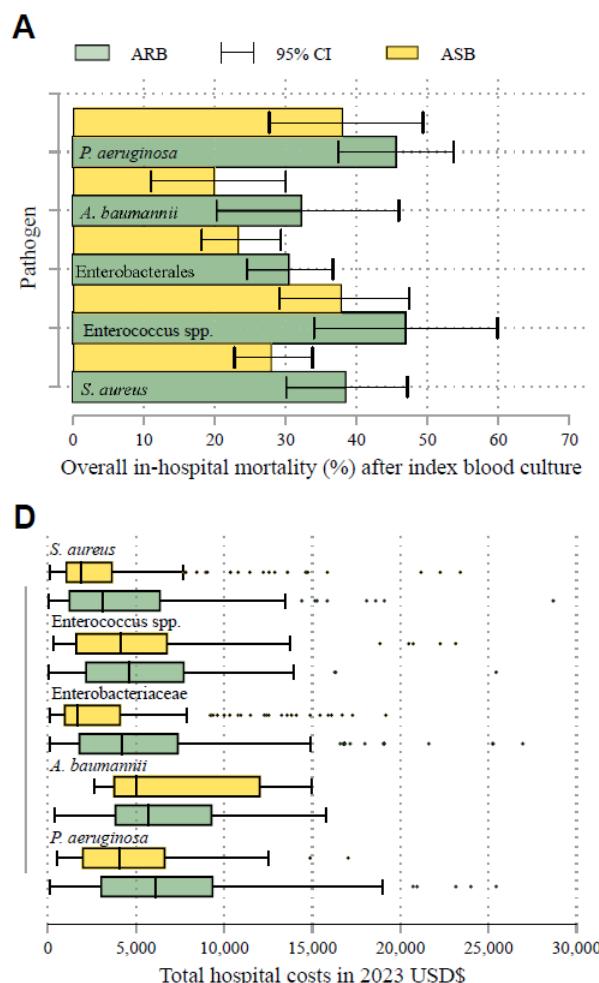
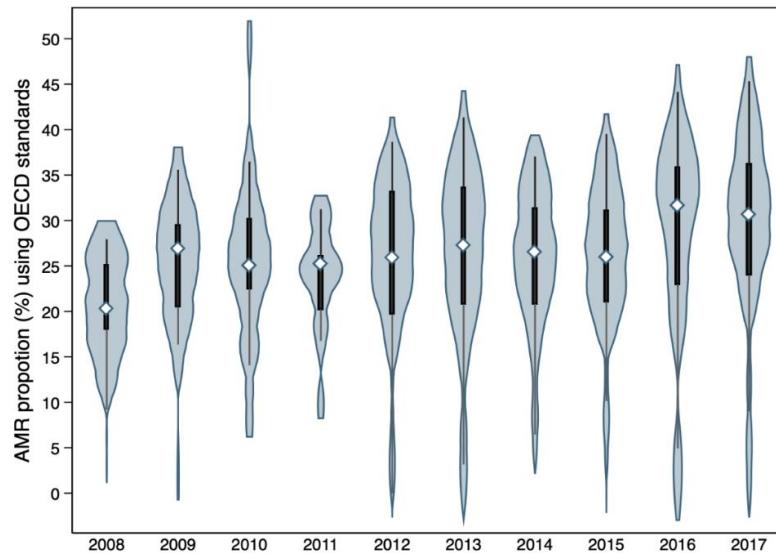
GLASS (surveillance):
128 countries

Americas: 7 countries (3 Atb)



Aguilar, G. R. et al. The burden of antimicrobial resistance in the Americas in 2019: a cross-country systematic analysis. Lancet Regional Health - Americas 25, 100561, (2023).

AMR in Chile



Ministerio de Salud Chile. Plan Nacional Contra la Resistencia a los Antimicrobianos Chile 2021-2025, <<https://bit.ly/3CjRrrE>> (2021).

Allel, K. et al. Excess burden of antibiotic-resistant bloodstream infections: multicentre retrospective cohort study in Chile, 2018–2022. *The Lancet Regional Health Americas* 40, 100943, (2024).

Allel, K. et al. Trends and socioeconomic, demographic, and environmental factors associated with antimicrobial resistance. *The Lancet Regional Health Americas* 21, 100484, (2023)

Challenges in Chile (and elsewhere)

Strengthen surveillance and diagnostics (e.g., GLASS)

Regional and global collaboration

State governance

Antimicrobial stewardship and infection control

Awareness and education

New technologies (e.g., non-antibiotic antimicrobial therapies, AI)

Research, development, and intellectual property

Ho, C. S. et al. Antimicrobial resistance: a concise update. *The Lancet Microbe* 6, (2025).

Aguilar, G. R. et al. The burden of antimicrobial resistance in the Americas in 2019: a cross-country systematic analysis. *The Lancet Regional Health Americas* 25, 100561, (2023).

Allel, K. et al. Trends and socioeconomic, demographic, and environmental factors associated with antimicrobial resistance. *The Lancet Regional Health Americas* 21, 100484, (2023).



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Thank you

Eduardo A. Undurraga

eundurra@uc.cl

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