2026 APRU Virtual Global Health Case Competition

"Containing Environmental Drivers of Antimicrobial Resistance to build resilient cities in the Asia-Pacific"

INTRODUCTION

Thank you for participating in the 11th annual APRU Global Health Case Competition. We hope this experience proves intellectually challenging, as well as fun and rewarding. Please keep in mind that this case presents a complex, real-world scenario for which there is no single "correct" solution. Your task is to thoughtfully develop and justify a strategic response to the challenge presented. We encourage teams to strike a balance between innovation and feasibility, grounding your proposals in sound evidence while remaining attentive to practical constraints. Although this case is hypothetical, many economies[1] around the world are actively grappling with how to address similar issues, making your work both timely and highly relevant.

OVERVIEW

Antimicrobial resistance (AMR) is not solely a clinical or pharmaceutical problem; it is a systems-level challenge that reflects how humans interact with animals, ecosystems, and global markets. Unless the world acts urgently to address the global burden of AMR, including the environmental drivers, AMR will have devastating impacts to humans and animals. Addressing AMR effectively will require aligning health systems, agricultural practices,

[1] The term "economies" is used instead of "countries"

environmental protections, and global cooperation to preserve the effectiveness of antimicrobials for future generations. Framing AMR as a One Health issue underscores the need for interdisciplinary collaboration, multisectoral governance, and sustainable policy solutions. In this challenge, your team is tasked with conducting a detailed plan to address the environmental drivers of AMR in one (hypothetical) Southeast Asian urban setting. You will make recommendations for the allocation of US$10 million for interventions to combat AMR and will have to convince multiple stakeholders on the city's Urban Resilience Task Force to approve your plan. This case incorporates dimensions of One Health, urban resilience planning, antimicrobial stewardship, and stakeholder tradeoffs.

BACKGROUND

Antimicrobial resistance (AMR) is one of the most urgent global health threats of the 21st century. It occurs when microorganisms—such as bacteria, viruses, fungi, and parasites—evolve mechanisms that render antimicrobial medicines (including antibiotics, antivirals, antifungals, and antiparasitics) ineffective. As a result, common infections become harder to treat, medical procedures become riskier, and morbidity, mortality, and health care costs rise worldwide. Strong evidence suggests that antimicrobials are increasingly failing to cure infections, while the research and development pipeline for new antimicrobial medicines remains insufficient. Consequently, AMR poses a significant threat to human, animal and plant health, food security, and economic development by reducing our ability to respond effectively to common infectious agents (UNEP, 2022). Without coordinated action, AMR threatens to undermine decades of progress in medicine, agriculture, and development. The World Health Organization (WHO) 2025 global surveillance reporting shows that resistance is widespread and rising across more than 100 countries (WHO, 2025).

AMR is a cause of death and poverty worldwide. Estimates suggest that bacterial AMR was associated with approximately 4.95 million deaths globally in 2019, including 1.27 million deaths directly attributable to resistant infections (Murray et al., 2022). Projections indicate that by 2050 AMR could cause up to 10 million deaths globally per year-comparable to the global mortality burden of cancer in 2020 (O'Neill 2016). Certain groups, including women, children, migrants, refugees, people employed in certain sectors such as agriculture or healthcare, and those living in poverty may be particularly vulnerable and/or more exposed to drug-resistant infections (Bhopal and Bhopal, 2020; WHO et al., 2021). AMR also poses a major economic threat; the World Bank estimates that, if left unchecked, AMR could add about US$1 trillion in healthcare costs by 2050 and cause US$1–3.4 trillion in GDP losses per year by 2030 (World Bank, 2017).

AMR as a One Health Problem

Recognizing the cross-sectoral nature of AMR, the WHO and other United Nations agencies promote a coordinated One Health approach to addressing AMR. According to the One Health High Level Expert Panel, One Health is *"an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent."* AMR exemplifies a One Health issue because it emerges from and spreads across the interconnected domains of human health, animal health, and the environment. Resistant organisms and resistance genes move among humans, animals, food chains, and ecosystems through pathways such as trade, travel, water systems, and migratory wildlife. The drivers and impacts of AMR therefore span multiple environmental sectors:

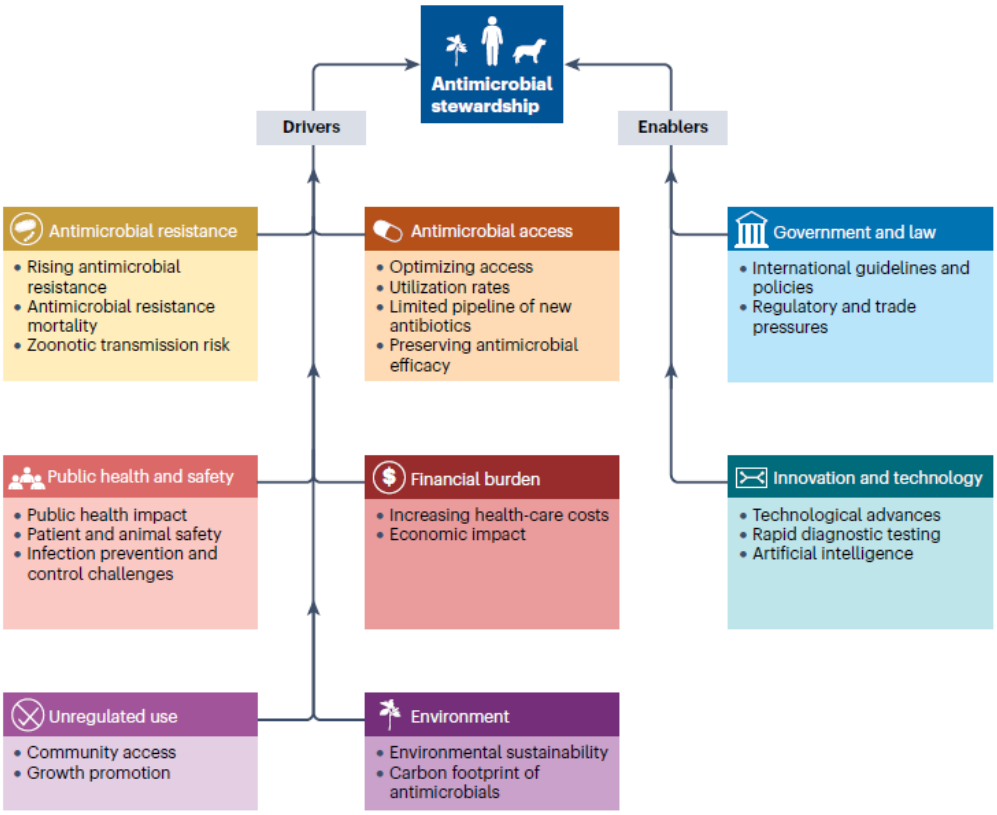
- Human health sector: Inappropriate prescribing, overuse of antibiotics in outpatient and inpatient settings, lack of diagnostic capacity, and poor infection prevention and control contribute to the emergence and spread of resistant pathogens.
- Animal health and agriculture: Antimicrobials are widely used in livestock production for treatment, disease prevention, and, in some settings, growth promotion. Resistant bacteria can spread between animals and humans through direct contact, food systems, and shared environments.
- Environmental pathways: Pharmaceutical manufacturing waste, hospital effluent, agricultural runoff, and inadequate sanitation release antimicrobial residues and resistant organisms into soil and water systems, creating ecological reservoirs of resistance genes.

AMR Governance and Stewardship

Because AMR has multiple interconnected drivers, it must be tackled on many fronts. A One Health approach is essential to ensure effective collaboration and coordination among stakeholders (OHLLEP, 2021). Addressing AMR requires engagement across multiple ministries, such as health, agriculture, and the environment. Without coordinated strategies, efforts in one sector may be undermined by inaction in another. For example, reducing inappropriate prescribing in hospitals will have limited impact if resistant organisms continue to proliferate through agricultural misuse or environmental contamination. The One Health Joint Plan of Action highlights the need to conceptualize health challenges at a systems level and promote the integration of data, knowledge, and expertise across disciplines and sectors. By enabling more comprehensive assessments of health risks, One Health supports the development of more effective prevention strategies, evidence-based policies, and sustainable

health systems and ecosystems, thereby strengthening social, ecological, and economic resilience (FAO, UNEP, WHO, and WOAH, 2022).

Antimicrobial stewardship is a key intervention in managing AMR. The WHO defines it as a "*coherent set of actions which promote the responsible use of antimicrobials. This definition can be applied to actions at the individual level as well as the national and global level, and across human health, animal health and the environment*" (WHO, 2019). As McEwen & Collignon (2017) highlight, to address antimicrobial resistance on a global scale, economies must have "*the basic regulatory, infrastructure, oversight, and enforcement capabilities to control antimicrobial availability and use as laid out by international guidelines*" (OIE, 2016; WHO, 2017).



Source: James et al., 2026

The complexity and interconnectedness of the drivers of AMR require integrated solutions that incorporate wider structural factors (Charani et al., 2021). For example, the One Health Joint Plan of Action (2022–2026) identifies several social factors that accelerate the emergence and spread of AMR, including insufficient access to health services, inadequate housing, a lack of clean water, poor sanitation/waste management, and a lack of awareness and education about the risks of AMR and the importance of appropriate

use of antimicrobials. Recent research has also emphasized the role of social inequities in shaping patterns of antimicrobial resistance. Socioeconomic status, race/ethnicity, gender, education and migration status have also been identified as important social determinants of health influencing exposure to AMR, as demonstrated by a review of 153 studies on AMR in marginalized populations (Shutt et al., 2025). As James et al. (2026) argue, these findings highlight the "*urgency in identifying strategies that respond to upstream social inequities, rather than focusing solely on individual behaviours*."

Addressing AMR will require contextually-tailored solutions that account for differences in political systems, health system capacity, and economic resources across diverse economies (Chen et al., 2026; James et al., 2026). It is also critical to acknowledge that AMR has significant equity dimensions, as economies vary widely in their ability to develop and implement effective policies and programs to address AMR drivers (WHO, 2015; James et al., 2026). For example, new innovations to prevent or respond to AMR are often designed for high-income settings and may not be easily adaptable to resource-constrained areas (Charani et al., 2021; Cohn et al., 2024). In low- and middle-income settings, barriers to AMR prevention include outdated formularies, guidelines and laboratory equipment; limited access to high-quality antimicrobials; and insufficient political support.

Recent studies have underscored the importance of comprehensive implementation of national AMR governance frameworks and sustained multisectoral engagement (Chen et al., 2026). There is no single model that applies universally across all economies, health systems or sectors. Effective interventions must be adapted to local infrastructural, political, and sociocultural contexts (Mendelson et al., 2020; James et al., 2026). Further, economies must ensure targeted and sustained financing tailored to their specific contexts and capacities (Chen et al., 2026). These challenges create complex policy and governance questions for decision-makers seeking to design and implement effective AMR strategies within their own national and local contexts.

THE SCENARIO

In late September, after several days of intense monsoon rains, floodwaters spread through several low-lying neighborhoods of Metro Santara (a hypothetical place). Overflowing drainage canals carried polluted river water into streets, homes, and local markets. Within days, hospitals reported a surge in severe gastrointestinal infections, and physicians noted that some patients were not responding to commonly prescribed antibiotics. At the same time, researchers from Santara University released preliminary findings from an environmental monitoring study. Water samples taken from several urban rivers contained high concentrations of antibiotic

residues and antimicrobial-resistant bacteria, particularly downstream from hospital districts and industrial zones. Similar resistant organisms were detected in samples from aquaculture farms supplying the city's food markets. These findings suggest that environmental pathways may be playing a significant role in the spread of AMR across the metropolitan region.

Local media quickly picked up the story. Community organizations demanded action, particularly in informal settlements where floodwaters frequently mix with untreated sewage. Facing growing public concern, the mayor announced a new initiative: "Resilient Santara: Environmental Action on Antimicrobial Resistance." The city council has allocated US$10 million over four years to address environmental drivers of AMR while strengthening the city's resilience to climate change and rapid urbanization.

THE CONTEXT

Santara is a rapidly expanding Southeast Asian coastal megacity with approximately 13 million residents. Rapid urbanization and economic development have transformed the city into a major regional hub, but growth has also placed significant pressure on environmental and public health infrastructure. Key trends shaping the city's health landscape include rapid population growth, expansion of informal settlements with limited sanitation services, increasing hospital density, pharmaceutical manufacturing along river corridors, and intensive peri-urban poultry and aquaculture production.

Key Environmental Drivers of AMR in Metro Santara

Investigators have identified four major environmental drivers contributing to the spread of antimicrobial resistance in the city:

1. **Hospital wastewater discharge**
   Many hospitals release untreated wastewater containing antibiotics and antimicrobial-resistant bacteria into municipal drainage systems.
2. **Pharmaceutical manufacturing effluent**
   Industrial zones located along major river corridors have elevated antibiotic concentrations in nearby waterways.

3. **Agricultural antibiotic use**

   Peri-urban livestock and aquaculture farms use antibiotics extensively to maintain production and prevent disease.

4. **Flooding and sanitation failures**

   Seasonal flooding regularly spreads contaminated water from rivers and drainage systems into densely populated communities. Climate change has intensified these seasonal flooding events, which have been linked to spikes in waterborne infections and increased antibiotic use.

Your Role

Your team is advising the Metro Santara Urban Resilience Task Force. It is your job to design a city strategy that reduces environmental transmission of antimicrobial resistance while strengthening urban resilience. Your plan must balance environmental protection with economic constraints and political feasibility. It must be realistic enough to be approved and implemented within the political environment, given the interests, power, and constraints of a variety of stakeholders.

To develop the plan, your team will consider: 1. Which environmental drivers contribute most to AMR in the city?; 2. How should limited resources be allocated across sectors?; 3. How can infrastructure improvements also increase climate resilience?; 4. Are there other models from other cities that have proven successful; and 5. What are the benchmarks or guidelines from international organizations that could be used in this setting?

Several intervention options have already been proposed. However, each of these have trade-offs. It is up to your team to decide how to allocate resources to combat AMR and to build a more resilient city for the future. You can consider any one or combination of the following interventions, or you can identify new possibilities:

Potential Intervention Options

Intervention	Cost (in USD millions)	Estimated Impact
Hospital wastewater treatment upgrades	$5M	40% reduction in AMR organisms entering rivers
Industrial effluent regulation & monitoring	$4M	35% reduction in antibiotic residues
Urban wastewater AMR surveillance network	$3M	Early detection of resistance hotspots
Peri-urban farm antibiotic stewardship program	$3M	25% reduction in agricultural antibiotic use
Climate-resilient sanitation upgrades	$5M	Reduced contamination during floods
Wet market hygiene improvements	$1M	Reduced foodborne transmission
Green infrastructure (wetlands & biofiltration)	$5M	Natural reduction of contaminants
Community education on antibiotic disposal	$1M	Reduced pharmaceutical waste

Your team must consider the stakeholders who make up the Metro Santana Urban Resilience Task Force, as they will have to approve the plan. Without their approval, your team will not receive your consulting fees.

Stakeholder Positions

Stakeholder	Position
Environmental Protection Agency	Supports wastewater and pollution controls
Hospital Association	Supports stewardship, concerned about wastewater upgrade costs
Pharmaceutical Manufacturers	Oppose stricter discharge regulations
Livestock Producers	Concerned about antibiotic restrictions
Urban Planning Department	Supports green infrastructure
Public Health Agencies	Support aggressive regulation
Community Organizations	Want sanitation improvements
Department of Finance	Concerned about government spending

THE PLAN COMPONENTS

Please pitch your plan to the Task Force in a video report. The video should include the following:

- A broad overview of the problem of AMR in this context, acknowledging the most important environmental drivers of AMR.
- A description of intended intervention(s) with a clear justification for these choices. You should give an overview of the intended project activities but a detailed plan of each program activity is not required. However, you will need to explain the benefits and drawbacks of the plan and convince multiple stakeholders that you have considered their positions. You should discuss the anticipated outcomes in terms of AMR, as well as any other positive expected outcomes.
- A description of how the plan integrates a One Health Approach.
- A description of how the plan strengthens the city's resilience to climate change, urban growth, and environmental contamination.
- A plan to measure impact. Define the indicators you will use to track progress.
- Sustainability of the activities after 4 years, if appropriate
- A very basic budget for US$10 million over four years.
- Scientific, up-to-date references.

Other Important Information

- Provide a link to your video on YouTube, Vimeo, Bilibili or similar site by June 15, 2026 at 11:59pm pacific time by emailing mwithers@usc.edu
- Video MUST be no more than 10 mins, 30 seconds.
- At the beginning or end of the video, please provide a slide with full name, discipline of study, affiliated department and institution, and academic status (e.g. undergraduate, graduate, medical, etc.) for each team member. Please make sure to clearly identify your team name and university name.
- Please be explicit in citing sources of work other than your own.
- Teams are encouraged to develop engaging and creative visual materials for the presentation. All team members must be physically shown in the videos at least once. However, just as in a live presentation, you can include video clips, slides, animations, and other media/props. Teams should begin with an introduction as in any presentation to an audience. Following the introduction, the format is open. The team can choose to 'zoom in', showing videos, photos, maps, diagrams, interviews, etc. We highly suggest using visual images as opposed to text.

- We highly recommend that teams use microphones when filming. Please do not speed up the video to make it difficult to understand, especially for non-native speakers. We also encourage the use of subtitles.
- Outside video clips or b-rolls (developed by other people or agencies) are allowed but they should not last for more than 180 seconds total (all clips combined).
- We encourage the use of AI as a tool. However, any use of AI or other generative technology should be explicitly acknowledged. You must include the required AI Use Disclosure Form in the email with your video. The purpose of this disclosure is not to deduct points from the scoring but to ensure that AI was used in an appropriate way.
- All teams automatically grant permission for APRU to screen their videos at the workshop and to post their videos on our website for an unlimited time.

APPENDIX

Environmental Monitoring Data

Additional environmental surveillance studies conducted by researchers and government agencies provide further insight into the problem in Metro Santara.

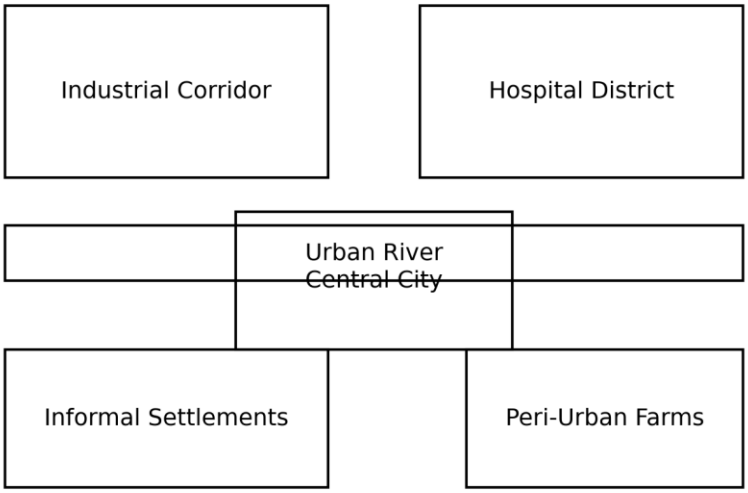
River Sampling Results

River Zone Antibiotic	Residues	Resistant Bacteria
Industrial Corridor	High	High
Hospital District	High	Very High
Peri-Urban Farms	Moderate	High
Upstream Rural Zone	Low	Low

Wastewater Infrastructure

Area	Wastewater Treatment Coverage
Central Santara	85%
Industrial District	60%
Peri-Urban Farms	35%
Informal Settlements	20%

Map of Key AMR Hotspots in Metro Santara



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