Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplementary material

Global antimicrobial-resistance drivers: An ecological country-level analysis at the human-animal interface

Table of Contents

Table S1: Descriptions of variables and associated data sources

Variables	Definition	Source
Antimicrobial resistance		
Critical human pathogens	Proportion of resistance observed in pathogen-antibiotic pairs defined as of critical importance to human health by the WHO (carbapenem-resistant *A. baumannii,* carbapenem-resistant *E. coli*, 3rd gen cephalosporin-resistant *E. coli*, carbapenem-resistant *K. pneumoniae*, cephalosporin resistant *K. pneumoniae*, carbapenem-resistant *P. aeruginosa*), most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1], Global antimicrobial resistance and surveillance system (GLASS) 2018[2], Pan American Health Organisation (PAHO)[3]
High priority human pathogens	Proportion of resistance observed in pathogen-antibiotic pairs defined as of high importance to human health by the WHO (oxacillin resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococcus faecium*), most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1], Global antimicrobial resistance and surveillance system (GLASS) 2018[2], Pan American Health Organisation (PAHO)[3]
Medium priority human pathogens	Proportion of resistance observed in pathogen-antibiotic pairs defined as of medium importance to human health by the WHO (penicillin-resistant *Streptococcus pneumoniae*), most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1], Global antimicrobial resistance and surveillance system (GLASS) 2018[2], Pan American Health Organisation (PAHO)[3]
Food-producing animals	Proportion of resistance observed in isolates obtained from food-producing animals, most recent year available (close to 2018)	Resistancebank[4], European Food Safety Authority biological hazards reports[5], other publications.[6-14]
Main exposure variables: Antibiotic consumption		
Carbapenems	Annual carbapenem consumption, defined daily doses (DDD) per 1000 individuals, most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1]
Cephalosporins	Annual cephalosporin consumption, defined daily doses (DDD) per 1000 individuals, most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1]
Penicillins	Annual penicillin consumption, defined daily doses (DDD) per 1000 individuals, most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1]

Oxacillins	Annual oxacillin consumption, defined daily doses (DDD) per 1000 individuals, most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1]
Glycopeptides	Annual glycopeptide consumption, defined daily doses (DDD) per 1000 individuals, most recent year available (close to 2018)	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1]
Food-producing animals	Estimated antibiotic consumption in livestock (mg/PCU), 2013	The Centre for Disease Dynamics, Economics and Policy (CDDEP ResistanceMap)[1,15,16]
Independent variables: Socioeconomic indicators		
Population (total N.)	Total population in 2020	United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects 2019 Revision[17]
Population density	Number of people divided by land area (km²), most recent year available	World Bank, World Development Indicators[18]
Median age of population	Median age of the population, UN projection for 2020	United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects 2017 Revision[19]
Population aged 65 or older (%)	Percentage of population that is aged 65 years or older, most recent year available	World Bank, World Development Indicators[18]
Population aged 70 or older (%)	Percentage of population that is aged 70 years or older, most recent year available	United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects 2017 Revision[19]
Population living in extreme poverty (%)	percentage of population living in extreme poverty, most recent year available since 2010	World Bank, World Development Indicators[18]
Life expectancy	Life expectancy at birth, 2019	United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects 2019 Revision[17]
Human development index	Summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living, most recent year available	United Nations Development Programme (UNDP)[20]
Mean years of schooling	Average years of schooling by country, 2018	United Nations Development Programme (UNDP)[20]
Urban population (%)	percentage of population living in an urban environment, 2018	World Bank, World Development Indicators[18]
Infants lacking DPT immunization (%)	percentage of children aged 1 year that have no DPT immunization by country, 2018	World Bank, World Development Indicators[18]

Dependency rate	Ratio of people aged 65 and above and people aged 15-64 years old, 2018	World Bank, World Development Indicators[18]
Current health expenditure (% of GDP)	Percentage of gross domestic product spent on healthcare by country, 2016	World Bank, World Development Indicators[18]
GDP (ppp)	Gross domestic product by country, 2018	World Bank, World Development Indicators[18]
Labour force participation rate	Percentage of population aged 15 years or older in the labour force, 2018	World Bank, World Development Indicators[18]
Homelessness due to natural disaster	Annual average of homelessness due to natural disasters per 1,000,000 people, 2008-2018	World Bank, World Development Indicators[18]
Homicide rate	Rate of homicides per 100,000 people, 2012-2017	World Bank, World Development Indicators[18]
Net migration rate	Annual difference in number of immigrants and emigrants, most recent year available	United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects 2017 Revision[19]
Hospital beds per 10,000 people	Number of hospital beds per 10,000 people by country, 2010-2015	WHO The global health observatory, indicator metadata registry list[21]
Population using at least basic sanitation services (%)	Percentage of population using at least basic sanitation services (improved sanitation facilities that are not shared with other households), most recent year available	WHO The global health observatory, indicator metadata registry list[21]
Mortality rate attributable to unsafe WASH	Deaths attributable to unsafe water, sanitation and hygiene focusing on inadequate WASH services, expressed per 100,000 population, most recent year available	WHO The global health observatory, indicator metadata registry list[21]
GINI	The extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution, most recent year available	World Bank, World Development Indicators[18]
Refugee population (total N.)	Total refugee population by country or territory of asylum, 2018	World Bank, World Development Indicators[18]
Independent variables: Environmental indicators		
Average temperature (°C)	Average 12-monthly temperature, 2016	National Centres for Environmental Information (NOAA)[22]
Average precipitation	Average 12-monthly precipitation, 2016	National Centres for Environmental Information (NOAA)[22]
PM 2·5	Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas, 2016	WHO Global Health Observatory Data Repository[23]

Arable land (% of land area)	Percentage of land area that is under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow, 2018	World Bank, World Development Indicators[18]
Agricultural land (% of land area)	Percentage of land area that is arable, under permanent crops, and under permanent pastures, 2018	World Bank, World Development Indicators[18]
Agricultural land per capita	Hectares of agricultural land per capita, 2018	Food and Agriculture Organization of the United Nations via Our World in Data [24]
Independent variables: Health-related indicators		
Alcohol per person per year (litres)	Litres of pure alcohol per person per year (regional estimates are derived from population weighted averages of countries), 2016	WHO Global Health Observatory Data Repository[23]
High blood glucose (% of population)	Percentage of population with high fasting blood glucose (≥ 7.0 mmol/L or on medication), 2014	WHO Global Health Observatory Data Repository[23]
High blood pressure (% of population)	Crude percentage of population with raised blood pressure (SBP ≥ 140 OR DBP ≥ 90), 2015	WHO Global Health Observatory Data Repository[23]
Obesity prevalence	Crude prevalence of obesity among adults (BMI ≥ 30), 2016	WHO Global Health Observatory Data Repository[23]
Smoking prevalence	Adults who smoke every day (aged 15 years and older), 2016	World Bank, World Development Indicators[18]
TB prevalence per 100,000 people	Tuberculosis prevalence by country, 2017	WHO The global health observatory, indicator metadata registry list[21]
Cardiovascular death rate per 100,000	Annual number of deaths per 100,000 people due to cardiovascular disease, 2017	Global Burden of Disease (GBD)[25]
Diabetes prevalence (% of population)	Percentage of population (aged 20 to 79) with diabetes, 2017	World Bank, World Development Indicators[18]
Independent variables: Animal density		
Cattle density	Global distribution of cattle expressed in total number of cattle per pixel (5 min of arc), 2010	Harvard Dataverse, Gridded Livestock of the World [26,27]
Chicken density	Global distribution of chickens expressed in total number of cattle per pixel (5 min of arc), 2010	Harvard Dataverse, Gridded Livestock of the World [26,28]
Pig density	Global distribution of pigs expressed in total number of cattle per pixel (5 min of arc), 2010	Harvard Dataverse, Gridded Livestock of the World [26,29]
Independent variables: Governance measures and corruption control		
Control of corruption	Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5, 2018	Worldbank, Worldwide Governance Indicators [30]

Government effectiveness	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5, 2018	Worldbank, Worldwide Governance Indicators [30]
Political stability and absence of violence/terrorism	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5, 2018	Worldbank, Worldwide Governance Indicators [30]
Regulatory quality	Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5, 2018	Worldbank, Worldwide Governance Indicators [30]
Rule of law	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5, 2018	Worldbank, Worldwide Governance Indicators [30]
Voice and accountability	Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5, 2018	Worldbank, Worldwide Governance Indicators [30]
Independent variables: Regulations and laws for AMR control in humans and animals		
Aggregate of surveillance and control measures for AMR in animals	Total score of 20 indicators assessing control and surveillance of AMR among animals, including ante and post-mortem inspections, compartmentalisation, control of vectors, control of wildlife reservoirs, disease notification, general surveillance, killing for commercial or own use, monitoring, movement control, official vaccination, precautions at borders, process to inactivate the pathogenic agent in products or by-products,, screening, selective killing and disposal, slaughter, stamping out, targeted surveillance, treatment, vaccination prohibited, vector surveillance, zoning, 2018	World Organization for Animal Health [31]
National action plan on AMR	Country progress with development of a national action plan on AMR. Variable is divided into 5 levels: A, B, C, D and E. A - No national AMR action plan. B - National AMR action plan under development. C - National AMR action plan developed. D - National AMR action plan approved by government that reflects Global Action Plan objectives, with an operational plan and monitoring arrangements. E - On a regular basis (every year/two years) data is collected and reported on: a) Antimicrobial sales or consumption at national level for human use; and b) Antibiotic	Tripartite AMR Country Self-Assessment Survey, 2018 [32]

	prescribing and appropriate/rational use, in a representative sample of health facilities, public and private. The variables was categorised for multivariable models accordingly by reporting two levels; 0 (A, B, C) and 1 (D, and E).	
Country policies and regulation on antimicrobial use in humans	Country has laws or regulations on prescription and sale of antimicrobials, for human use (binary yes/no outcome)	Tripartite AMR Country Self-Assessment Survey, 2018 [32]
Country policies and regulation on antimicrobial use in animals	Country has laws or regulations on prescription and sale of antimicrobials, for use in animals (binary yes/no outcome)	Tripartite AMR Country Self-Assessment Survey, 2018 [32]
Country policies and regulation on antimicrobial use for growth promotion in animals	Country has laws or regulations that prohibits the use of antibiotics for growth promotion in the absence of risk analysis (binary yes/no outcome)	Tripartite AMR Country Self-Assessment Survey, 2018 [32]
National monitoring system for antibiotic use in humans	National monitoring system for consumption and rational use of antimicrobials in human health. Variable is divided into 5 levels: A, B, C, D and E. A - No formal multi-sectoral governance or coordination mechanism on AMR exists. B - Multi-sectoral working group(s) or coordination committee on AMR established with Government leadership. C - Multi-sectoral working group(s) is (are) functional, with clear terms of reference; regular meetings, and funding for working group(s). Activities and reporting/accountability arrangements are defined. D - Joint working on issues including agreement on common objectives. E - Integrated approaches used to implement the national AMR action plan with relevant data and lessons learned from all sectors used to adapt implementation of the action plan. The variables was categorised for univariate and multivariable models accordingly by reporting two levels; 0 (A, B, C) and 1 (D, and E).	Tripartite AMR Country Self-Assessment Survey (TrACSS) 2017-2018 (missing values were imputed carrying back or forward the data from 2018-2019 and 2016-2017 respectively) [32]
National monitoring system for antibiotic use in animals	National monitoring system for antimicrobials intended to be used in animals (sales/use). Variable is divided into 5 levels: A, B, C, D and E. A - No formal multi-sectoral governance or coordination mechanism on AMR exists. B - Multi-sectoral working group(s) or coordination committee on AMR established with Government leadership. C - Multi-sectoral working group(s) is (are) functional, with clear terms of reference; regular meetings, and funding for working group(s). Activities and reporting/accountability arrangements are defined. D - Joint working on issues including agreement on common objectives. E - Integrated approaches used to implement the national AMR action plan with relevant data and lessons learned from all sectors used to adapt implementation of the action plan. The variables was categorised for multivariable models accordingly by reporting two levels; 0 (A, B, C) and 1 (D, and E).	Tripartite AMR Country Self-Assessment Survey (TrACSS) 2017-2018 (missing values were imputed carrying back or forward the data from 2018-2019 and 2016-2017 respectively) [32]
National surveillance system for AMR in humans	National surveillance system for antimicrobial resistance (AMR) in humans. Variable is divided into 5 levels: A, B, C, D and E. A - No formal multi-sectoral governance or coordination mechanism on AMR exists. B - Multi-sectoral working group(s) or coordination committee on AMR established with Government leadership. C - Multi-sectoral working group(s) is (are) functional, with clear terms of reference; regular meetings, and funding for working group(s). Activities and reporting/accountability arrangements are defined. D - Joint working on issues including agreement on common objectives. E - Integrated approaches used to implement the national AMR action plan with	Tripartite AMR Country Self-Assessment Survey (TrACSS) 2017-2018 (missing values were imputed carrying back or forward the data from 2018-2019 and 2016-2017 respectively) [32]

	relevant data and lessons learned from all sectors used to adapt implementation of the action plan. The variables was categorised for multivariable models accordingly by reporting two levels; 0 (A, B, C) and 1 (D, and E).	
National surveillance system for AMR in animals	National surveillance system for antimicrobial resistance (AMR) in animals, plants, foods and environment Variable is divided into 5 levels: A, B, C, D and E. A - No formal multi-sectoral governance or coordination mechanism on AMR exists. B - Multi-sectoral working group(s) or coordination committee on AMR established with Government leadership. C - Multi-sectoral working group(s) is (are) functional, with clear terms of reference; regular meetings, and funding for working group(s). Activities and reporting/accountability arrangements are defined. D - Joint working on issues including agreement on common objectives. E - Integrated approaches used to implement the national AMR action plan with relevant data and lessons learned from all sectors used to adapt implementation of the action plan. The variables was categorised for multivariable models accordingly by reporting two levels; 0 (A, B, C) and 1 (D, and E).	Tripartite AMR Country Self-Assessment Survey (TrACSS) 2017-2018 (missing values were imputed carrying back or forward the data from 2018-2019 and 2016-2017 respectively) [32]

Notes: N stands for observations. WASH- Water, sanitation and hygiene. AMR= Antimicrobial resistance. GDP= Gross domestic product. USD= United States Dollars. UN= United Nations. DDD= Daily defined dose. TB= Tuberculosis. DTP= Diphtheria and tetanus toxoids. ppp= purchasing power parity

Table S2.1: Rates of Human AMR that were imported from the WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS)[2]

E. coli / carbapenems	*E coli* / 3rd gen ceph	*K. pneumoniae* / carbapenems	*K. pneumoniae* / 3rd gen ceph	*S. aureus* / oxacillin	*S. pneumoniae* / penicillin
Bangladesh	Afghanistan	Bahrain	Bahrain	Bahrain	Bosnia and Herzegovina
Brazil	Bangladesh	Bangladesh	Bangladesh	Brazil	Iran
Cambodia	Brazil	Brazil	Brazil	Egypt	Mali
Laos	Cambodia	Cambodia	Cambodia	Indonesia	Malta
Mali	Egypt	Iran	Ethiopia	Jordan	South Africa
Myanmar	Ethiopia	Iraq	Indonesia	Myanmar	
Nepal	Georgia	Jordan	Iran	Nepal	
Sudan	Indonesia	Lebanon	Iraq		
Uganda	Iran	Mali	Jordan		
	Iraq	Myanmar	Laos		
	Jordan	Nepal	Lebanon		
	Laos	Nigeria	Madagascar		
	Madagascar	North Macedonia	Mali		
	Mali	Sudan	Mozambique		
	Myanmar	Uganda	Myanmar		
	Nepal		Nepal		
	Sudan		North Macedonia		
	Syria		Sudan		
	Uganda		Uganda		
	Yemen				

Notes: Numbers were obtained from urine and blood samples.

Table S2.2: Rates of AMR that were imported from the Pan American Health Organization (PAHO)[3]

K. pneumoniae / carbapenems	K. pneumoniae / 3rd gen cephalosporins	S. aureus / oxacillin
Bolivia	Bolivia	Bolivia
Colombia	Colombia	Colombia
Paraguay	Paraguay	Paraguay
Peru	Peru	Peru

Protocol S3: Inclusion criteria for animal AMR data extracted from the European Food Safety Authority (EFSA) and other published sources

Missing animal AMR data were extracted from sources following the inclusion criteria used to create the Resistancebank data repository for AMR resistance data in animals, available as part of ResistanceMap.[1,16] Data were extracted and pooled for the following species: chickens (including turkeys, duck, quail), cattle, pigs, sheep and goats. The vast majority of data came from cattle, pigs and chickens (distributions shown below in figure S6). Data from diseased or sick animals were not included. Sample types included killed animal samples (caecum, organ/tissue, carcase swab), meat, milk and egg products, fecal samples and environmental samples (boot swab). Pathogen species included *Escherichia coli*, non-typhoidal *Salmonella* spp., *Campylobacter* spp., and *Staphylococcus aureus*. There were no exclusion criteria regarding antibiotic class.

Table S4: List of initial countries for which data was available, by dependent variable

WHO critical-priority pathogens (N=98)	WHO high-priority pathogens (N=80)	WHO medium-priority pathogens (N=50)	Carbapenem-resistant *Acinetobacter baumanii* (N= 66)	Carbapenem-resistant *Pseudomonas aeruginosa* (N= 41)	3rd generation cephalosporins-resistant *Escherichia coli* (N= 89)	3rd generation cephalosporins-resistant *Klebsiella pneumoniae* (N= 92)	Oxacillin-resistant *Staphylococcus aureus* (N= 80)	Vancomycin-resistant *Enterococcus faecium* (N= 37)
Afghanistan	Argentina	Argentina	Argentina	Australia	Afghanistan	Argentina	Argentina	Austria
Argentina	Australia	Austria	Australia	Austria	Argentina	Australia	Australia	Belarus
Australia	Austria	Belgium Bosnia and Herzegovina	Austria	Belarus	Australia	Austria	Austria	Belgium Bosnia and Herzegovina
Austria	Bahrain	Bulgaria	Bahrain	Belgium Bosnia and Herzegovina	Austria	Bahrain	Bahrain	Bulgaria
Bahrain	Belarus	Cambodia	Belarus	Bulgaria	Bahrain	Bangladesh	Belarus	Canada
Bangladesh	Belgium	Canada	Belgium Bosnia and Herzegovina	Canada	Bangladesh	Belarus	Belgium	Croatia
Belarus	Bhutan	Croatia	Brazil	Croatia	Belarus	Belgium	Bhutan	Cyprus
Belgium	Bolivia Bosnia and Herzegovina	Czech Republic	Brunei	Cyprus	Belgium	Bhutan	Bolivia Bosnia and Herzegovina	Czech Republic
Bhutan	Brazil	Denmark	Bulgaria	Czech Republic	Bhutan Bosnia and Herzegovina	Bolivia Bosnia and Herzegovina	Brazil	Denmark
Bolivia Bosnia and Herzegovina	Brunei	Estonia	Cambodia	Denmark	Brazil	Brazil	Brunei	Estonia
Brazil	Bulgaria	Finland	Croatia	Estonia	Brunei	Brunei	Bulgaria	Finland
Brunei	Canada	France	Cyprus	Finland	Bulgaria	Bulgaria	Canada	France
Bulgaria	Colombia	Germany	Czech Republic	France	Cambodia	Cambodia	Colombia	Germany
Cambodia	Croatia	Hungary	Denmark	Georgia	Canada	Canada	Croatia	Greece
Canada	Cyprus	Iceland	Egypt	Germany	Croatia	Colombia	Cyprus	Hungary
Colombia	Czech Republic	Iran	Finland	Ghana	Cyprus	Croatia	Czech Republic	Ireland
Croatia	Denmark	Ireland	France	Greece	Czech Republic	Cyprus	Denmark	Italy
Cyprus	Egypt	Italy	Georgia	Hungary	Denmark	Czech Republic	Egypt	Latvia

Czech Republic	Estonia	Japan	Germany	Ireland	Egypt	Denmark	Estonia	Lithuania
Denmark	Finland	Laos	Ghana	Italy	Estonia	Egypt	Finland	Luxembourg
Egypt	France	Latvia	Greece	Latvia	Ethiopia	Estonia	France	Netherlands
Estonia	Georgia	Lithuania	Hungary	Lithuania	Finland	Ethiopia	Georgia	Norway
Ethiopia	Germany	Luxembourg	India	Luxembourg	France	Finland	Germany	Poland
Finland	Ghana	Malawi	Indonesia	Malta	Georgia	France	Ghana	Portugal
France	Greece	Malaysia	Iran	Netherlands	Germany	Georgia	Greece	Romania
Georgia	Hungary	Mali	Ireland	Norway	Ghana	Germany	Hungary	Russia
Germany	Iceland	Malta	Italy	Poland	Greece	Ghana	Iceland	Serbia
Ghana	India	Nepal	Japan	Portugal	Hungary	Greece	India	Slovakia
Greece	Indonesia	Netherlands	Jordan	Romania	Iceland	Hungary	Indonesia	Slovenia
Hungary	Iran	Norway	Kosovo	Russia	India	India	Iran	Spain
Iceland	Ireland	Philippines	Latvia	Serbia	Indonesia	Indonesia	Ireland	Sweden
India	Italy	Poland	Lebanon	Slovakia	Iran	Iran	Italy	Switzerland
Indonesia	Japan	Portugal	Lithuania	Slovenia	Iraq	Iraq	Japan	Turkey
Iran	Jordan	Qatar	Malawi	Spain	Ireland	Ireland	Jordan	United Kingdom
Iraq	Laos	Romania	Malaysia	Sweden	Italy	Italy	Laos	United States
Ireland	Latvia	Serbia	Montenegro	Switzerland	Japan	Japan	Latvia	Vietnam
Italy	Lithuania	Slovakia	Myanmar	Turkey	Jordan	Jordan	Lithuania	
Japan	Luxembourg	Slovenia	Nepal	United Kingdom	Kenya	Kenya	Luxembourg	
Jordan	Malawi	South Africa	Netherlands	United States	Laos	Kosovo	Malawi	
Kenya	Malaysia	South Korea	North Macedonia	Vietnam	Latvia	Laos	Malaysia	
Kosovo	Mali	Spain	Oman		Lebanon	Latvia	Mali	
Laos	Malta	Sweden	Pakistan		Lithuania	Lebanon	Malta	
Latvia	Montenegro	Switzerland	Philippines		Luxembourg	Libya	Montenegro	
Lebanon	Myanmar	Thailand	Poland		Madagascar	Lithuania	Myanmar	
Libya	Nepal	Tunisia	Portugal		Malawi	Luxembourg	Nepal	
Lithuania	Netherlands	Turkey	Romania		Malaysia	Madagascar	Netherlands	

Luxembourg	Nigeria	United Arab Emirates	Russia	Mali	Malawi	Nigeria
Madagascar	North Macedonia	United Kingdom	Saudi Arabia	Malta	Malaysia	North Macedonia
Malawi	Norway	Vietnam	Serbia	Myanmar	Mali	Norway
Malaysia	Oman		Slovakia	Nepal	Malta	Oman
Mali	Pakistan		Slovenia	Netherlands	Moldova	Pakistan
Malta	Paraguay		South Africa	New Zealand	Mozambique	Paraguay
Moldova	Peru		South Korea	Nigeria	Myanmar	Peru
Montenegro	Philippines		Spain	North Macedonia	Nepal	Philippines
Mozambique	Poland		Sri Lanka	Norway	Netherlands	Poland
Myanmar	Portugal		Sweden	Oman	New Zealand	Portugal
Nepal	Qatar		Switzerland	Pakistan	Nigeria	Qatar
Netherlands	Romania		Thailand	Philippines	North Macedonia	Romania
New Zealand	Russia		Tunisia	Poland	Norway	Russia
Nigeria	Saudi Arabia		Turkey	Portugal	Oman	Saudi Arabia
North Macedonia	Serbia		Ukraine	Qatar	Pakistan	Serbia
Norway	Singapore		United Arab Emirates	Romania	Paraguay	Singapore
Oman	Slovakia		United Kingdom	Russia	Peru	Slovakia
Pakistan	Slovenia		United States	Saudi Arabia	Philippines	Slovenia
Paraguay	South Africa		Vietnam	Serbia	Poland	South Africa
Peru	South Korea			Singapore	Portugal	South Korea
Philippines	Spain			Slovakia	Qatar	Spain
Poland	Sri Lanka			Slovenia	Romania	Sri Lanka
Portugal	Sudan			South Africa	Russia	Sudan
Qatar	Sweden			South Korea	Saudi Arabia	Sweden
Romania	Switzerland			Spain	Serbia	Switzerland
Russia	Thailand			Sri Lanka	Singapore	Thailand
Saudi Arabia	Tunisia			Sudan	Slovakia	Tunisia
Serbia	Turkey			Sweden	Slovenia	Turkey

Singapore	Ukraine		Switzerland	South Africa	Ukraine
Slovakia	United Arab Emirates		Syria	South Korea	United Arab Emirates
Slovenia	United Kingdom		Thailand	Spain	United Kingdom
South Africa	United States		Tunisia	Sri Lanka	United States
South Korea	Vietnam		Turkey	Sudan	Vietnam
Spain			Uganda	Sweden	
Sri Lanka			Ukraine	Switzerland	
Sudan			United Arab Emirates	Thailand	
Sweden			United Kingdom	Tunisia	
Switzerland			United States	Turkey	
Syria			Vietnam	Uganda	
Thailand			Yemen	Ukraine	
Tunisia			Zambia	United Arab Emirates	
Turkey			Zimbabwe	United Kingdom	
Uganda				United States	
Ukraine				Vietnam	
United Arab Emirates				Zambia	
United Kingdom					
United States					
Vietnam					
Yemen					
Zambia					
Zimbabwe					

AMR levels in animals (N=164)

Afghanistan	Central African Republic	Gambia	Kyrgyzstan	Pakistan	Suriname
Algeria	Chad	Georgia	Laos	Palestine	Sweden
Angola	Chile	Germany	Latvia	Panama	Switzerland
Antigua and Barbuda	China	Ghana	Lebanon	Paraguay	Syria
Argentina	Colombia	Greece	Lesotho	Peru	Taiwan
Armenia	Comoros	Grenada	Liberia	Philippines	Tajikistan
Australia	Congo	Guatemala	Libya	Poland	Tanzania
Austria	Costa Rica	Guinea	Lithuania	Portugal	Thailand
Azerbaijan	Cote d'Ivoire	Guinea-Bissau	Luxembourg	Qatar	Timor
Bahamas	Croatia	Guyana	Madagascar	Romania	Togo
Bahrain	Cuba	Haiti	Malawi	Russia	Trinidad and Tobago
Bangladesh	Cyprus	Honduras	Malaysia	Rwanda	Tunisia
Barbados	Czech Republic	Hong Kong	Mali	Saint Kitts and Nevis	Turkey
Belgium	Democratic Republic of Congo	Hungary	Malta	Saint Lucia	Uganda
Belize	Denmark	Iceland	Mexico	Saint Vincent and the Grenadines	United Arab Emirates
Benin	Djibouti	India	Mongolia	Saudi Arabia	United Kingdom
Bhutan	Dominica	Indonesia	Morocco	Senegal	United States
Bolivia	Dominican Republic	Iran	Mozambique	Sierra Leone	Uruguay
Botswana	Ecuador	Iraq	Myanmar	Singapore	Uzbekistan
Brazil	Egypt	Ireland	Namibia	Slovakia	Venezuela
Brunei	El Salvador	Israel	Nepal	Slovenia	Vietnam
Bulgaria	Equatorial Guinea	Italy	Netherlands	Somalia	Yemen
Burkina Faso	Eritrea	Jamaica	Nicaragua	South Africa	Zambia
Burundi	Estonia	Japan	Niger	South Korea	Zimbabwe
Cambodia	Ethiopia	Jordan	Nigeria	South Sudan	
Cameroon	Finland	Kazakhstan	North Macedonia	Spain	
Canada	France	Kenya	Norway	Sri Lanka	
Cape Verde	Gabon	Kuwait	Oman	Sudan	

Table S5: Number of countries captured per WHO priority list and Animal AMR and by WHO region and World Bank income group

Critical pathogens model (n=98)		High priority pathogens model (n=80)	
WHO region	n. countries	WHO region	n. countries
African Region	13	African Region	6
Eastern Mediterranean Region	16	Eastern Mediterranean Region	10
European Region	42	European Region	40
Region of the Americas	8	Region of the Americas	8
South-East Asian Region	8	South-East Asian Region	7
Western Pacific Region	11	Western Pacific Region	9
World Bank income class	n. countries	World Bank income class	n. countries
Low income	11	Low income	3
Lower middle income	22	Lower middle income	17
Upper middle income	22	Upper middle income	18
High income	43	High income	42
Medium priority pathogens model (n=50)		**Animal model (n=164)**	
WHO region	n. countries	WHO region	n. countries
African Region	3	African Region	44
Eastern Mediterranean Region	4	Eastern Mediterranean Region	19
European Region	32	European Region	43
Region of the Americas	2	Region of the Americas	35
South-East Asian Region	2	South-East Asian Region	9
Western Pacific Region	7	Western Pacific Region	14
World Bank income class	n. countries	World Bank income class	n. countries
Low income	2	Low income	28
Lower middle income	7	Lower middle income	44
Upper middle income	8	Upper middle income	38
High income	33	High income	54

Notes: 'n.' stands for number.

Figure S6: kernel density estimates of the distribution of animal AMR data by species (cattle, chicken, pig)
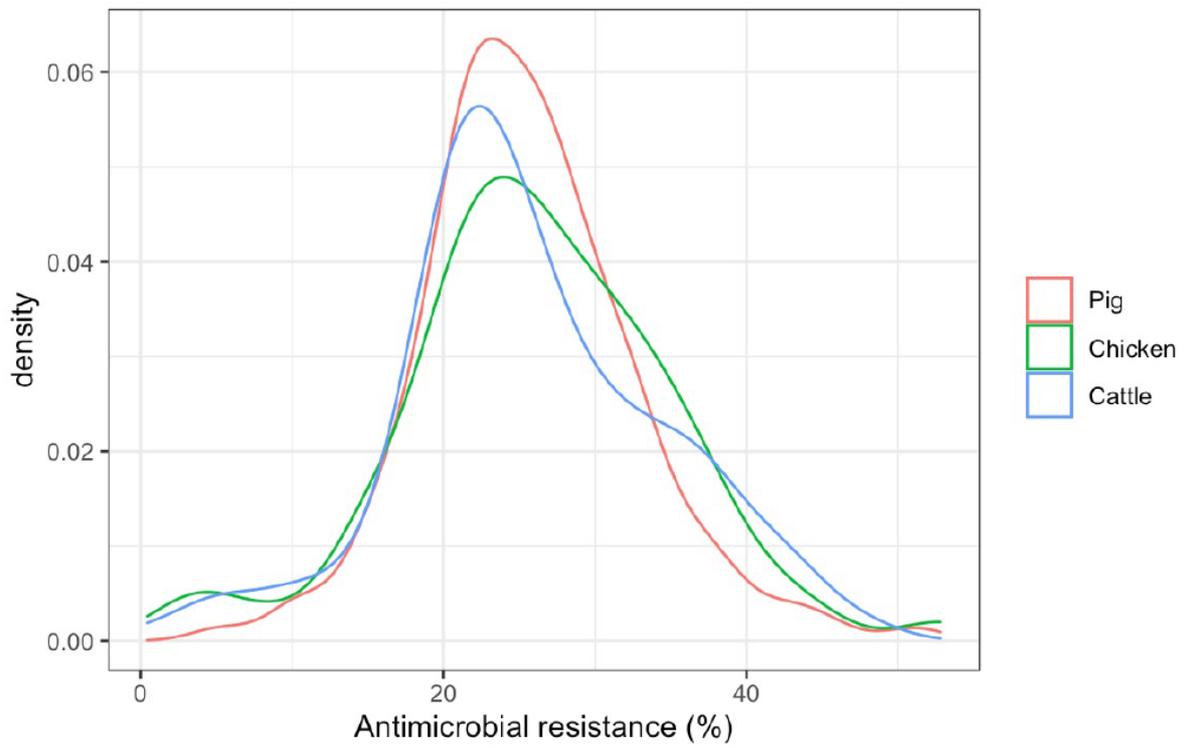
Figure S7. Percentage of bacterial isolates with resistance to select antibiotics. Data stratified by World Bank income class
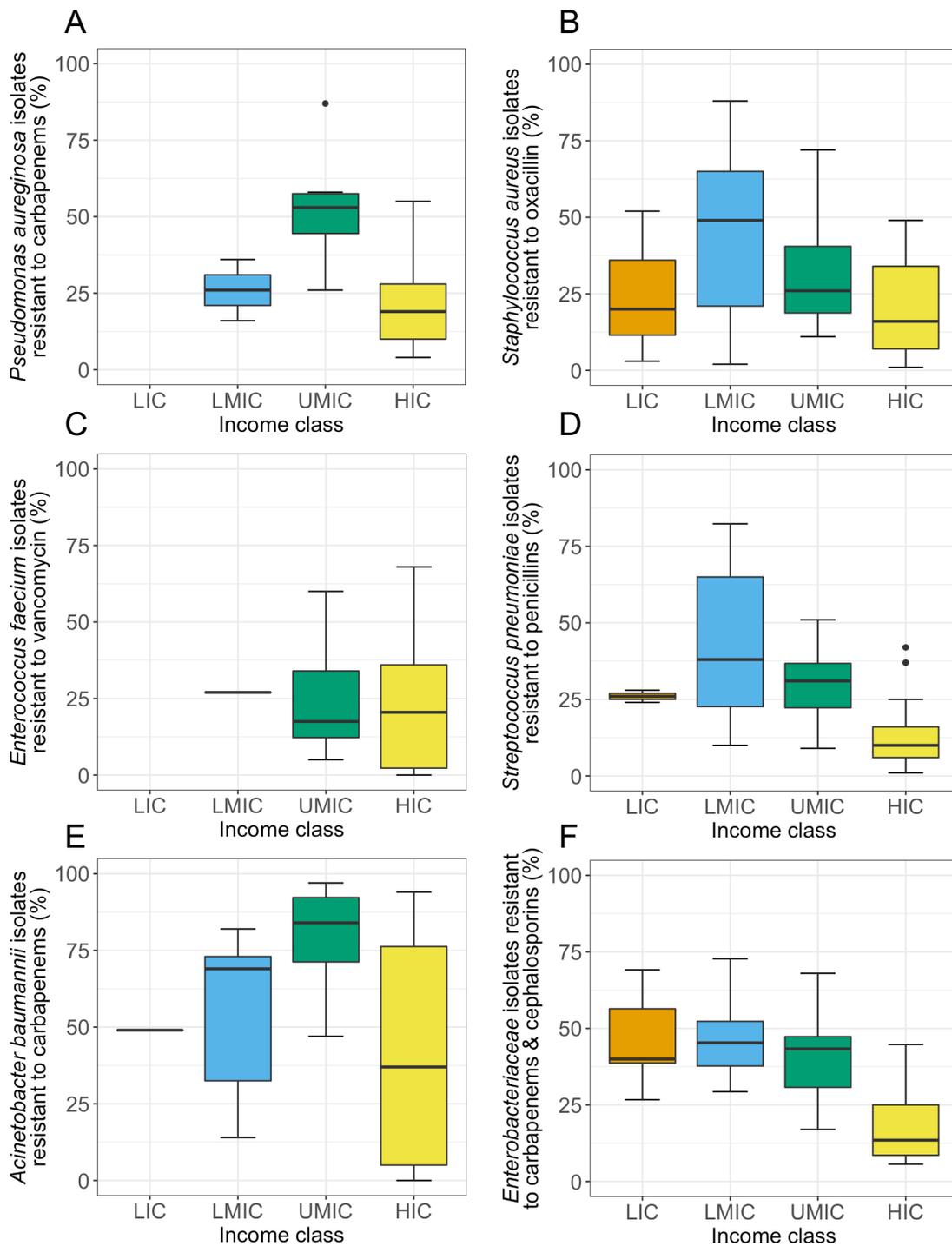
Notes: LIC = low-income countries, LMIC = lower-middle income countries, UMIC = upper-middle income countries, HIC = high-income countries. Figure A total N: LIC = 0, LMIC = 2, UMIC = 7, HIC = 32. Figure B total N: LIC = 3, LMIC = 7, UMIC = 18, HIC = 42. Figure C total N: LIC = 0, LMIC = 1, UMIC = 6, HIC = 30. Figure D total N: LIC = 2, LMIC = 7, UMIC = 8, HIC = 33. Figure E total N: LIC = 1, LMIC = 15, UMIC = 16, HIC = 34. Figure F total N: LIC = 11, LMIC = 22, UMIC = 21, HIC = 43.

Figure S8: Percentage of bacterial isolates with resistance to select antibiotics. Data stratified by WHO region
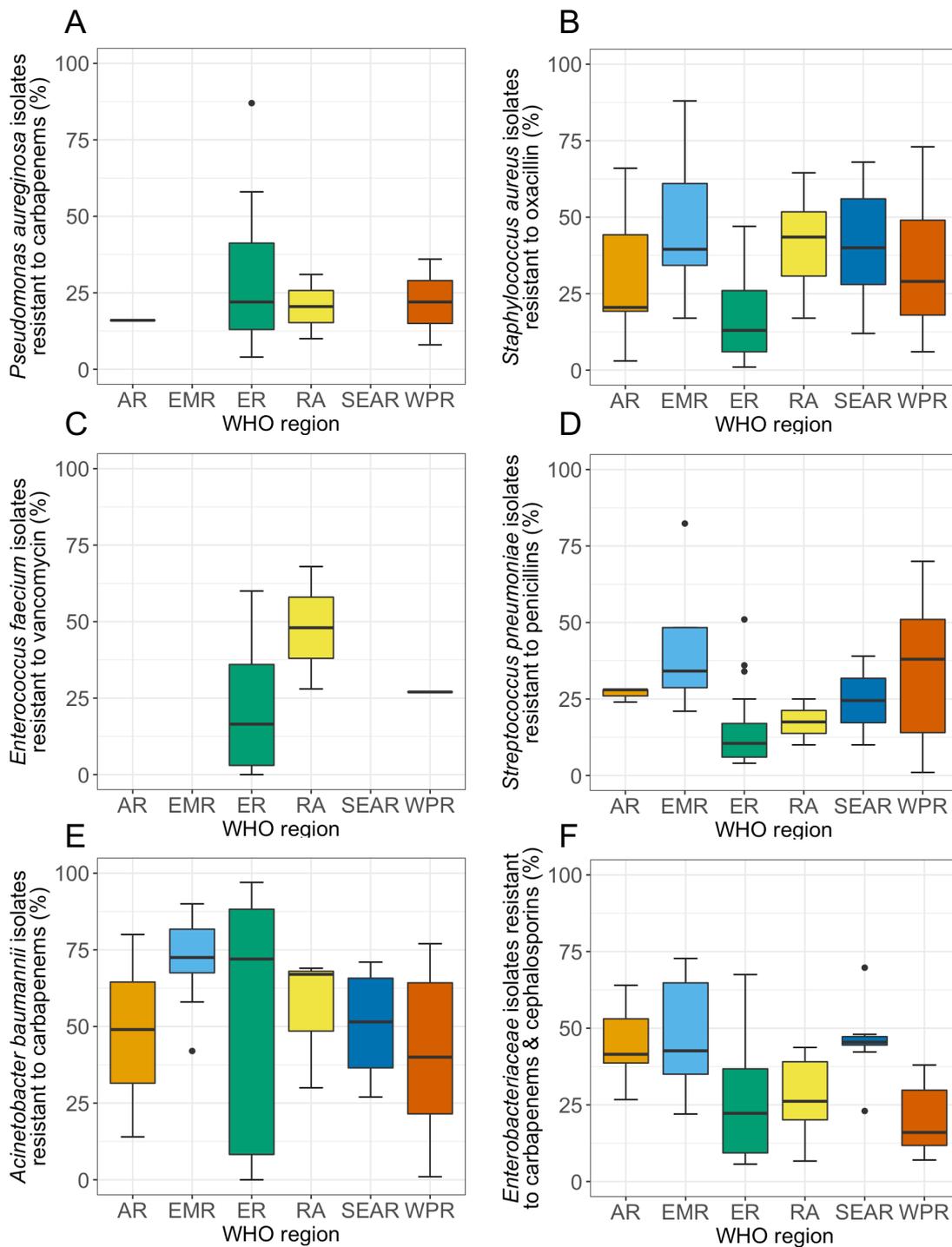
Notes: AR = African Region, EMR = Eastern Mediterranean Region, ER = European Region, RA = Region of the Americas, SEAR = South-East Asian Region, WPR = Western Pacific region. Figure A total N: AR = 1, EMR = 0, ER = 36, RA = 2, SEAR = 0, WPR = 2. Figure B total N: AR = 6, EMR = 10, ER = 40, RA = 8, SEAR = 7, WPR = 9. Figure C total N: AR = 0, EMR = 0, ER = 34, RA = 2, SEAR = 0, WPR = 1. Figure D total N: AR = 3, EMR = 4, ER = 32, RA = 2, SEAR = 2, WPR = 7. Figure E total N: AR = 3, EMR = 10, ER = 36, RA = 3, SEAR = 6, WPR = 8. Figure F total N: AR = 13, EMR = 16, ER = 41, RA = 8, SEAR = 8, WPR = 11.

Table S9: Correlation table between WHO priority pathogen list and independent variables

Independent variables	Critical-priority pathogens			High-priority pathogens			Medium-priority pathogens		
	Pearson coefficient	p-value	Number of observations	Pearson coefficient	p-value	Number of observations	Pearson coefficient	p-value	Number of observations
Carbapenem and cephalosporin consumption (DDD)	0.33	**0.010**	60	-	-	-	-	-	-
Oxacillin and Glycopeptides consumption (DDD)	-	-	-	0.05	0.703	57	-	-	-
Penicillin consumption (DDD)	-	-	-	-	-	-	-0.29	0.070	41
National surveillance system for antimicrobial resistance (AMR) in humans	-0.50	**0.000**	88	-0.49	**0.000**	76	-0.36	**0.013**	47
Median age of the population, UN projection for 2020	-0.45	**0.000**	97	-0.45	**0.000**	80	-0.50	**0.000**	50
Percentage of population that is aged 65 years or older, around 2018	-0.47	**0.000**	96	-0.46	**0.000**	80	-0.62	**0.000**	50
Percentage of population that is aged 70 years or older, around 2018	-0.47	**0.000**	96	-0.47	**0.000**	79	-0.63	**0.000**	49
Percentage of population living in extreme poverty, around 2018	0.16	0.196	69	0.02	0.862	57	0.16	0.361	35
Cardiovascular death rate per 100,000 people in 2017	0.67	**0.000**	97	0.22	0.051	80	0.29	**0.041**	50
Diabetes prevalence (% of population) in 2017	0.21	**0.043**	96	0.39	**0.000**	80	0.17	0.228	50
Infants lacking DPT immunization (% of population) in 2018	0.27	**0.006**	97	0.15	0.186	80	0.26	0.068	50
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	-0.47	**0.000**	97	-0.44	**0.000**	80	-0.62	**0.000**	50
TB prevalence per 100,000 people in 2017	0.28	**0.005**	97	0.27	**0.016**	80	0.26	0.064	50
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	0.12	0.241	97	0.21	0.065	80	0.34	**0.017**	50
Net migration rate, around 2018	-0.33	**0.001**	97	-0.15	0.189	80	-0.20	0.173	50
Alcohol consumed per person per year (litres) in 2016	-0.40	**0.000**	97	-0.36	**0.001**	80	-0.42	**0.002**	50
Refugee population (total N) in 2018	0.16	0.130	94	0.20	0.079	77	0.31	**0.027**	50
Prevalence of adults who smoke every day in 2016	0.08	0.454	86	-0.16	0.168	73	-0.18	0.217	49
Percentage of population with high blood glucose in 2016	0.25	**0.013**	96	0.23	**0.043**	79	0.07	0.621	50
Percentage of population with high blood pressure in 2015	0.08	0.450	96	-0.32	**0.004**	79	-0.40	**0.004**	50
Prevalence of obesity in adults in 2016	-0.16	0.119	96	-0.15	0.182	79	-0.28	**0.045**	50
GDP PPP per capita in 2018 USD	-0.63	**0.000**	96	-0.35	**0.001**	80	-0.35	**0.012**	50
Hospital beds per 10,000 people, 2010-2015	-0.19	0.067	95	-0.26	**0.023**	78	-0.35	**0.013**	49
Current health expenditure (% of GDP) in 2016	-0.41	**0.000**	95	-0.32	**0.004**	80	-0.45	**0.001**	50

Labour force participation rate in 2018	-0.24	**0.020**	97	-0.18	0.119	80	0.08	0.577	50
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	0.25	**0.015**	97	0.15	0.188	80	0.28	**0.010**	50
GINI index, most recent year available	0.33	**0.002**	95	0.33	**0.003**	80	0.36	**0.009**	50
Perception of control of corruption in 2018	-0.75	**0.000**	98	-0.52	**0.000**	80	-0.63	**0.000**	50
Perception of government effectiveness in 2018	-0.74	**0.000**	98	-0.49	**0.000**	80	-0.59	**0.000**	50
Perception of regulatory quality in 2018	-0.75	**0.000**	98	-0.48	**0.000**	80	-0.71	**0.000**	50
Country policies and regulation on antimicrobial use in humans in 2018	-0.24	**0.019**	93	-0.32	**0.004**	77	-0.26	0.071	49
National monitoring systems for sales, prescription and consumption of antibiotics in humans	-0.39	**0.000**	93	-0.28	**0.014**	77	-0.26	0.076	49
National action plan on AMR in 2018	-0.12	0.260	93	0.09	0.438	77	-0.10	0.476	49
National surveillance system for antimicrobial usage in humans	-0.42	**0.000**	92	-0.14	0.222	77	-0.37	**0.010**	49
Income class as defined by the World Bank	-0.55	**0.000**	98	-0.36	**0.001**	80	-0.57	**0.000**	50
Percentage of the population living in an urban environment in 2018	-0.47	**0.000**	97	-0.31	**0.005**	80	-0.34	**0.017**	50
Average life expectancy at birth in 2019	-0.58	**0.000**	97	-0.35	**0.001**	80	-0.40	**0.004**	50
Average years of schooling by country in 2018	-0.48	**0.000**	97	-0.33	**0.003**	80	-0.57	**0.000**	50
Percentage of population using at least basic sanitation services, most recent year available	-0.32	**0.001**	97	-0.24	**0.031**	80	-0.31	**0.029**	50
Annual mean concentration of PM 2.5 in urban areas in 2016	0.49	**0.000**	97	0.49	**0.000**	80	0.33	**0.019**	50
Population density in 2018	0.20	**0.049**	98	0.34	**0.002**	80	0.22	0.125	50
Average 12-monthly temperature in 2016	0.29	**0.004**	97	0.51	**0.000**	80	0.44	**0.001**	50
Human development index, around 2018	-0.58	**0.000**	97	-0.40	**0.000**	80	-0.49	**0.000**	50
Rule of law in 2018	-0.77	**0.000**	98	-0.50	**0.000**	80	-0.65	**0.000**	50
Political stability and absence of violence/terrorism in 2018	-0.66	**0.000**	98	-0.46	**0.000**	80	-0.54	**0.000**	50
Voice and accountability of the general public in 2018	-0.64	**0.000**	98	-0.46	**0.000**	80	-0.78	**0.000**	50

Notes: N stands for observations. WASH- Water, sanitation and hygiene. AMR= Antimicrobial resistance. GDP= Gross domestic product. USD= United States Dollars. UN= United Nations. DDD= Daily defined dose. TB= Tuberculosis. DTP= Diphtheria and tetanus toxoids. Darker red colours indicate higher positive correlation, whereas darker blue colours greater negative correlation between variables. ppp= purchasing power parity

Table S10: Correlation table between antibiotic-bacterium specific resistant pairs for critical-priority pathogens and independent variables

Independent variables	Carbapenem-resistant *Acinetobacter baumanii*			Carbapenem-resistant *Pseudomonas aeruginosa*			3rd generation cephalosporins-resistant *Escherichia coli*			3rd generation cephalosporins-resistant *Klebsiella pneumoniae*		
	Pearson coefficient	p-value	Number of observations	Pearson coefficient	p-value	Number of observations	Pearson coefficient	p-value	Number of observations	Pearson coefficient	p-value	Number of observations
Carbapenem consumption (DDD)	-0.35	**0.011**	51	-0.15	0.402	35	-	-	-	-	-	-
3rd generation cephalosporins consumption (DDD)	-	-	-	-	-	-	0.31	**0.019**	58	0.27	**0.035**	60
National surveillance system for antimicrobial resistance (AMR) in humans	-0.45	**0.000**	61	-0.26	0.106	39	-0.57	**0.000**	80	-0.50	**0.000**	83
Median age of the population, UN projection for 2020	-0.12	0.342	65	0.14	**0.090**	41	-0.72	**0.000**	89	-0.52	**0.000**	91
Percentage of population that is aged 65 years or older, around 2018	-0.24	0.056	65	-0.16	0.322	41	-0.76	**0.000**	88	-0.50	**0.000**	91
Percentage of population that is aged 70 years or older, around 2018	-0.25	**0.048**	64	-0.12	0.471	40	-0.75	**0.000**	88	-0.51	**0.000**	90
Percentage of population living in extreme poverty, around 2018	-0.05	0.762	46	0.17	0.382	30	0.33	**0.010**	61	0.26	**0.036**	65
Cardiovascular death rate per 100,000 people in 2017	0.55	**0.000**	65	0.74	**0.000**	41	0.48	**0.000**	89	0.63	**0.000**	91
Diabetes prevalence (% of population) in 2017	0.33	**0.007**	65	0.31	0.051	41	0.23	**0.028**	88	0.12	0.248	91
Infants lacking DPT immunization (% of population) in 2018	0.11	0.379	65	0.12	0.463	41	0.29	**0.006**	89	0.29	**0.005**	91
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	-0.26	**0.037**	65	-0.17	0.280	41	-0.75	**0.000**	89	-0.50	**0.000**	91
TB prevalence per 100,000 people in 2017	0.00	0.972	65	0.32	**0.043**	41	0.48	**0.000**	89	0.33	**0.001**	91
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	0.06	0.608	65	0.12	0.449	41	0.18	0.095	89	0.11	0.303	91
Net migration rate, around 2018	-0.26	**0.034**	65	-0.41	**0.008**	41	-0.18	0.099	89	-0.33	**0.001**	91

Variable	Corr	p	N	Corr	p	N	Corr	p	N	Corr	p	N
Alcohol consumed per person per year (litres) in 2016	-0.23	0.064	65	0.00	0.988	41	-0.66	**0.000**	89	-0.39	**0.000**	91
Refugee population (total N) in 2018	0.16	0.211	63	0.10	0.516	41	0.29	**0.008**	86	0.15	0.164	88
Prevalence of adults who smoke every day in 2016	0.35	**0.006**	62	0.52	**0.001**	41	-0.30	**0.007**	80	-0.03	0.761	82
Percentage of population with high blood glucose in 2016	0.53	**0.000**	65	0.47	**0.002**	41	0.08	0.459	88	0.16	0.136	90
Percentage of population with high blood pressure in 2015	0.21	0.090	65	0.43	**0.005**	41	-0.34	**0.001**	88	0.08	0.470	90
Prevalence of obesity in adults in 2016	0.26	**0.021**	65	-0.04	0.819	41	-0.47	**0.000**	88	-0.19	0.073	90
GDP PPP per capita in 2018 USD	-0.45	**0.000**	65	-0.61	**0.000**	41	-0.59	**0.000**	88	-0.69	**0.000**	91
Hospital beds per 10,000 people, 2010-2015	0.22	**0.045**	64	0.45	**0.003**	41	-0.49	**0.000**	87	-0.23	**0.027**	89
Current health expenditure (% of GDP) in 2016	-0.42	**0.001**	65	-0.40	**0.009**	41	-0.60	**0.000**	88	-0.47	**0.000**	90
Labour force participation rate in 2018	-0.39	**0.001**	65	-0.14	0.390	41	0.04	0.726	89	-0.18	0.087	91
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	-0.07	0.578	65	-0.18	0.099	41	0.42	**0.000**	89	0.39	**0.000**	91
GINI index, most recent year available	0.23	0.070	65	0.03	0.862	41	0.30	**0.004**	88	0.28	**0.009**	90
Perception of control of corruption in 2018	-0.67	**0.000**	66	-0.69	**0.000**	41	-0.73	**0.000**	89	-0.80	**0.000**	92
Perception of government effectiveness in 2018	-0.58	**0.000**	66	-0.72	**0.000**	41	-0.74	**0.000**	89	-0.81	**0.000**	92
Perception of regulatory quality in 2018	-0.57	**0.000**	66	-0.74	**0.000**	41	-0.79	**0.000**	89	-0.79	**0.000**	92
Country policies and regulation on antimicrobial use in humans in 2018	-0.06	0.646	63	0.00	1.000	41	-0.35	**0.001**	86	-0.27	**0.013**	87
National monitoring systems for sales, prescription and consumption of antibiotics in humans	-0.30	0.021	63	-0.17	**0.100**	40	-0.53	**0.000**	86	-0.44	**0.000**	87
National action plan on AMR in 2018	-0.20	0.120	63	-0.32	**0.044**	40	0.05	0.654	86	-0.07	0.520	87
National surveillance system for antimicrobial usage in humans	-0.42	**0.001**	63	-0.36	**0.023**	40	-0.42	**0.000**	85	-0.41	**0.000**	87
Income class as defined by the World Bank	-0.24	**0.049**	66	-0.44	**0.004**	41	-0.73	**0.000**	89	-0.63	**0.000**	92

Independent variables	Pearson coefficient	p-value	N	Pearson coefficient	p-value	N	Pearson coefficient	p-value	N	Pearson coefficient	p-value	N
Percentage of the population living in an urban environment in 2018	-0.14	0.256	65	-0.41	**0.008**	41	-0.59	**0.000**	89	-0.50	**0.000**	91
Average life expectancy at birth in 2019	-0.31	**0.011**	65	-0.49	**0.001**	41	-0.69	**0.000**	89	-0.66	**0.000**	91
Average years of schooling by country in 2018	-0.18	0.155	65	-0.16	0.317	41	-0.72	**0.000**	89	-0.55	**0.000**	91
Percentage of population using at least basic sanitation services, most recent year available	0.06	0.626	65	-0.04	0.804	41	-0.54	**0.000**	89	-0.45	**0.000**	91
Annual mean concentration of PM 2.5 in urban areas in 2016	0.26	**0.035**	65	0.47	**0.002**	41	0.71	**0.000**	89	0.49	**0.000**	91
Population density in 2018	0.23	0.040	66	-0.03	0.850	41	0.30	**0.004**	89	0.17	0.111	92
Average 12-monthly temperature in 2016	0.26	**0.035**	65	0.00	0.991	41	0.54	**0.000**	89	0.38	**0.000**	91
Human development index, around 2018	-0.28	**0.023**	65	-0.50	**0.001**	41	-0.74	**0.000**	89	-0.67	**0.000**	91
Rule of law in 2018	-0.64	**0.000**	66	-0.77	**0.000**	41	-0.76	**0.000**	89	-0.82	**0.000**	92
Political stability and absence of violence/terrorism in 2018	-0.42	**0.000**	66	-0.55	**0.000**	41	-0.69	**0.000**	89	-0.71	**0.000**	92
Voice and accountability of the general public in 2018	-0.52	**0.000**	66	-0.75	**0.000**	41	-0.77	**0.000**	89	-0.59	**0.000**	92

Notes: N stands for observations. WASH- Water, sanitation, and hygiene. AMR= Antimicrobial resistance. GDP= Gross domestic product. USD= United States Dollars. UN= United Nations. DDD= Daily defined dose. TB= Tuberculosis. DTP= Diphtheria and tetanus toxoids. Darker red colours indicate higher positive correlation, whereas darker blue colours greater negative correlation between variables. ppp= purchasing power parity

Table S11: Correlation table between antibiotic-bacterium specific resistant pairs for high-priority pathogens and independent variables

Independent variables	Oxacillin-resistant *Staphylococcus aureus*			Vancomycin-resistant *Enterococcus faecium*		
	Pearson coefficient	p-value	Number of observations	Pearson coefficient	p-value	Number of observations
Oxacilin consumption (DDD)	0.40	**0.003**	52	-	-	-
Glycopeptides consumption (DDD)	-	-	-	0.31	0.069	35
National surveillance system for antimicrobial resistance (AMR) in humans	-0.48	**0.000**	76	-0.51	**0.002**	35
Median age of the population, UN projection for 2020	-0.47	**0.000**	80	-0.14	0.403	37
Percentage of population that is aged 65 years or older, around 2018	-0.49	**0.000**	80	-0.21	0.218	37

Percentage of population that is aged 70 years or older, around 2018	-0.49	**0.000**	79	-0.22	0.207	36
Percentage of population living in extreme poverty, around 2018	0.03	0.808	57	0.29	0.148	26
Cardiovascular death rate per 100,000 people in 2017	0.19	0.093	80	0.37	**0.025**	37
Diabetes prevalence (% of population) in 2017	0.39	**0.000**	80	0.35	**0.031**	37
Infants lacking DPT immunization (% of population) in 2018	0.18	0.102	80	0.06	0.737	37
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	-0.48	**0.000**	80	-0.20	0.247	37
TB prevalence per 100,000 people in 2017	0.29	**0.008**	80	0.14	0.425	37
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	0.23	**0.043**	80	0.08	0.630	37
Net migration rate, around 2018	-0.11	0.332	80	-0.38	**0.020**	37
Alcohol consumed per person per year (litres) in 2016	-0.40	**0.000**	80	0.05	0.780	37
Refugee population (total N) in 2018	0.23	**0.046**	77	-0.07	0.672	37
Prevalence of adults who smoke every day in 2016	-0.21	0.073	73	0.32	**0.050**	37
Percentage of population with high blood glucose in 2016	0.21	0.068	79	0.26	0.116	37
Percentage of population with high blood pressure in 2015	-0.35	**0.001**	79	0.06	0.710	37
Prevalence of obesity in adults in 2016	-0.21	0.064	79	0.22	0.194	37
GDP PPP per capita in 2018 USD	-0.37	**0.001**	80	-0.30	0.070	37
Hospital beds per 10,000 people, 2010-2015	-0.27	**0.015**	78	-0.01	0.935	37
Current health expenditure (% of GDP) in 2016	-0.36	**0.001**	80	-0.03	0.873	37
Labour force participation rate in 2018	-0.14	0.224	80	-0.13	0.440	37
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	0.16	0.166	80	0.17	0.317	37
GINI index, most recent year available	0.35	**0.002**	80	0.28	0.096	37
Perception of control of corruption in 2018	-0.54	**0.000**	80	-0.43	**0.009**	37
Perception of government effectiveness in 2018	-0.51	**0.000**	80	-0.39	**0.016**	37
Perception of regulatory quality in 2018	-0.53	**0.000**	80	-0.27	0.102	37
Country policies and regulation on antimicrobial use in humans in 2018	-0.32	**0.005**	77	0.00		
National monitoring systems for sales, prescription and consumption of antibiotics in humans	-0.28	**0.014**	77	-0.20	0.234	36
National action plan on AMR in 2018	0.11	0.359	77	-0.21	0.219	36
National surveillance system for antimicrobial usage in humans	-0.16	0.152	77	-0.28	**0.096**	36
Income class as defined by the World Bank	-0.40	**0.000**	80	-0.10	0.546	37
Percentage of the population living in an urban environment in 2018	-0.31	**0.005**	80	-0.40	**0.015**	37
Average life expectancy at birth in 2019	-0.35	**0.002**	80	-0.39	**0.018**	37

Average years of schooling by country in 2018	-0.40	**0.000**	80	0.02	0.891	37
Percentage of population using at least basic sanitation services, most recent year available	-0.26	**0.021**	80	-0.17	0.316	37
Annual mean concentration of PM 2.5 in urban areas in 2016	0.50	**0.000**	80	0.28	**0.050**	37
Population density in 2018	0.34	**0.002**	80	0.29	0.087	37
Average 12-monthly temperature in 2016	0.52	**0.000**	80	0.37	**0.024**	37
Human development index, around 2018	-0.43	**0.000**	80	-0.32	0.052	37
Rule of law in 2018	-0.53	**0.000**	80	-0.36	**0.029**	37
Political stability and absence of violence/terrorism in 2018	-0.48	**0.000**	80	-0.23	0.175	37
Voice and accountability of the general public in 2018	-0.52	**0.000**	80	-0.29	**0.096**	37

Notes: N stands for observations. WASH- Water, sanitation and hygiene. AMR= Antimicrobial resistance. GDP= Gross domestic product. USD= United States Dollars. UN= United Nations. DDD= Daily defined dose. TB= Tuberculosis. DTP= Diphtheria and tetanus toxoids. Darker red colours indicate higher negative correlation values, whereas darker blue colours greater positive correlation values between variables. ppp= purchasing power parity.

Table S12: Correlation table between antibiotic-bacterium specific resistant pairs for high priority pathogens and independent variables

Independent variables	Antimicrobial-resistance in animals		
	Pearson coefficient	p-value	Number of observations
Antibiotic consumption in animals (mg/PCU)	0.28	**0.001**	154
National monitoring system for antimicrobial usage in animals	-0.11	0.193	139
National monitoring system for antimicrobial usage in plants	-0.18	0.060	111
National surveillance system for antimicrobial usage in plants and animals	-0.06	0.487	122
Percentage of population living in extreme poverty, most recent year available since 2010	-0.34	**0.000**	110
Net migration rate, most recent year available	0.04	0.635	163
GDP PPP per capita in 2018 USD	0.19	**0.020**	158
Current health expenditure (% of GDP) in 2016	-0.21	**0.009**	158
GINI index, most recent year available	-0.17	**0.044**	156
Agricultural land (total % of land area) in 2018	-0.09	0.265	163
Agricultural land per capita in 2018	-0.17	**0.028**	163
Arable land (total % of land area) in 2018	0.19	**0.050**	163
Cattle density in 2010	0.22	**0.041**	148
Chicken density in 2010	0.17	0.053	125

Pig density in 2010	-0.02	0.832	124
Control of corruption in 2018	-0.06	0.434	164
Perception of Government effectiveness in 2018	0.05	0.562	164
Regulatory quality in 2018	-0.01	0.872	164
Aggregate of surveillance and control measures for AMR in animals in 2018	0.05	0.502	158
Country policies and regulation on antimicrobial use in animals in 2018	0.04	0.666	136
Country policies and regulation on antimicrobial use for growth promotion in animals in 2018	0.17	**0.050**	136
National action plan on AMR in 2018	-0.04	0.683	136
Income class as defined by the World Bank	0.17	**0.025**	164
Percentage of the population living in an urban environment in 2018	0.14	0.065	163
Annual mean concentration of PM 2.5 in urban areas in 2016	0.24	**0.002**	161
Average 12-monthly temperature in 2016	0.12	**0.100**	163
Rule of law in 2018	-0.04	0.643	164
Political stability and absence of violence/terrorism in 2018	-0.10	0.211	164
Perception of voice and accountability of the general public in 2018	-0.16	**0.047**	164

Notes: N stands for observations. WASH- Water, sanitation and hygiene. AMR= Antimicrobial resistance. GDP= Gross domestic product. USD= United States Dollars. UN= United Nations. DDD= Daily defined dose. Darker red colours indicate higher positive correlation, whereas darker blue colours greater negative correlation between variables. ppp= purchasing power parity

Descriptive statistics, by sample used

Table S13.1: Descriptive statistics for the sample using critical-priority pathogens AMR in humans as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-imputed data (N=60)		III. Descriptive statistics with fully imputed data for independent variables (N=97)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Antibiotic consumption of Carbapenems or 3rd generation cephalosporins in DDDs	564.34	480.56	44.67	2658.90	564.34	480.56	540.43	425.64	0.753
Antibiotic consumption of 3rd generation cephalosporins in DDDs	1100.14	962.68	83.35	5280.11	1100.14	962.68	808.29	942.10	0.068
Antibiotic consumption of carbapenems in DDDs	21.16	18.59	0.01	90.85	21.16	18.59	16.95	17.13	0.161
Antibiotic consumption in animals (mg/PCU)	55.92	32.36	7.05	187.93	60.63	36.93	55.92	32.36	0.419
Median age of the population, UN projection for 2020	33.87	9.16	16.40	48.20	38.26	6.72	33.87	9.16	0.001
Percentage of population that is aged 65 years or older, most recent year available	11.13	6.96	1.14	27.05	14.17	6.23	11.05	6.96	0.005
Percentage of population that is aged 70 years or older, most recent year available	7.09	4.83	0.53	18.49	9.23	4.49	7.13	4.83	0.008
percentage of population living in extreme poverty, most recent year available since 2010	8.69	17.15	0.10	77.60	2.37	4.65	6.74	18.08	0.027
Cardiovascular death rate per 100,000 people in 2017	244.99	120.44	79.37	597.03	219.36	118.40	244.99	120.44	0.196
Diabetes prevalence (% of population) in 2017	7.57	3.63	1.82	17.72	7.72	3.40	7.60	3.62	0.836
Infants lacking DPT immunization (% of population) in 2018	6.46	8.16	1.00	35.00	5.40	7.22	6.46	8.16	0.397
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	17.22	10.91	1.29	46.17	21.99	10.08	17.22	10.91	0.007
TB prevalence per 100,000 people in 2017	85.74	123.79	0.81	567.00	60.14	114.85	85.74	123.79	0.193
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	115.12	563.34	0.00	5256.67	121.55	679.76	115.12	563.34	0.951
Net migration rate, most recent year available	1.03	5.79	-24.08	31.11	1.27	4.03	1.03	5.79	0.754

Alcohol consumed per person per year (litres) in 2016	7.00	4.59	0.00	15.20	8.39	4.26	7.00	4.59	0.058
Refugee population (total N) in 2018	215848.60	562220.80	5.00	3681688.00	240022.80	655546.10	214927.10	554266.90	0.806
Prevalence of adults who smoke every day in 2016	23.08	9.40	4.00	46.00	25.70	8.14	22.65	9.04	0.033
Percentage of population with high blood glucose in 2016	8.38	2.59	2.80	16.20	8.82	2.12	8.38	2.57	0.246
Percentage of population with high blood pressure in 2015	24.39	6.43	12.60	41.00	25.65	6.90	24.38	6.40	0.254
Prevalence of obesity in adults in 2016	19.78	9.91	2.10	37.30	22.35	8.93	19.71	9.88	0.090
GDP PPP per capita in 2018 USD	25760.93	22487.24	1163.28	112531.50	31457.00	20226.86	25760.93	22487.24	0.106
Hospital beds per 10,000 people, 2010-2015	33.87	26.51	1.00	134.00	42.10	26.45	33.63	26.31	0.055
Current health expenditure (% of GDP) in 2016	6.96	2.72	2.34	17.07	7.53	2.85	6.96	2.70	0.214
Labour force participation rate in 2018	61.80	10.79	38.50	86.90	59.52	7.76	61.80	10.79	0.131
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	6.62	13.76	0.10	70.70	1.66	4.11	6.62	13.76	0.002
GINI index	35.90	7.03	25.00	63.00	34.76	6.69	35.96	6.98	0.284
Perception of control of corruption in 2018	0.15	1.09	-1.64	2.21	0.56	1.02	0.15	1.09	0.022
Perception of government effectiveness in 2018	0.26	1.02	-2.26	2.22	0.72	0.84	0.26	1.02	0.003
Perception of regulatory quality in 2018	0.27	1.02	-2.19	2.13	0.72	0.86	0.27	1.02	0.005
Country policies and regulation on antimicrobial use in humans	0.92	0.27	0.00	1.00	0.97	0.18	0.92	0.26	0.234
National action plan on AMR in 2018	3.80	0.98	1.00	5.00	3.90	0.96	3.77	0.97	0.424
National surveillance system for AMR in humans	3.58	0.96	1.00	5.00	3.85	0.89	3.53	0.97	0.041
Income class as defined by the World Bank	2.99	1.06	1.00	4.00	3.42	0.79	2.99	1.06	0.005
Percentage of the population living in an urban environment in 2018	63.92	22.19	16.90	100.00	70.77	17.94	63.92	22.19	0.038
Average life expectancy at birth in 2019	75.21	6.62	54.69	84.63	78.17	4.45	75.21	6.62	0.001
Average years of schooling by country in 2018	9.54	3.04	2.35	14.13	10.85	2.12	9.54	3.04	0.002
Percentage of population using at least basic sanitation services, most recent year available	82.66	25.19	7.00	100.00	93.23	11.04	82.66	25.19	0.001
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	25.46	19.14	5.70	94.30	20.52	16.69	25.46	19.14	0.094

	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Population (total N) in 2018	54500000.00	148000000.00	341250.00	138000000.00	72300000.00	185000000.00	72300000.00	185000000.00	1.000
Average 12-monthly temperature in 2016	17.17	8.77	-4.97	29.29	15.10	8.67	17.17	8.77	0.153
human development index, most recent year available	0.76	0.15	0.43	0.95	0.83	0.09	0.76	0.15	0.001
Perception of rule of law in 2018	0.21	1.04	-2.05	2.07	0.64	0.90	0.21	1.04	0.007
Political stability and absence of violence/terrorism in 2018	-0.14	1.08	-3.01	1.53	0.17	0.88	-0.14	1.08	0.057
Perception of voice and accountability of the general public in 2018	0.07	1.01	-1.97	1.70	0.48	0.90	0.07	1.01	0.011
World region as defined by the World Health Organisation	3.15	1.45	1.00	6.00	3.52	1.26	3.15	1.45	0.102
National monitoring system for antibiotic use in humans	0.65	0.48	0.00	1.00	0.76	0.43	0.63	0.49	0.076

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.2: Descriptive statistics for the sample using high-priority pathogens AMR in humans as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-imputed data (N=56)		III. Descriptive statistics with fully imputed data for independent variables (N=80)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Consumption of oxacillin and glycopeptides in DDDs	6.29	6.85	0.03	40.93	6.36	6.88	5.06	6.40	0.268
Antibiotic consumption Oxacillin	3.53	5.07	0.02	24.68	3.60	5.09	4.41	7.92	0.469
Antibiotic consumption Glycopeptides	9.35	11.77	0.03	72.51	9.44	11.85	6.61	11.51	0.170
Antibiotic consumption in animals (mg/PCU)	58.64	34.66	7.05	187.93	61.75	37.50	58.64	34.66	0.626
Median age of the population, UN projection for 2020	36.07	8.05	16.40	48.20	38.51	6.71	36.07	8.05	0.060
Percentage of population that is aged 65 years or older, most recent year available	12.39	6.78	1.14	27.05	14.37	6.28	12.39	6.78	0.085
Percentage of population that is aged 70 years or older, most recent year available	7.98	4.77	0.53	18.49	9.37	4.54	8.03	4.76	0.101
percentage of population living in extreme poverty, most recent year available since 2010	4.18	10.42	0.10	71.40	2.13	4.33	3.07	13.90	0.572

Cardiovascular death rate per 100,000 people in 2017	230.87	116.70	79.37	539.85	216.77	120.45	230.87	116.70	0.499
Diabetes prevalence (% of population) in 2017	7.85	3.66	2.42	17.72	7.57	3.43	7.85	3.66	0.648
Infants lacking DPT immunization (% of population) in 2018	5.65	7.57	1.00	35.00	5.41	7.41	5.65	7.57	0.855
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	19.27	10.73	1.29	46.17	22.37	10.12	19.27	10.73	0.092
TB prevalence per 100,000 people in 2017	65.78	108.12	0.81	567.00	59.66	116.48	65.78	108.12	0.757
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	99.89	590.23	0.00	5256.67	127.74	703.46	99.89	590.23	0.809
Net migration rate, most recent year available	1.71	5.49	-11.60	31.11	1.54	3.92	1.71	5.49	0.835
Alcohol consumed per person per year (litres) in 2016	7.67	4.36	0.20	15.00	8.66	4.13	7.67	4.36	0.187
Refugee population (total N) in 2018	185211.80	578598.70	5.00	3681688.00	215414.80	651723.40	185243.30	568544.60	0.781
Prevalence of adults who smoke every day in 2016	24.22	9.27	4.00	46.00	25.53	8.04	23.76	9.08	0.236
Percentage of population with high blood glucose in 2016	8.57	2.28	4.30	16.20	8.77	2.13	8.57	2.27	0.610
Percentage of population with high blood pressure in 2015	24.96	6.80	12.60	41.00	25.74	6.87	24.94	6.76	0.502
Prevalence of obesity in adults in 2016	21.04	9.16	2.10	37.30	22.41	8.70	20.94	9.14	0.348
GDP PPP per capita in 2018 USD	29463.87	22540.85	1163.28	112531.50	32550.41	20245.41	29463.87	22540.85	0.407
Hospital beds per 10,000 people, 2010-2015	37.71	27.02	1.00	134.00	43.35	26.84	37.31	26.82	0.202
Current health expenditure (% of GDP) in 2016	7.10	2.77	2.34	17.07	7.56	2.85	7.10	2.77	0.353
Labour force participation rate in 2018	61.41	9.20	39.30	86.90	59.79	7.54	61.41	9.20	0.266
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	4.34	12.01	0.10	70.70	1.54	4.01	4.34	12.01	0.058
GINI index	35.47	6.59	25.00	63.00	34.91	6.90	35.47	6.59	0.639
Perception of control of corruption in 2018	0.39	1.00	-1.44	2.21	0.61	0.98	0.39	1.00	0.213
Perception of government effectiveness in 2018	0.51	0.89	-1.61	2.22	0.78	0.79	0.51	0.89	0.069
Perception of regulatory quality in 2018	0.50	0.91	-1.62	2.13	0.76	0.82	0.50	0.91	0.091
Country policies and regulation on antimicrobial use in humans	0.96	0.19	0.00	1.00	0.96	0.19	0.96	0.19	0.863
National action plan on AMR in 2018	3.83	0.97	2.00	5.00	3.91	0.98	3.80	0.96	0.533
National surveillance system for AMR in humans	3.73	0.91	2.00	5.00	3.89	0.87	3.71	0.90	0.232
Income class as defined by the World Bank	3.24	0.92	1.00	4.00	3.46	0.76	3.24	0.92	0.122
Percentage of the population living in an urban environment in 2018	67.93	20.01	16.90	100.00	71.19	17.44	67.93	20.01	0.319
Average life expectancy at birth in 2019	76.54	6.01	54.69	84.63	78.19	4.51	76.54	6.01	0.072
Average years of schooling by country in 2018	10.17	2.72	2.35	14.13	10.96	2.05	10.17	2.72	0.058

Variable name	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	Mean test
Percentage of population using at least basic sanitation services, most recent year available	88.68	18.44	18.00	100.00	93.80	9.59	88.68	18.44	0.039
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	23.77	19.45	5.80	94.30	19.81	16.30	23.77	19.45	0.204
Population (total N) in 2018	58800000.00	16300000.00	341250.00	138000000.00	74300000.00	19100000.00	58800000.00	16300000.00	0.623
Average 12-monthly temperature in 2016	16.07	9.07	-4.97	29.29	15.03	8.83	16.07	9.07	0.505
human development index, most recent year available	0.80	0.12	0.43	0.95	0.84	0.09	0.80	0.12	0.045
Perception of rule of law in 2018	0.44	0.92	-1.20	2.07	0.68	0.87	0.44	0.92	0.128
Political stability and absence of violence/terrorism in 2018	0.09	0.91	-2.27	1.49	0.21	0.84	0.09	0.91	0.447
Perception of voice and accountability of the general public in 2018	0.25	0.97	-1.85	1.70	0.51	0.89	0.25	0.97	0.108
World region as defined by the World Health Organisation	3.34	1.34	1.00	6.00	3.48	1.22	3.34	1.34	0.516
National monitoring system for antibiotic use in humans	0.74	0.44	0.00	1.00	0.79	0.41	0.73	0.45	0.420

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.3: Descriptive statistics for the sample using medium-priority pathogens AMR in humans as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-imputed data (N=40)		III. Descriptive statistics with fully imputed data for independent variables (N=49)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Penicillin consumption in DDDs	458.57	699.11	0.86	3281.86	455.61	707.76	439.94	652.20	0.915
Antibiotic consumption in animals (mg/PCU)	61.74	40.97	8.47	187.93	63.25	42.78	61.74	40.97	0.867
Median age of the population, UN projection for 2020	38.34	7.73	16.40	48.20	40.91	5.12	38.34	7.73	0.069
Percentage of population that is aged 65 years or older, most recent year available	14.51	6.75	1.14	27.05	16.49	5.42	14.51	6.75	0.132

Indicator									
Percentage of population that is aged 70 years or older, most recent year available	9.47	4.80	0.53	18.49	10.91	3.96	9.52	4.76	0.139
percentage of population living in extreme poverty, most recent year available since 2010	4.33	12.83	0.10	71.40	0.81	1.12	3.79	14.49	0.160
Cardiovascular death rate per 100,000 people in 2017	209.46	99.36	79.37	439.42	203.59	105.27	209.46	99.36	0.790
Diabetes prevalence (% of population) in 2017	6.94	3.24	2.42	17.26	6.99	3.04	6.94	3.24	0.941
Infants lacking DPT immunization (% of population) in 2018	5.02	7.08	1.00	34.00	4.18	6.25	5.02	7.08	0.554
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	22.66	10.80	1.29	46.17	25.70	8.93	22.66	10.80	0.154
TB prevalence per 100,000 people in 2017	59.46	119.50	0.81	567.00	37.97	90.38	59.46	119.50	0.340
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	28.93	81.23	0.00	430.91	21.98	72.14	28.93	81.23	0.672
Net migration rate, most recent year available	1.44	4.54	-11.60	16.33	1.45	4.49	1.44	4.54	0.997
Alcohol consumed per person per year (litres) in 2016	9.00	3.86	0.90	15.00	9.92	3.36	9.00	3.86	0.242
Refugee population (total N) in 2018	155527.90	549208.10	61.00	3681688.00	165927.30	597416.50	155527.90	549208.10	0.933
Prevalence of adults who smoke every day in 2016	25.31	7.16	11.00	39.00	27.09	6.31	25.21	7.12	0.196
Percentage of population with high blood glucose in 2016	8.37	2.02	4.30	13.20	8.46	1.80	8.37	2.02	0.822
Percentage of population with high blood pressure in 2015	26.49	6.78	13.00	41.00	27.64	6.93	26.49	6.78	0.439
Prevalence of obesity in adults in 2016	21.42	8.89	2.10	33.90	22.67	7.36	21.42	8.89	0.472
GDP PPP per capita in 2018 USD	33544.44	22414.91	1163.28	112531.50	35756.73	18026.88	33544.44	22414.91	0.609
Hospital beds per 10,000 people, 2010-2015	42.65	27.21	1.00	134.00	48.60	25.89	42.40	26.99	0.277
Current health expenditure (% of GDP) in 2016	7.73	2.47	2.36	12.25	8.02	2.36	7.73	2.47	0.563
Labour force participation rate in 2018	62.08	9.78	44.10	86.90	59.90	6.95	62.08	9.78	0.227
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	3.42	11.07	0.10	70.70	0.49	0.87	3.42	11.07	0.072
GINI index	33.86	6.18	25.40	63.00	32.72	4.21	33.86	6.18	0.308
Perception of control of corruption in 2018	0.61	1.02	-1.34	2.21	0.82	0.93	0.61	1.02	0.313
Perception of government effectiveness in 2018	0.76	0.86	-1.00	2.05	0.97	0.71	0.76	0.86	0.197
Perception of regulatory quality in 2018	0.74	0.87	-1.38	2.02	0.96	0.70	0.74	0.87	0.195
Country policies and regulation on antimicrobial use in humans	0.96	0.20	0.00	1.00	1.00	0.00	0.96	0.20	0.151

Variable name	Mean	SD	Min	Max	Mean	SD	Mean	SD	Mean test
National action plan on AMR in 2018	3.78	1.01	2.00	5.00	3.82	1.05	3.75	1.01	0.764
National surveillance system for AMR in humans	3.92	0.84	2.00	5.00	4.03	0.81	3.90	0.84	0.485
Income class as defined by the World Bank	3.44	0.88	1.00	4.00	3.68	0.62	3.44	0.88	0.149
Percentage of the population living in an urban environment in 2018	68.72	20.32	16.90	99.10	71.74	14.88	68.72	20.32	0.423
Average life expectancy at birth in 2019	78.01	5.53	59.31	84.63	79.55	3.20	78.01	5.53	0.109
Average years of schooling by country in 2018	10.68	2.67	2.35	14.13	11.46	1.72	10.68	2.67	0.104
Percentage of population using at least basic sanitation services, most recent year available	91.56	15.51	26.00	100.00	96.38	5.32	91.56	15.51	0.049
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	20.11	17.42	5.90	94.30	16.01	8.95	20.11	17.42	0.160
Population (total N) in 2018	28800000.00	32800000.00	341250.00	126000000.00	30000000.00	34200000.00	28800000.00	32800000.00	0.868
Average 12-monthly temperature in 2016	13.95	8.55	-4.97	29.29	12.77	8.00	13.95	8.55	0.505
human development index, most recent year available	0.83	0.12	0.43	0.95	0.86	0.07	0.83	0.12	0.086
Perception of rule of law in 2018	0.71	0.90	-1.12	2.07	0.92	0.77	0.71	0.90	0.255
Political stability and absence of violence/terrorism in 2018	0.35	0.78	-2.09	1.41	0.46	0.65	0.35	0.78	0.477
Perception of voice and accountability of the general public in 2018	0.52	0.96	-1.75	1.70	0.73	0.81	0.52	0.96	0.280
World region as defined by the World Health Organisation	3.34	1.30	1.00	6.00	3.43	1.08	3.34	1.30	0.739
National monitoring system for antibiotic use in humans	0.80	0.41	0.00	1.00	0.87	0.34	0.78	0.42	0.260

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.4: Descriptive statistics for the sample using animal AMR as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-		III. Descriptive statistics with fully imputed data for		Mean test (Difference in means between II and III)

	imputed data (N=63)						independent variables (N=69)		
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Antibiotic consumption in animals (mg/PCU)	54.12	34.28	7.05	318.59	64.74	47.99	53.45	33.38	0.125
Antibiotic consumption of Carbapenems or 3rd generation cephalosporins in DDDs	543.80	470.43	44.67	2658.90	537.16	476.95	543.80	470.43	0.936
Percentage of population living in extreme poverty, most recent year available since 2010	14.84	21.10	0.10	77.60	2.34	4.41	11.39	21.42	0.001
Net migration rate, most recent year available	0.11	5.45	-24.08	31.11	0.86	4.89	0.12	5.43	0.418
GDP PPP per capita in 2018 USD	19875.22	20451.83	660.27	112531.50	29476.99	18527.98	19451.70	20418.00	0.004
Current health expenditure (% of GDP) in 2016	6.51	2.59	2.34	17.07	7.29	2.87	6.52	2.57	0.110
GINI index	38.74	7.47	25.40	63.00	35.89	7.00	38.74	7.31	0.026
Agricultural land (total % of land area) in 2018	39.04	21.71	0.54	81.08	41.09	20.22	39.02	21.65	0.571
Agricultural land per capita in 2018	1.25	3.49	0.00	35.78	1.00	2.36	1.28	3.49	0.597
Arable land (total % of land area) in 2018	14.55	13.18	0.09	59.71	18.49	14.39	14.60	13.15	0.111
cattle density in 2010	17.51	22.14	0.01	172.87	21.04	28.91	17.35	21.32	0.410
chicken density in 2010	265.64	468.31	0.30	3021.28	329.10	408.73	245.63	422.80	0.253
Perception of control of corruption in 2018	-0.07	1.02	-1.77	2.21	0.43	1.01	0.57	1.02	0.437
Perception of government effectiveness in 2018	-0.06	1.02	-2.33	2.22	0.62	0.85	0.70	1.02	0.614
pig density in 2010	18.97	47.53	0.00	306.92	31.74	62.48	16.87	44.27	0.123
Perception of regulatory quality in 2018	-0.03	1.01	-2.37	2.23	0.58	0.92	0.55	1.01	0.836
Aggregate of surveillance and control measures for AMR in animals in 2018	15.27	3.35	2.00	20.00	16.82	2.27	15.18	3.35	0.001
Country policies and regulation on antimicrobial use in animals, 2018	0.70	0.46	0.00	1.00	0.95	0.21	0.67	0.43	0.000
Country policies and regulation on antimicrobial use for growth promotion in animals, 2018	0.57	0.50	0.00	1.00	0.83	0.38	0.53	0.47	0.000

	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
National monitoring system for antibiotic use in animals	2.62	1.37	1.00	5.00	3.32	1.17	2.53	1.30	0.000
National action plan on AMR in 2018	3.44	1.11	1.00	5.00	3.79	1.02	3.40	1.03	0.032
National surveillance system for AMR in animals	2.93	1.53	1.00	5.00	3.98	1.18	2.77	1.51	0.000
Income class as defined by the World Bank	2.72	1.10	1.00	4.00	3.35	0.83	2.72	1.10	0.000
Percentage of the population living in an urban environment in 2018	59.68	22.75	13.00	100.00	70.89	17.21	59.73	22.69	0.002
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	26.78	17.02	5.80	94.30	20.85	16.69	26.65	16.93	0.052
Average 12-monthly temperature in 2016	19.78	8.26	-4.97	29.29	15.17	8.51	19.74	8.25	0.003
Perception of rule of law in 2018	-0.09	1.01	-2.29	2.07	0.51	0.95	-0.09	1.01	0.001
Political stability and absence of violence/terrorism in 2018	-0.19	0.99	-3.01	1.49	0.11	0.81	-0.19	0.99	0.061
Perception of voice and accountability of the general public in 2018	-0.11	0.99	-2.19	1.70	0.38	0.96	-0.11	0.99	0.006
World region as defined by the World Health Organisation	2.93	1.55	1.00	6.00	3.51	1.20	2.93	1.55	0.019

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.5: Descriptive statistics for the sample using carbapenem-resistant *Acinetobacter baumanii* levels as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-imputed data (N=50)		III. Descriptive statistics with fully imputed data for independent variables (N=65)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Carbapenems consumption in DDDs	22.83	18.94	0.02	90.85	22.64	19.08	20.24	18.01	0.495
Antibiotic consumption in animals (mg/PCU)	60.62	35.56	8.47	187.93	62.42	37.51	60.62	35.56	0.794
Median age of the population, UN projection for 2020	36.99	7.46	18.10	48.20	38.41	6.94	36.99	7.46	0.296

Variable								
Percentage of population that is aged 65 years or older, most recent year available	12.97	6.74	1.14	27.05	14.36	6.49	12.97	6.74	0.265
Percentage of population that is aged 70 years or older, most recent year available	8.41	4.80	0.53	18.49	9.39	4.69	8.46	4.78	0.296
percentage of population living in extreme poverty, most recent year available since 2010	4.26	11.20	0.10	71.40	2.22	4.62	2.10	11.71	0.940
Cardiovascular death rate per 100,000 people in 2017	242.59	118.15	79.37	539.85	229.99	121.08	242.59	118.15	0.577
Diabetes prevalence (% of population) in 2017	7.98	3.60	3.28	17.72	7.82	3.59	7.98	3.60	0.806
Infants lacking DPT immunization (% of population) in 2018	4.97	6.96	1.00	35.00	5.46	7.75	4.97	6.96	0.726
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	20.12	10.81	1.29	46.17	22.42	10.52	20.12	10.81	0.255
TB prevalence per 100,000 people in 2017	69.58	120.29	0.81	567.00	62.50	122.33	69.58	120.29	0.757
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	117.34	653.83	0.00	5256.67	138.31	744.18	117.34	653.83	0.875
Net migration rate, most recent year available	1.20	5.46	-11.60	31.11	0.78	3.42	1.20	5.46	0.608
Alcohol consumed per person per year (litres) in 2016	7.84	4.39	0.20	15.00	8.63	4.29	7.84	4.39	0.338
Refugee population (total N) in 2018	227934.00	643330.20	61.00	3681688.00	266234.20	706081.80	223077.00	633947.90	0.735
Prevalence of adults who smoke every day in 2016	25.63	8.97	4.00	46.00	26.48	7.77	25.44	8.85	0.505
Percentage of population with high blood glucose in 2016	8.84	2.31	4.30	16.20	8.99	2.24	8.84	2.31	0.714
Percentage of population with high blood pressure in 2015	25.82	6.73	13.00	41.00	26.22	6.64	25.82	6.73	0.751
Prevalence of obesity in adults in 2016	21.44	9.22	2.10	37.30	22.68	8.91	21.44	9.22	0.470
GDP PPP per capita in 2018 USD	27323.83	17643.95	1163.28	71802.46	29679.89	16622.62	27323.83	17643.95	0.465
Hospital beds per 10,000 people, 2010-2015	40.67	28.12	3.00	134.00	44.78	27.66	40.51	27.93	0.417
Current health expenditure (% of GDP) in 2016	7.35	2.75	2.34	17.07	7.64	2.89	7.35	2.75	0.597
Labour force participation rate in 2018	60.01	8.88	39.30	83.00	58.60	7.39	60.01	8.88	0.356
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	2.65	6.00	0.10	28.30	1.68	4.22	2.65	6.00	0.313
GINI index	34.96	6.43	25.00	63.00	34.60	6.81	34.96	6.43	0.776
Perception of control of corruption in 2018	0.31	0.92	-1.34	2.21	0.48	0.94	0.31	0.92	0.328
Perception of government effectiveness in 2018	0.49	0.82	-1.08	2.05	0.69	0.77	0.49	0.82	0.185
Perception of regulatory quality in 2018	0.47	0.84	-1.38	2.02	0.65	0.81	0.47	0.84	0.256

Country policies and regulation on antimicrobial use in humans	0.94	0.25	0.00	1.00	0.96	0.20	0.94	0.24	0.555
National action plan on AMR in 2018	3.86	0.93	2.00	5.00	3.92	0.94	3.83	0.93	0.599
National surveillance system for AMR in humans	3.78	0.92	2.00	5.00	3.90	0.91	3.76	0.91	0.425
Income class as defined by the World Bank	3.26	0.86	1.00	4.00	3.40	0.81	3.26	0.86	0.366
Percentage of the population living in an urban environment in 2018	66.81	19.95	16.90	98.00	69.86	17.70	66.81	19.95	0.390
Average life expectancy at birth in 2019	76.89	5.03	64.07	84.63	77.89	4.58	76.89	5.03	0.271
Average years of schooling by country in 2018	10.38	2.42	4.63	14.13	10.85	2.08	10.38	2.42	0.276
Percentage of population using at least basic sanitation services, most recent year available	90.54	16.55	18.00	100.00	93.86	9.63	90.54	16.55	0.181
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	23.67	18.70	5.80	94.30	21.03	16.91	23.67	18.70	0.431
Population (total N) in 2018	65100000.00	17700000.00	437483.00	138000000.00	80600000.00	20100000.00	65100000.00	17700000.00	0.667
Average 12-monthly temperature in 2016	16.08	8.47	-4.24	29.04	15.42	8.22	16.08	8.47	0.674
human development index, most recent year available	0.81	0.11	0.48	0.94	0.83	0.09	0.81	0.11	0.206
Perception of rule of law in 2018	0.41	0.86	-1.12	2.07	0.60	0.85	0.41	0.86	0.245
Political stability and absence of violence/terrorism in 2018	0.03	0.82	-2.27	1.33	0.11	0.85	0.03	0.82	0.627
Perception of voice and accountability of the general public in 2018	0.23	0.94	-1.70	1.58	0.44	0.90	0.23	0.94	0.223
World region as defined by the World Health Organisation	3.35	1.32	1.00	6.00	3.40	1.25	3.35	1.32	0.831
National monitoring system for antibiotic use in humans	0.73	0.45	0.00	1.00	0.76	0.43	0.72	0.45	0.656

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.6: Descriptive statistics for the sample using carbapenem-resistant *Pseudomonas aeruginosa* levels as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-imputed data (N=35)		III. Descriptive statistics with fully imputed data for independent variables (N=41)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Carbapenems consumption in DDDs	26.14	16.07	0.01	67.47	25.95	16.27	23.90	16.12	0.586
Antibiotic consumption in animals (mg/PCU)	59.72	38.64	8.47	181.79	59.06	41.23	59.72	38.64	0.944
Median age of the population, UN projection for 2020	41.27	4.59	21.10	47.90	41.99	3.40	41.27	4.59	0.437
Percentage of population that is aged 65 years or older, most recent year available	17.25	3.94	3.39	23.02	17.85	3.36	17.25	3.94	0.478
Percentage of population that is aged 70 years or older, most recent year available	11.46	2.92	1.95	16.24	11.93	2.59	11.46	2.88	0.459
percentage of population living in extreme poverty, most recent year available since 2010	1.32	2.36	0.10	12.00	0.88	1.12	0.93	2.99	0.921
Cardiovascular death rate per 100,000 people in 2017	215.18	117.54	86.06	496.22	198.44	106.31	215.18	117.54	0.519
Diabetes prevalence (% of population) in 2017	6.51	2.14	3.28	12.13	6.33	2.12	6.51	2.14	0.713
Infants lacking DPT immunization (% of population) in 2018	3.27	3.80	1.00	22.00	3.26	3.85	3.27	3.80	0.990
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	26.85	6.52	5.17	35.59	27.89	5.62	26.85	6.52	0.458
TB prevalence per 100,000 people in 2017	22.81	33.06	3.10	152.00	17.63	25.10	22.81	33.06	0.444
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	22.74	71.34	0.00	430.91	22.31	74.55	22.74	71.34	0.980
Net migration rate, most recent year available	1.59	4.55	-11.60	16.33	1.92	4.64	1.59	4.55	0.755
Alcohol consumed per person per year (litres) in 2016	10.54	2.67	2.00	15.00	10.95	2.39	10.54	2.67	0.488
Refugee population (total N) in 2018	169442.90	590122.00	319.00	3681688.00	197321.30	635790.00	169442.90	590122.00	0.845
Prevalence of adults who smoke every day in 2016	27.77	7.97	4.00	43.70	27.86	7.20	27.77	7.97	0.959
Percentage of population with high blood glucose in 2016	8.42	1.99	4.80	15.00	8.25	1.68	8.42	1.99	0.687

Percentage of population with high blood pressure in 2015	28.36	6.40	16.40	41.00	28.49	6.41	28.36	6.40	0.930
Prevalence of obesity in adults in 2016	24.72	5.63	2.10	37.30	25.17	5.30	24.72	5.63	0.722
GDP PPP per capita in 2018 USD	35598.35	17549.14	4211.85	93734.28	38385.05	16769.04	35598.35	17549.14	0.485
Hospital beds per 10,000 people, 2010-2015	48.24	20.62	9.00	110.00	49.06	17.79	48.24	20.62	0.855
Current health expenditure (% of GDP) in 2016	8.49	2.44	4.31	17.07	8.68	2.49	8.49	2.44	0.751
Labour force participation rate in 2018	59.70	5.76	46.80	77.40	59.58	5.40	59.70	5.76	0.924
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	0.68	2.91	0.10	18.80	0.24	0.28	0.68	2.91	0.339
GINI index	32.75	4.53	25.40	43.50	32.55	4.24	32.75	4.53	0.850
Perception of control of corruption in 2018	0.84	0.93	-0.85	2.21	0.95	0.94	0.84	0.93	0.605
Perception of government effectiveness in 2018	0.94	0.73	-0.64	2.05	1.06	0.67	0.94	0.73	0.444
Perception of regulatory quality in 2018	1.00	0.74	-0.80	2.02	1.10	0.68	1.00	0.74	0.511
Country policies and regulation on antimicrobial use in humans	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.01	0.324
National action plan on AMR in 2018	3.70	0.99	2.00	5.00	3.69	1.02	3.68	0.99	0.966
National surveillance system for AMR in humans	3.93	0.89	2.00	5.00	4.03	0.86	3.90	0.89	0.541
Income class as defined by the World Bank	3.73	0.55	2.00	4.00	3.83	0.45	3.73	0.55	0.405
Percentage of the population living in an urban environment in 2018	72.02	13.95	35.90	98.00	72.86	13.48	72.02	13.95	0.793
Average life expectancy at birth in 2019	79.31	3.97	64.07	83.78	79.95	3.05	79.31	3.97	0.434
Average years of schooling by country in 2018	11.75	1.56	7.18	14.13	11.89	1.44	11.75	1.56	0.675
Percentage of population using at least basic sanitation services, most recent year available	94.85	13.06	18.00	100.00	96.83	4.55	94.85	13.06	0.371
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	14.70	7.65	5.90	42.00	13.53	7.23	14.70	7.65	0.497
Population (total N) in 2018	31800000.00	57900000.00	441539.00	331000000.00	35800000.00	61700000.00	31800000.00	57900000.00	0.774
Average 12-monthly temperature in 2016	11.03	7.12	-4.97	29.04	10.21	6.68	11.03	7.12	0.610
human development index, most recent year available	0.87	0.07	0.59	0.95	0.88	0.06	0.87	0.07	0.349
Perception of rule of law in 2018	0.90	0.82	-0.88	2.07	1.03	0.78	0.90	0.82	0.502
Political stability and absence of violence/terrorism in 2018	0.52	0.57	-1.32	1.36	0.57	0.54	0.52	0.57	0.681

Variable name/ descriptive statistics type									
Perception of voice and accountability of the general public in 2018	0.79	0.81	-1.48	1.70	0.89	0.76	0.79	0.81	0.580
World region as defined by the World Health Organisation	3.15	0.76	1.00	6.00	3.23	0.73	3.15	0.76	0.634
National monitoring system for antibiotic use in humans	0.90	0.30	0.00	1.00	0.91	0.28	0.88	0.33	0.611

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.7: Descriptive statistics for the sample using 3rd generation cephalosporins-resistant *Escherichia coli* levels as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data				II. Descriptive statistics using our analytical sample, non-imputed data (N=57)		III. Descriptive statistics with fully imputed data for independent variables (N=89)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
3rd generation cephalosporins consumption in DDDs	1128.38	966.92	83.35	5280.11	1133.68	974.66	838.80	965.01	0.079
Antibiotic consumption in animals (mg/PCU)	56.64	33.56	7.05	187.93	60.73	37.88	56.64	33.56	0.509
Median age of the population, UN projection for 2020	34.26	9.27	16.40	48.20	38.45	6.71	34.26	9.27	0.003
Percentage of population that is aged 65 years or older, most recent year available	11.44	7.11	1.14	27.05	14.37	6.25	11.36	7.11	0.010
Percentage of population that is aged 70 years or older, most recent year available	7.30	4.95	0.53	18.49	9.38	4.51	7.35	4.94	0.013
percentage of population living in extreme poverty, most recent year available since 2010	8.49	16.71	0.10	77.60	2.34	4.79	6.65	17.84	0.035
Cardiovascular death rate per 100,000 people in 2017	243.63	120.84	79.37	597.03	221.44	118.61	243.63	120.84	0.278
Diabetes prevalence (% of population) in 2017	7.60	3.73	1.82	17.72	7.71	3.47	7.63	3.72	0.891
Infants lacking DPT immunization (% of population) in 2018	6.38	8.47	1.00	35.00	5.18	7.33	6.38	8.47	0.366
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	17.68	11.18	1.29	46.17	22.29	10.17	17.68	11.18	0.013

TB prevalence per 100,000 people in 2017	82.16	118.71	0.81	567.00	60.22	117.51	82.16	118.71	0.278
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	116.50	586.26	0.00	5256.67	124.09	697.36	116.50	586.26	0.946
Net migration rate, most recent year available	1.09	6.01	-24.08	31.11	1.32	3.98	1.09	6.01	0.778
Alcohol consumed per person per year (litres) in 2016	7.07	4.62	0.00	15.00	8.51	4.34	7.07	4.62	0.061
Refugee population (total N) in 2018	235710.10	584081.80	5.00	3681688.00	252514.80	670511.50	234036.30	575031.70	0.864
Prevalence of adults who smoke every day in 2016	23.30	9.05	4.00	43.70	25.76	7.76	23.03	8.68	0.053
Percentage of population with high blood glucose in 2016	8.41	2.59	2.80	16.20	8.86	2.16	8.41	2.58	0.253
Percentage of population with high blood pressure in 2015	24.59	6.31	13.00	41.00	25.81	6.63	24.57	6.28	0.263
Prevalence of obesity in adults in 2016	19.74	10.15	2.10	37.30	22.46	9.15	19.67	10.12	0.090
GDP PPP per capita in 2018 USD	27096.81	22973.70	1163.28	112531.50	32430.48	20291.58	27096.81	22973.70	0.147
Hospital beds per 10,000 people, 2010-2015	34.72	27.07	1.00	134.00	43.18	26.64	34.44	26.86	0.059
Current health expenditure (% of GDP) in 2016	6.97	2.80	2.34	17.07	7.57	2.89	6.98	2.79	0.223
Labour force participation rate in 2018	61.63	10.59	38.50	86.90	59.25	7.28	61.63	10.59	0.114
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	6.79	14.12	0.10	70.70	1.70	4.21	6.79	14.12	0.002
GINI index	35.37	6.52	25.00	63.00	34.37	6.45	35.39	6.49	0.358
Perception of control of corruption in 2018	0.24	1.10	-1.64	2.21	0.61	1.02	0.24	1.10	0.038
Perception of government effectiveness in 2018	0.34	1.03	-2.26	2.22	0.78	0.82	0.34	1.03	0.006
Perception of regulatory quality in 2018	0.34	1.02	-1.74	2.13	0.74	0.87	0.34	1.02	0.013
Country policies and regulation on antimicrobial use in humans	0.93	0.26	0.00	1.00	0.96	0.19	0.93	0.25	0.332
National action plan on AMR in 2018	3.84	0.99	1.00	5.00	3.93	0.96	3.81	0.99	0.472
National surveillance system for AMR in humans	3.62	0.95	1.00	5.00	3.86	0.90	3.58	0.96	0.080
Income class as defined by the World Bank	3.02	1.09	1.00	4.00	3.44	0.80	3.02	1.09	0.010
Percentage of the population living in an urban environment in 2018	63.87	22.67	16.90	100.00	70.87	18.09	63.87	22.67	0.044
Average life expectancy at birth in 2019	75.43	6.70	54.69	84.63	78.22	4.56	75.43	6.70	0.004
Average years of schooling by country in 2018	9.62	3.08	2.35	14.13	10.94	2.13	9.62	3.08	0.003
Percentage of population using at least basic sanitation services, most recent year available	83.15	25.40	7.00	100.00	93.60	11.02	83.15	25.40	0.001

Variable name	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	Mean test
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	25.83	19.74	5.70	94.30	20.43	17.09	25.83	19.74	0.085
Population (total N) in 2018	58400000.00	155000000.00	341250.00	138000000.00	74600000.00	190000000.00	58400000.00	155000000.00	0.592
Average 12-monthly temperature in 2016	16.84	8.76	-4.97	29.29	14.90	8.74	16.84	8.76	0.197
human development index, most recent year available	0.77	0.15	0.43	0.95	0.84	0.09	0.77	0.15	0.002
Perception of rule of law in 2018	0.30	1.03	-2.05	2.07	0.70	0.89	0.30	1.03	0.017
Political stability and absence of violence/terrorism in 2018	-0.09	1.10	-3.01	1.53	0.20	0.89	-0.09	1.10	0.085
Perception of voice and accountability of the general public in 2018	0.10	1.04	-1.97	1.70	0.50	0.92	0.10	1.04	0.017
World region as defined by the World Health Organisation	3.16	1.49	1.00	6.00	3.51	1.28	3.16	1.49	0.136
National monitoring system for antibiotic use in humans	0.66	0.48	0.00	1.00	0.77	0.42	0.65	0.48	0.118

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.8: Descriptive statistics for the sample using 3rd generation cephalosporins-resistant *Klebsiella pneumoniae* levels as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data (N=92)				II. Descriptive statistics using our analytical sample, non-imputed data (N=59)		III. Descriptive statistics with fully imputed data for independent variables (N=91)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
3rd generation cephalosporins consumption in DDDs	1100.14	962.68	83.35	5280.11	1104.78	970.27	845.95	952.58	0.113
Antibiotic consumption in animals (mg/PCU)	56.58	33.08	7.05	187.93	60.60	37.25	56.58	33.08	0.504
Median age of the population, UN projection for 2020	34.38	8.96	16.40	48.20	38.18	6.76	34.38	8.96	0.004

Percentage of population that is aged 65 years or older, most recent year available	11.33	6.96	1.14	27.05	14.13	6.28	11.33	6.96	0.013
Percentage of population that is aged 70 years or older, most recent year available	7.27	4.85	0.53	18.49	9.21	4.52	7.32	4.84	0.018
percentage of population living in extreme poverty, most recent year available since 2010	8.59	17.50	0.10	77.60	2.42	4.69	6.18	18.28	0.065
Cardiovascular death rate per 100,000 people in 2017	236.07	112.61	79.37	539.85	217.50	118.52	236.07	112.61	0.344
Diabetes prevalence (% of population) in 2017	7.63	3.65	2.42	17.72	7.68	3.41	7.63	3.65	0.944
Infants lacking DPT immunization (% of population) in 2018	5.80	7.36	1.00	35.00	5.31	7.24	5.80	7.36	0.686
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	17.61	10.96	1.29	46.17	21.95	10.16	17.61	10.96	0.016
TB prevalence per 100,000 people in 2017	85.95	125.81	0.81	567.00	60.70	115.75	85.95	125.81	0.213
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	119.40	581.21	0.00	5256.67	123.61	685.41	119.40	581.21	0.969
Net migration rate, most recent year available	1.47	5.24	-11.60	31.11	1.40	3.93	1.47	5.24	0.926
Alcohol consumed per person per year (litres) in 2016	7.21	4.56	0.00	15.20	8.43	4.28	7.21	4.56	0.103
Refugee population (total N) in 2018	220797.30	578153.80	5.00	3681688.00	244002.40	660441.90	219651.90	569380.30	0.818
Prevalence of adults who smoke every day in 2016	23.04	9.19	4.00	43.70	25.46	8.01	22.60	8.93	0.045
Percentage of population with high blood glucose in 2016	8.40	2.61	2.80	16.20	8.82	2.14	8.40	2.60	0.292
Percentage of population with high blood pressure in 2015	24.43	6.53	12.60	41.00	25.46	6.80	24.41	6.49	0.352
Prevalence of obesity in adults in 2016	19.94	10.02	2.10	37.30	22.40	9.00	19.86	9.99	0.112
GDP PPP per capita in 2018 USD	26378.65	22546.23	1163.28	112531.50	31773.97	20249.64	26378.65	22546.23	0.133
Hospital beds per 10,000 people, 2010-2015	34.85	26.91	1.00	134.00	42.22	26.66	34.57	26.71	0.091
Current health expenditure (% of GDP) in 2016	6.89	2.76	2.34	17.07	7.51	2.87	6.88	2.74	0.192
Labour force participation rate in 2018	61.95	10.21	39.30	86.90	59.74	7.65	61.95	10.21	0.134
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	6.48	14.02	0.10	70.70	1.68	4.14	6.48	14.02	0.003

GINI index	36.03	7.07	25.00	63.00	34.78	6.74	36.09	7.05	0.262
Perception of control of corruption in 2018	0.21	1.05	-1.51	2.21	0.58	1.02	0.21	1.05	0.036
Perception of government effectiveness in 2018	0.33	0.96	-1.66	2.22	0.74	0.83	0.33	0.96	0.007
Perception of regulatory quality in 2018	0.34	0.98	-2.19	2.13	0.73	0.86	0.34	0.98	0.012
Country policies and regulation on antimicrobial use in humans	0.93	0.25	0.00	1.00	0.97	0.18	0.93	0.25	0.304
National action plan on AMR in 2018	3.83	0.94	2.00	5.00	3.90	0.96	3.80	0.93	0.538
National surveillance system for AMR in humans	3.62	0.94	1.00	5.00	3.85	0.89	3.60	0.93	0.101
Income class as defined by the World Bank	3.05	1.02	1.00	4.00	3.42	0.79	3.05	1.02	0.015
Percentage of the population living in an urban environment in 2018	64.73	21.85	16.90	100.00	71.15	17.84	64.73	21.85	0.053
Average life expectancy at birth in 2019	75.50	6.45	54.69	84.63	78.18	4.48	75.50	6.45	0.004
Average years of schooling by country in 2018	9.68	2.94	2.35	14.13	10.87	2.13	9.68	2.94	0.005
Percentage of population using at least basic sanitation services, most recent year available	83.43	24.94	7.00	100.00	93.20	11.13	83.43	24.94	0.002
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	25.12	19.25	5.70	94.30	20.41	16.81	25.12	19.25	0.118
Population (total N) in 2018	57000000.00	155000000.00	341250.00	1380000000.00	74600000.00	190000000.00	58400000.00	155000000.00	0.592
Average 12-monthly temperature in 2016	17.38	8.71	-4.97	29.29	15.17	8.73	17.38	8.71	0.135
human development index, most recent year available	0.77	0.14	0.43	0.95	0.83	0.09	0.77	0.14	0.002
Perception of rule of law in 2018	0.28	0.98	-1.79	2.07	0.66	0.90	0.28	0.98	0.017
Political stability and absence of violence/terrorism in 2018	-0.06	0.98	-2.53	1.53	0.18	0.88	-0.06	0.98	0.125
Perception of voice and accountability of the general public in 2018	0.12	0.98	-1.85	1.70	0.49	0.90	0.12	0.98	0.021
World region as defined by the World Health Organisation	3.22	1.47	1.00	6.00	3.53	1.26	3.22	1.47	0.177
National monitoring system for antibiotic use in humans	0.67	0.47	0.00	1.00	0.76	0.43	0.65	0.48	0.134

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.9: Descriptive statistics for the sample using oxacillin-resistant *Staphylococcus aureus* levels as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data (N=80)				II. Descriptive statistics using our analytical sample, non-imputed data (N=48)		III. Descriptive statistics with fully imputed data for independent variables (N=80)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Oxacillin consumption in DDDs	3.53	5.07	0.02	24.68	3.73	5.22	4.41	7.92	0.559
Antibiotic consumption in animals (mg/PCU)	58.64	34.66	7.05	187.93	63.32	39.74	58.64	34.66	0.502
Median age of the population, UN projection for 2020	36.07	8.05	16.40	48.20	38.76	6.59	36.07	8.05	0.045
Percentage of population that is aged 65 years or older, most recent year available	12.39	6.78	1.14	27.05	14.54	6.34	12.39	6.78	0.076
Percentage of population that is aged 70 years or older, most recent year available	7.98	4.77	0.53	18.49	9.43	4.60	8.03	4.76	0.105
percentage of population living in extreme poverty, most recent year available since 2010	4.18	10.42	0.10	71.40	2.25	4.72	3.07	13.90	0.631
Cardiovascular death rate per 100,000 people in 2017	230.87	116.70	79.37	539.85	205.86	113.86	230.87	116.70	0.239
Diabetes prevalence (% of population) in 2017	7.85	3.66	2.42	17.72	7.65	3.55	7.85	3.66	0.766
Infants lacking DPT immunization (% of population) in 2018	5.65	7.57	1.00	35.00	4.94	6.62	5.65	7.57	0.579
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	19.27	10.73	1.29	46.17	22.67	10.30	19.27	10.73	0.082
TB prevalence per 100,000 people in 2017	65.78	108.12	0.81	567.00	61.97	124.88	65.78	108.12	0.862
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	99.89	590.23	0.00	5256.67	144.93	759.14	99.89	590.23	0.726
Net migration rate, most recent year available	1.71	5.49	-11.60	31.11	1.55	3.27	1.71	5.49	0.837
Alcohol consumed per person per year (litres) in 2016	7.67	4.36	0.20	15.00	8.69	4.02	7.67	4.36	0.186
Refugee population (total N) in 2018	185211.80	578598.70	5.00	3681688.00	189417.60	574052.80	185243.30	568544.60	0.968
Prevalence of adults who smoke every day in 2016	24.22	9.27	4.00	46.00	24.79	8.10	23.76	9.08	0.506

Percentage of population with high blood glucose in 2016	8.57	2.28	4.30	16.20	8.66	2.12	8.57	2.27	0.821
Percentage of population with high blood pressure in 2015	24.96	6.80	12.60	41.00	25.52	6.53	24.94	6.76	0.631
Prevalence of obesity in adults in 2016	21.04	9.16	2.10	37.30	21.89	9.18	20.94	9.14	0.574
GDP PPP per capita in 2018 USD	29463.87	22540.85	1163.28	112531.50	33479.38	18798.42	29463.87	22540.85	0.284
Hospital beds per 10,000 people, 2010-2015	37.71	27.02	1.00	134.00	43.06	27.27	37.31	26.82	0.251
Current health expenditure (% of GDP) in 2016	7.10	2.77	2.34	17.07	7.81	2.99	7.10	2.77	0.187
Labour force participation rate in 2018	61.41	9.20	39.30	86.90	60.30	6.74	61.41	9.20	0.436
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	4.34	12.01	0.10	70.70	1.72	4.31	4.34	12.01	0.083
GINI index	35.47	6.59	25.00	63.00	35.08	7.20	35.47	6.59	0.759
Perception of control of corruption in 2018	0.39	1.00	-1.44	2.21	0.66	0.97	0.39	1.00	0.139
Perception of government effectiveness in 2018	0.51	0.89	-1.61	2.22	0.84	0.78	0.51	0.89	0.033
Perception of regulatory quality in 2018	0.50	0.91	-1.62	2.13	0.79	0.82	0.50	0.91	0.074
Country policies and regulation on antimicrobial use in humans	0.96	0.19	0.00	1.00	0.98	0.14	0.96	0.19	0.494
National action plan on AMR in 2018	3.83	0.97	2.00	5.00	4.02	0.89	3.80	0.96	0.202
National surveillance system for AMR in humans	3.73	0.91	2.00	5.00	4.04	0.82	3.71	0.90	0.037
Income class as defined by the World Bank	3.24	0.92	1.00	4.00	3.50	0.74	3.24	0.92	0.084
Percentage of the population living in an urban environment in 2018	67.93	20.01	16.90	100.00	70.78	18.20	67.93	20.01	0.415
Average life expectancy at birth in 2019	76.54	6.01	54.69	84.63	78.47	4.68	76.54	6.01	0.048
Average years of schooling by country in 2018	10.17	2.72	2.35	14.13	10.97	2.09	10.17	2.72	0.067
Percentage of population using at least basic sanitation services, most recent year available	88.68	18.44	18.00	100.00	94.21	9.77	88.68	18.44	0.032
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	23.77	19.45	5.80	94.30	19.89	17.16	23.77	19.45	0.246
Population (total N) in 2018	58800000.00	16300000.00	341250.00	138000000.00	84100000.00	20400000.00	58800000.00	16300000.00	0.469
Average 12-monthly temperature in 2016	16.07	9.07	-4.97	29.29	15.34	9.21	16.07	9.07	0.662
human development index, most recent year available	0.80	0.12	0.43	0.95	0.84	0.09	0.80	0.12	0.028
Perception of rule of law in 2018	0.44	0.92	-1.20	2.07	0.73	0.87	0.44	0.92	0.088

	MEAN	SD	MIN	MAX					
Political stability and absence of violence/terrorism in 2018	0.09	0.91	-2.27	1.49	0.26	0.81	0.09	0.91	0.276
Perception of voice and accountability of the general public in 2018	0.25	0.97	-1.85	1.70	0.52	0.92	0.25	0.97	0.120
World region as defined by the World Health Organisation	3.34	1.34	1.00	6.00	3.58	1.27	3.34	1.34	0.304
National monitoring system for antibiotic use in humans	0.74	0.44	0.00	1.00	0.79	0.41	0.73	0.45	0.395

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.10: Descriptive statistics for the sample using vancomycin-resistant *Enterococcus faecium* levels as main dependent variable

Variable name/ descriptive statistics type	I. Descriptive statistics including missing data (N=37)				II. Descriptive statistics using our analytical sample, non-imputed data (N=33)		III. Descriptive statistics with fully imputed data for independent variables (N=37)		Mean test (Difference in means between II and III)
	MEAN	SD	MIN	MAX	MEAN	SD	MEAN	SD	
Glycopeptides consumption in DDDs	12.32	13.38	0.06	72.51	12.85	13.60	11.91	13.14	0.771
Antibiotic consumption in animals (mg/PCU)	61.56	39.69	8.47	181.79	60.19	41.66	61.56	39.69	0.889
Median age of the population, UN projection for 2020	41.94	3.34	31.60	47.90	42.08	3.42	41.94	3.34	0.863
Percentage of population that is aged 65 years or older, most recent year available	17.68	3.37	7.15	23.02	17.92	3.44	17.68	3.37	0.766
Percentage of population that is aged 70 years or older, most recent year available	11.79	2.59	4.72	16.24	11.99	2.65	11.79	2.55	0.745
percentage of population living in extreme poverty, most recent year available since 2010	0.87	1.13	0.10	5.70	0.70	0.56	0.57	2.47	0.774
Cardiovascular death rate per 100,000 people in 2017	209.50	112.03	86.06	443.13	195.96	103.99	209.50	112.03	0.604
Diabetes prevalence (% of population) in 2017	6.51	2.20	3.28	12.13	6.26	2.09	6.51	2.20	0.631

Infants lacking DPT immunization (% of population) in 2018	3.43	3.96	1.00	22.00	3.21	3.93	3.43	3.96	0.817
Dependency rate: Ratio of people aged 65 and above and people aged 15-64 years old in 2018	27.51	5.71	10.46	35.59	28.02	5.75	27.51	5.71	0.712
TB prevalence per 100,000 people in 2017	18.36	24.67	3.10	129.00	16.32	23.91	18.36	24.67	0.727
Average number of homeless people due to natural disaster per 1,000,000 people between 2008 and 2018	20.32	72.70	0.00	430.91	22.78	76.74	20.32	72.70	0.892
Net migration rate, most recent year available	1.61	4.66	-11.60	16.33	1.96	4.60	1.61	4.66	0.755
Alcohol consumed per person per year (litres) in 2016	10.84	2.44	2.00	15.00	10.91	2.44	10.84	2.44	0.908
Refugee population (total N) in 2018	185615.20	619782.30	319.00	3681688.00	207429.60	653915.70	185615.20	619782.30	0.887
Prevalence of adults who smoke every day in 2016	28.75	6.99	14.30	43.70	28.19	7.04	28.75	6.99	0.741
Percentage of population with high blood glucose in 2016	8.32	1.65	4.90	13.20	8.27	1.72	8.32	1.65	0.899
Percentage of population with high blood pressure in 2015	28.89	6.28	16.40	41.00	28.57	6.27	28.89	6.28	0.835
Prevalence of obesity in adults in 2016	24.85	5.18	2.10	37.30	25.04	5.39	24.85	5.18	0.881
GDP PPP per capita in 2018 USD	36799.53	17102.25	6608.62	93734.28	38590.71	17064.30	36799.53	17102.25	0.664
Hospital beds per 10,000 people, 2010-2015	50.22	20.22	25.00	110.00	48.97	18.06	50.22	20.22	0.787
Current health expenditure (% of GDP) in 2016	8.56	2.47	4.31	17.07	8.77	2.48	8.56	2.47	0.729
Labour force participation rate in 2018	59.27	5.64	46.80	77.40	59.57	5.41	59.27	5.64	0.822
Mortality rate (deaths per 100,000 people) attributable to unsafe WASH, most recent year available	0.24	0.27	0.10	1.60	0.24	0.28	0.24	0.27	0.981
GINI index	32.32	4.26	25.40	41.90	32.35	4.29	32.32	4.26	0.977
Perception of control of corruption in 2018	0.85	0.95	-0.85	2.21	0.96	0.93	0.85	0.95	0.623
Perception of government effectiveness in 2018	0.96	0.73	-0.64	2.05	1.08	0.65	0.96	0.73	0.473
Perception of regulatory quality in 2018	0.99	0.74	-0.80	2.02	1.10	0.68	0.99	0.74	0.524
Country policies and regulation on antimicrobial use in humans	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.01	0.325
National action plan on AMR in 2018	3.64	1.02	2.00	5.00	3.73	1.01	3.61	1.02	0.643
National surveillance system for AMR in humans	3.97	0.84	2.00	5.00	4.03	0.85	3.95	0.85	0.690
Income class as defined by the World Bank	3.78	0.48	2.00	4.00	3.82	0.46	3.78	0.48	0.763
Percentage of the population living in an urban environment in 2018	71.83	13.59	35.90	98.00	73.03	13.29	71.83	13.59	0.711
Average life expectancy at birth in 2019	79.68	3.05	72.58	83.78	79.96	3.01	79.68	3.05	0.695

Average years of schooling by country in 2018	11.83	1.44	7.67	14.13	11.90	1.47	11.83	1.44	0.847
Percentage of population using at least basic sanitation services, most recent year available	96.78	4.42	84.00	100.00	97.12	4.06	96.78	4.42	0.741
Annual mean concentration of particulate matter of less than 2.5 microns of diameter (ug/m3) in urban areas in 2016	14.28	7.34	5.90	42.00	13.70	7.37	14.28	7.34	0.741
Population (total N) in 2018	33600000.00	60600000.00	625976.00	331000000.00	36700000.00	63500000.00	33600000.00	60600000.00	0.836
Average 12-monthly temperature in 2016	10.12	6.41	-4.97	29.04	9.84	6.53	10.12	6.41	0.860
human development index, most recent year available	0.87	0.06	0.69	0.95	0.88	0.06	0.87	0.06	0.610
Perception of rule of law in 2018	0.92	0.83	-0.88	2.07	1.03	0.78	0.92	0.83	0.574
Political stability and absence of violence/terrorism in 2018	0.53	0.55	-1.32	1.36	0.57	0.55	0.53	0.55	0.712
Perception of voice and accountability of the general public in 2018	0.79	0.84	-1.48	1.70	0.89	0.77	0.79	0.84	0.611
World region as defined by the World Health Organisation	3.14	0.54	3.00	6.00	3.15	0.57	3.14	0.54	0.902
National monitoring system for antibiotic use in humans	0.92	0.28	0.00	1.00	0.91	0.29	0.89	0.31	0.814

Notes: SD= Standard deviation. WHO= World Health Organization, DDD= Defined Daily Dose. TB= Tuberculosis. DPT= Dipropyltryptamine. UN= United Nations. Red cells in last column indicates statistically significant differences between imputed and non-imputed samples.

Table S13.11: List of countries included in final analyses, by dependent variable

WHO critical-priority pathogens (N=60)	WHO high-priority pathogens (N= 56)	WHO medium-priority pathogens (N= 40)	Carbapenem-resistant *Acinetobacter baumanii* (N= 50)	Carbapenem-resistant *Pseudomonas aeruginosa* (N= 35)	3rd generation cephalosporins-resistant *Escherichia coli* (N= 57)	3rd generation cephalosporins-resistant *Klebsiella pneumoniae* (N= 59)	Oxacillin-resistant *Staphylococcus aureus* (N= 48)	Vancomycin-resistant *Enterococcus faecium* (N= 33)	Animal AMR (N= 63)
Argentina	Argentina	Argentina	Argentina	Australia	Argentina	Argentina	Argentina	Austria	Argentina
Australia	Australia	Austria	Australia	Austria	Australia	Australia	Australia	Belgium	Australia
Austria	Austria	Belgium	Austria	Belgium	Austria	Austria	Austria	Bulgaria	Austria
Bangladesh	Belgium	Bosnia and Herzegovina	Belgium	Bulgaria	Bangladesh	Bangladesh	Belgium	Canada	Bangladesh
Belgium	Brazil	Bulgaria	Brazil	Canada	Belgium	Belgium	Brazil	Croatia	Belgium
Bosnia and Herzegovina	Bulgaria	Canada	Bulgaria	Croatia	Brazil	Brazil	Bulgaria	Czech Republic	Brazil
Brazil	Canada	Croatia	Croatia	Czech Republic	Bulgaria	Bulgaria	Canada	Denmark	Bulgaria
Bulgaria	Colombia	Czech Republic	Czech Republic	Denmark	Canada	Canada	Colombia	Estonia	Canada
Canada	Croatia	Denmark	Denmark	Estonia	Croatia	Colombia	Croatia	Finland	Chile
Colombia	Czech Republic	Estonia	Egypt	Finland	Czech Republic	Croatia	Czech Republic	France	China
Croatia	Denmark	Finland	Finland	France	Denmark	Czech Republic	Denmark	Germany	Colombia
Czech Republic	Egypt	France	France	Germany	Egypt	Denmark	Egypt	Greece	Croatia
Denmark	Estonia	Germany	Germany	Greece	Estonia	Egypt	Finland	Hungary	Czech Republic
Egypt	Finland	Hungary	Greece	Hungary	Finland	Estonia	France	Ireland	Denmark
Estonia	France	Ireland	Hungary	Ireland	France	Finland	Germany	Italy	Dominican Republic
Finland	Germany	Italy	India	Italy	Germany	France	Greece	Latvia	Ecuador
France	Greece	Japan	Indonesia	Latvia	Greece	Germany	Hungary	Lithuania	Egypt
Germany	Hungary	Latvia	Ireland	Lithuania	Hungary	Greece	India	Luxembourg	Estonia

Greece	India	Lithuania	Italy	Luxembourg	India	Hungary	Indonesia	Netherlands	Finland
Hungary	Indonesia	Luxembourg	Japan	Netherlands	Indonesia	India	Ireland	Norway	France
India	Ireland	Malaysia	Jordan	Norway	Ireland	Indonesia	Italy	Poland	Germany
Indonesia	Italy	Netherlands	Latvia	Poland	Italy	Ireland	Japan	Portugal	Greece
Ireland	Japan	Norway	Lebanon	Portugal	Japan	Italy	Lithuania	Russia	Hungary
Italy	Jordan	Philippines	Lithuania	Romania	Jordan	Japan	Malaysia	Serbia	India
Japan	Latvia	Poland	Malaysia	Russia	Latvia	Jordan	Netherlands	Slovakia	Indonesia
Jordan	Lithuania	Portugal	Netherlands	Serbia	Lebanon	Latvia	Norway	Slovenia	Ireland
Latvia	Luxembourg	Romania	Pakistan	Slovakia	Lithuania	Lebanon	Pakistan	Spain	Italy
Lebanon	Malaysia	Serbia	Philippines	Slovenia	Luxembourg	Lithuania	Philippines	Sweden	Japan
Lithuania	Netherlands	Slovakia	Poland	Spain	Malaysia	Luxembourg	Poland	Switzerland	Jordan
Luxembourg	Norway	Slovenia	Portugal	Sweden	Netherlands	Malaysia	Portugal	Turkey	Kazakhstan
Malaysia	Pakistan	South Korea	Romania	Switzerland	New Zealand	Netherlands	Russia	United Kingdom	Latvia
Netherlands	Peru	Spain	Russia	Turkey	Norway	New Zealand	Saudi Arabia	United States	Lebanon
New Zealand	Philippines	Sweden	Saudi Arabia	United Kingdom	Pakistan	Norway	Serbia	Vietnam	Lithuania
Norway	Poland	Switzerland	Serbia	United States	Philippines	Pakistan	Singapore		Luxembourg
Pakistan	Portugal	Thailand	Slovakia	Vietnam	Poland	Peru	Slovakia		Malaysia
Peru	Romania	Tunisia	Slovenia		Portugal	Philippines	Slovenia		Mexico
Philippines	Russia	Turkey	South Africa		Romania	Poland	South Africa		Morocco
Poland	Saudi Arabia	United Arab Emirates	South Korea		Russia	Portugal	South Korea		Netherlands
Portugal	Serbia	United Kingdom	Spain		Saudi Arabia	Romania	Spain		Norway
Romania	Singapore	Vietnam	Sri Lanka		Serbia	Russia	Sri Lanka		Pakistan
Russia	Slovakia		Sweden		Singapore	Saudi Arabia	Sweden		Peru
Saudi Arabia	Slovenia		Switzerland		Slovakia	Serbia	Switzerland		Philippines

Serbia	South Africa	Thailand	Slovenia	Singapore	Thailand	Poland
Singapore	South Korea	Tunisia	South Africa	Slovakia	Turkey	Portugal
Slovakia	Spain	Turkey	South Korea	Slovenia	United Arab Emirates	Romania
Slovenia	Sri Lanka	Ukraine	Spain	South Africa	United Kingdom	Russia
South Africa	Sweden	United Arab Emirates	Sri Lanka	South Korea	United States	Saudi Arabia
South Korea	Switzerland	United Kingdom	Sweden	Spain	Vietnam	Slovakia
Spain	Thailand	United States	Switzerland	Sri Lanka		Slovenia
Sri Lanka	Tunisia	Vietnam	Thailand	Sweden		South Africa
Sweden	Turkey		Tunisia	Switzerland		South Korea
Switzerland	Ukraine		Turkey	Thailand		Spain
Thailand	United Arab Emirates		Ukraine	Tunisia		Sri Lanka
Tunisia	United Kingdom		United Arab Emirates	Turkey		Sweden
Turkey	United States		United Kingdom	Ukraine		Switzerland
Ukraine	Vietnam		United States	United Arab Emirates		Thailand
United Arab Emirates			Vietnam	United Kingdom		Tunisia
United Kingdom				United States		Turkey
United States				Vietnam		United Arab Emirates
Vietnam						United Kingdom
						United States
						Venezuela
						Vietnam

Table S14: Beta regression univariate relation between AMR levels and their respective antibiotic-consumption variables, by model

A. WHO critical human pathogen AMR (N=60)	**OR**	**95% CI**	**p-value**
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.56	1.31, 1.81	<0.001
B. WHO high priority human pathogen AMR (N=56)	**OR**	**95% CI**	**p-value**
Consumption of oxacillin and glycopeptides in DDD	1.01	0.97, 1.05	0.630
C. WHO medium priority human pathogen AMR (N=40)	**OR**	**95% CI**	**p-value**
Consumption of penicillins in DDD (scale x1000)	0.97	0.94, 1.01	0.147
D. AMR in food-producing animals (N= 63)	**OR**	**95% CI**	**p-value**
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.27	1.10, 1.45	0.003
E. Carbapenem-resistant *Acinetobacter baumanii* (N=50)	**OR**	**95% CI**	**p-value**
Consumption of carbapenems in DDD (scale x1000)	0.99	0.97, 1.01	0.516
F. Carbapenem-resistant *Pseudomonas aeruginosa* (N=35)	**OR**	**95% CI**	**p-value**
Consumption of carbapenems in DDD (scale x1000)	0.99	0.98, 1.01	0.503
G. 3rd generation cephalosporins-resistant *Escherichia coli* (N=57)	**OR**	**95% CI**	**p-value**
Consumption of 3rd generation cephalosporins in DDD (scale x1000)	1.29	1.12, 1.47	0.001
H. 3rd generation cephalosporins-resistant *Klebsiella pneumoniae* (N=59)	**OR**	**95% CI**	**p-value**
Consumption of 3rd generation cephalosporins in DDD (scale x1000)	1.27	1.08, 1.46	0.004
I. Oxacillin-resistant *Staphylococcus aureus* (N=48)	**OR**	**95% CI**	**p-value**
Consumption of oxacillin in DDD	1.07	1.02, 1.12	0.004
J. Vancomycin-resistant *Enterococcus faecium* (N=33)	**OR**	**95% CI**	**p-value**
Consumption of glycopeptides in DDD	1.02	1.00, 1.04	0.040

Notes: Only independent variables were imputed. All imputations were constrained to take values >0. SD= Standard Deviation. WHO= World Health Organization. DDD= Defined Daily Doses per 1000 individuals. All models included a constant term.

Figure S15: Global consumption data for antibiotics deemed by the WHO to be of critical importance to human health (2000-2015)
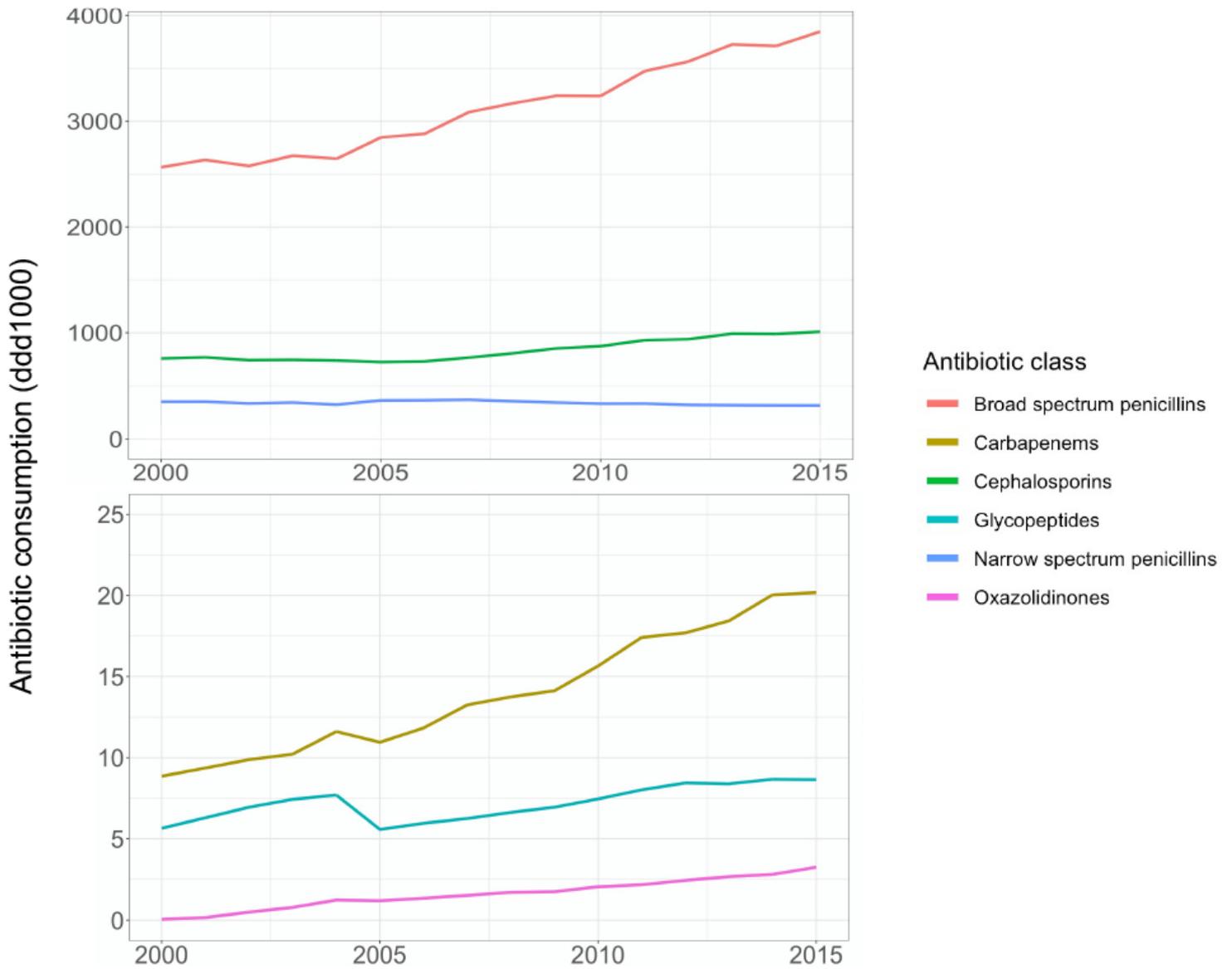
Notes: antibiotic consumption across all countries (n=190) from the years 2000-2015. The chosen antibiotics correspond to the pathogen/antibiotic pairings described as of critical, high, and medium importance to human health by the WHO.

Figure S16: AMR rates in pathogen/antibiotic combinations deemed by the WHO to be of critical, high and medium importance to human health (1998-2017)
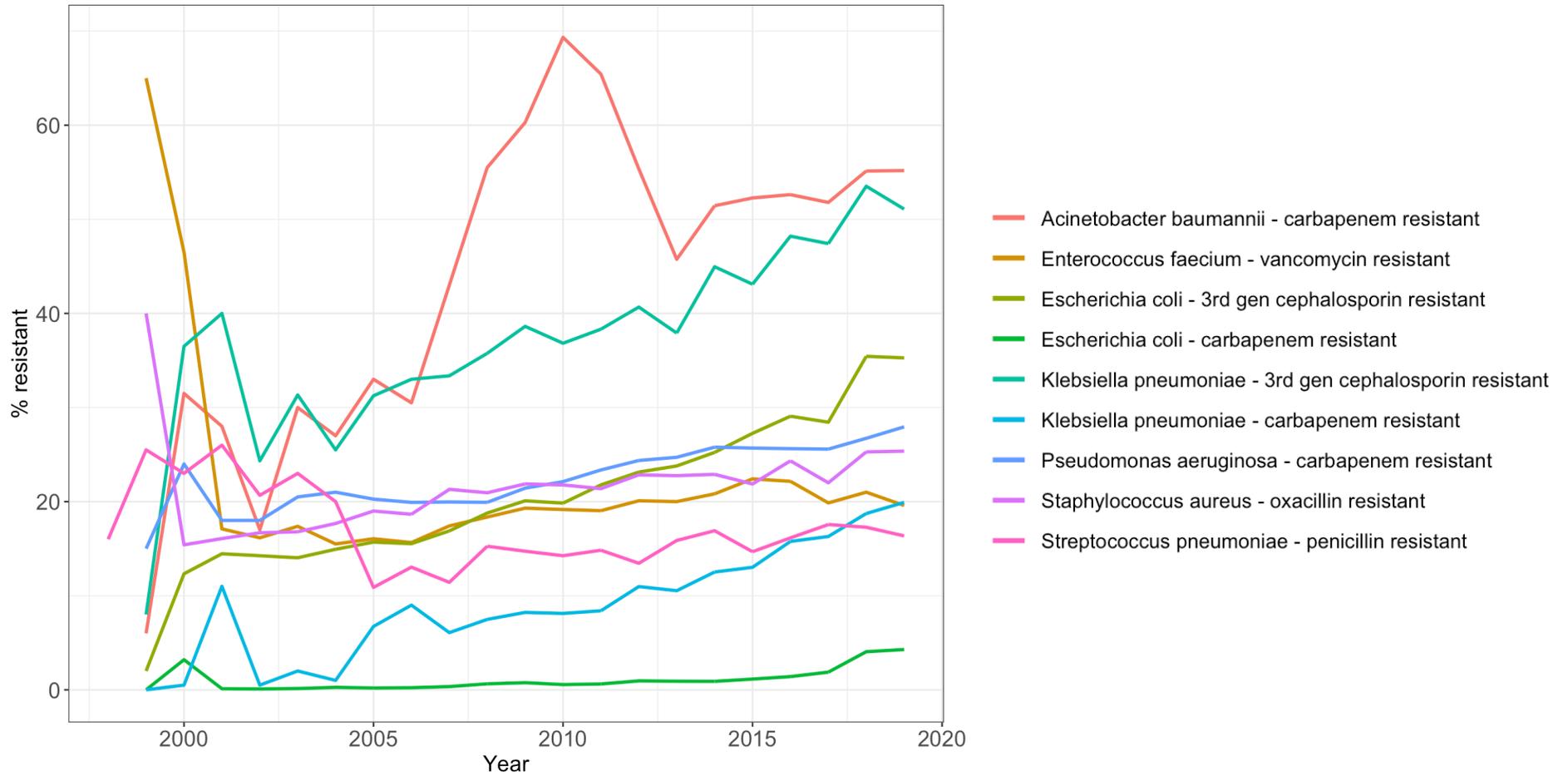
Notes: % resistant stands for specific resistant strains detailed to the right of the figure.

Figure S17: Crude relationship between AMR levels (proportions) and GDP per capita, by dependent variable used and differentiating by high and low-and-middle income countries

(A) WHO's critical-priority pathogens *(blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
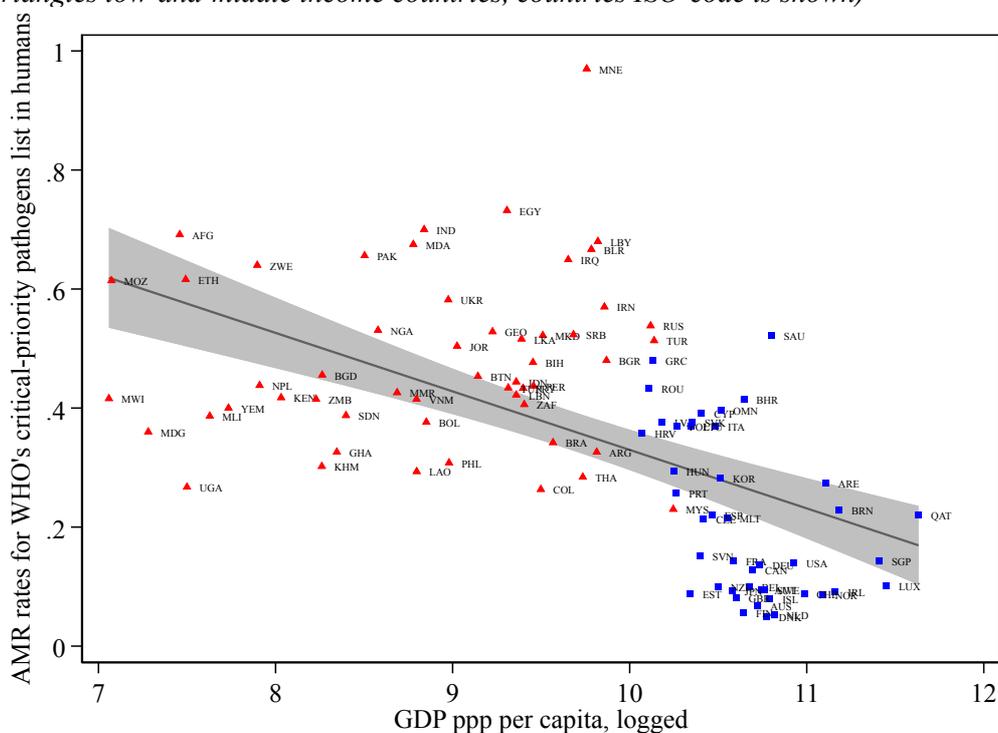
(B) WHO's high-priority pathogens *(blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
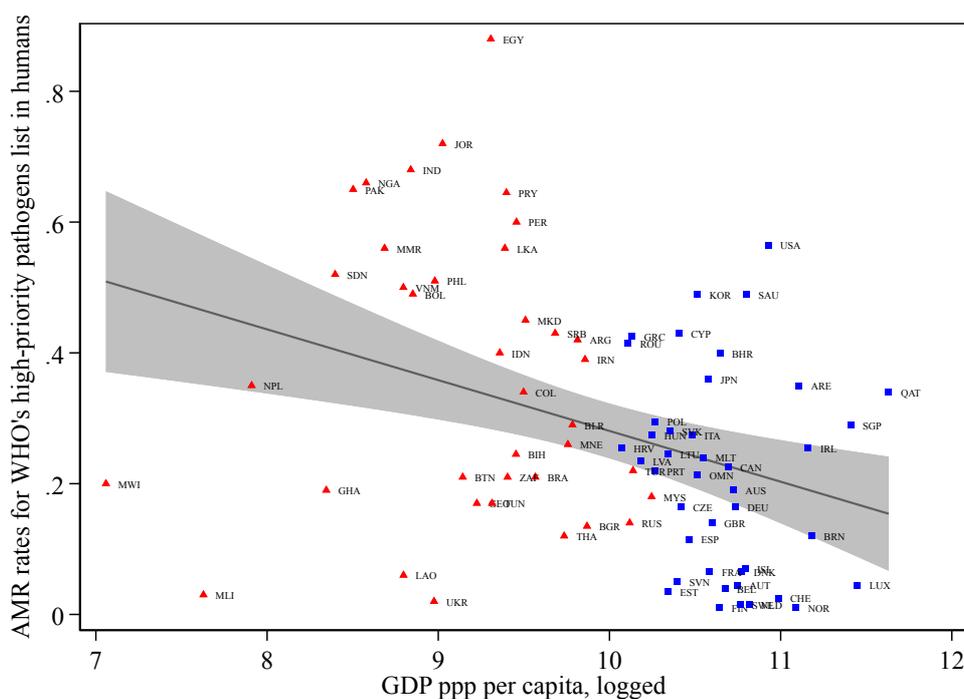
*(C)* WHO's medium-priority pathogens *(blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
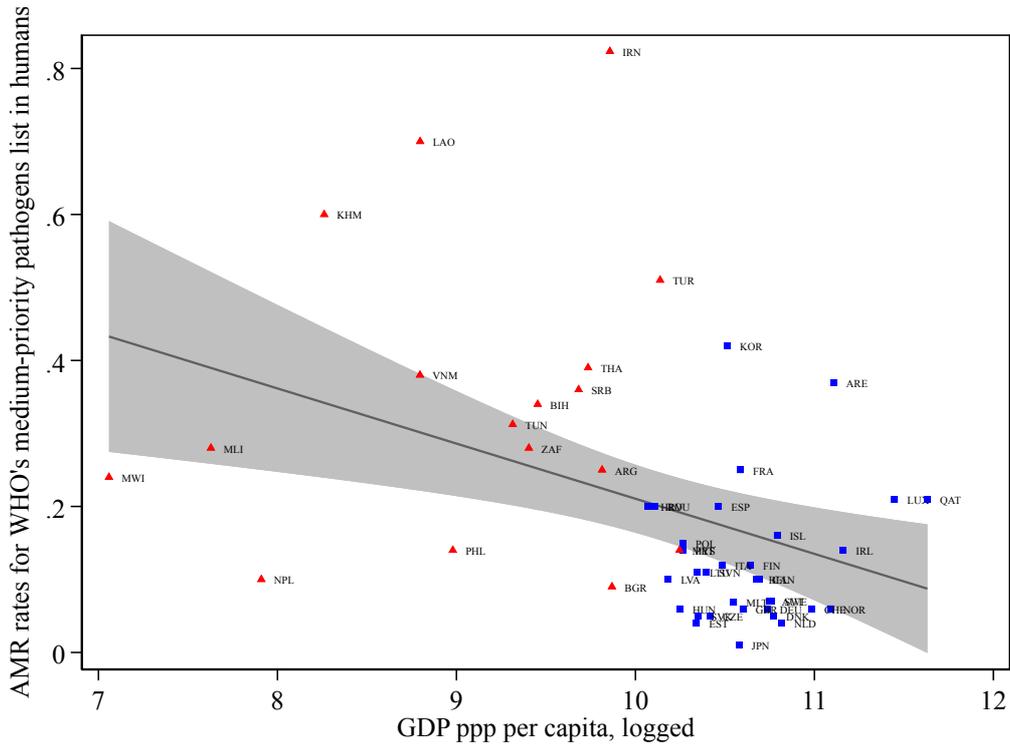
(D) WHO's medium-priority pathogens *(blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
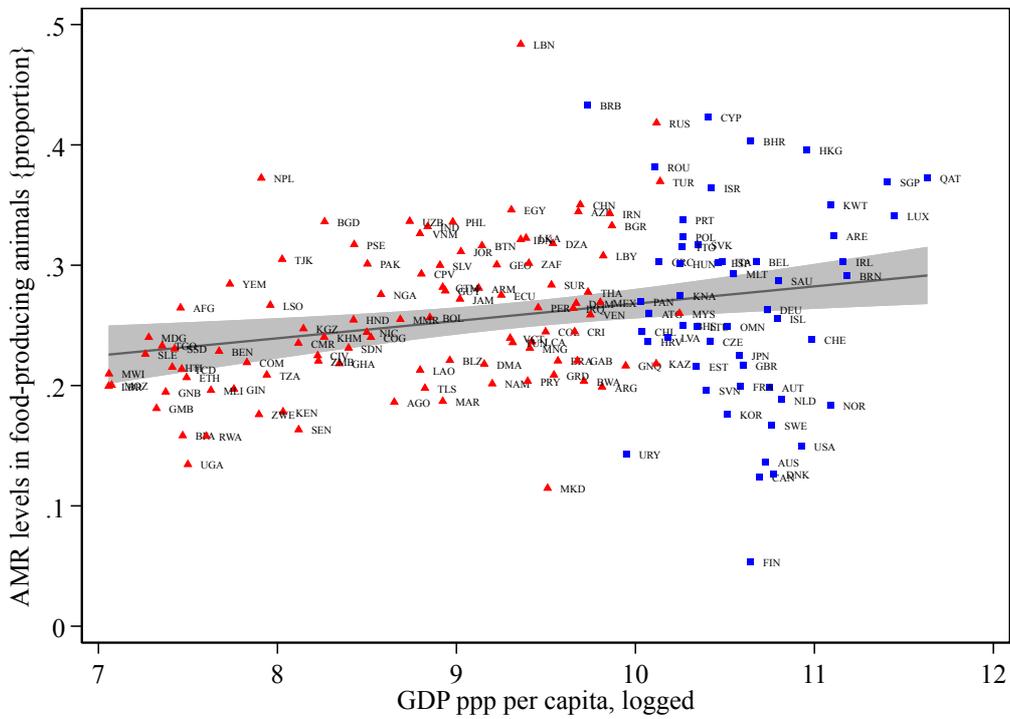
(E) Carbapenem-resistant *Acinetobacter baumanii (blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
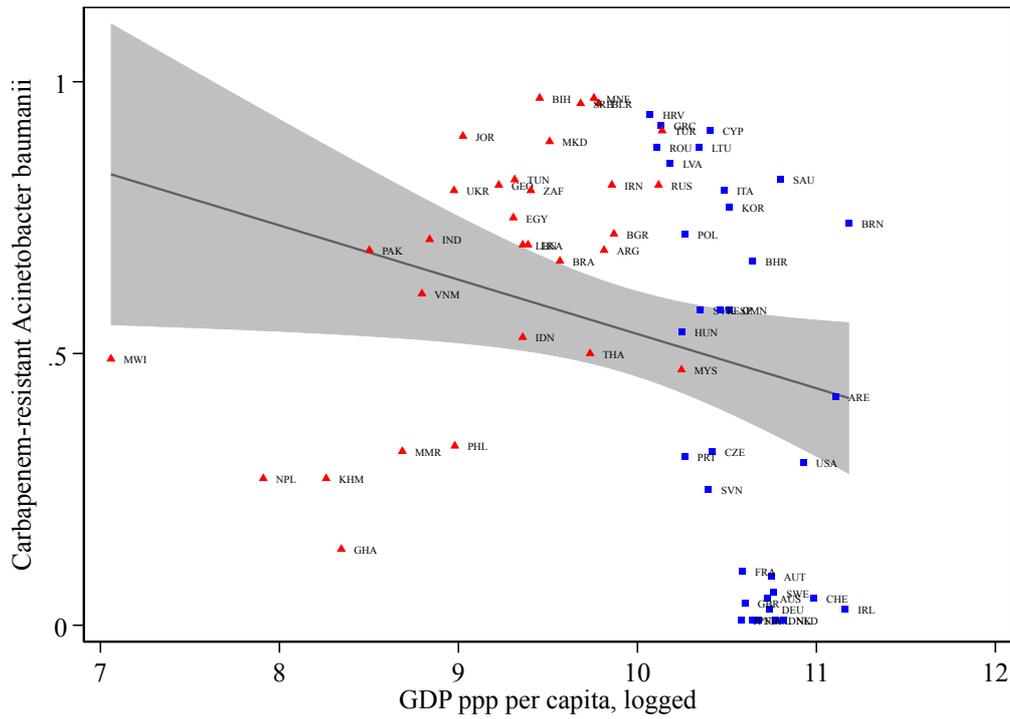
(F) Carbapenem-resistant *Pseudomonas aeruginosa (blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
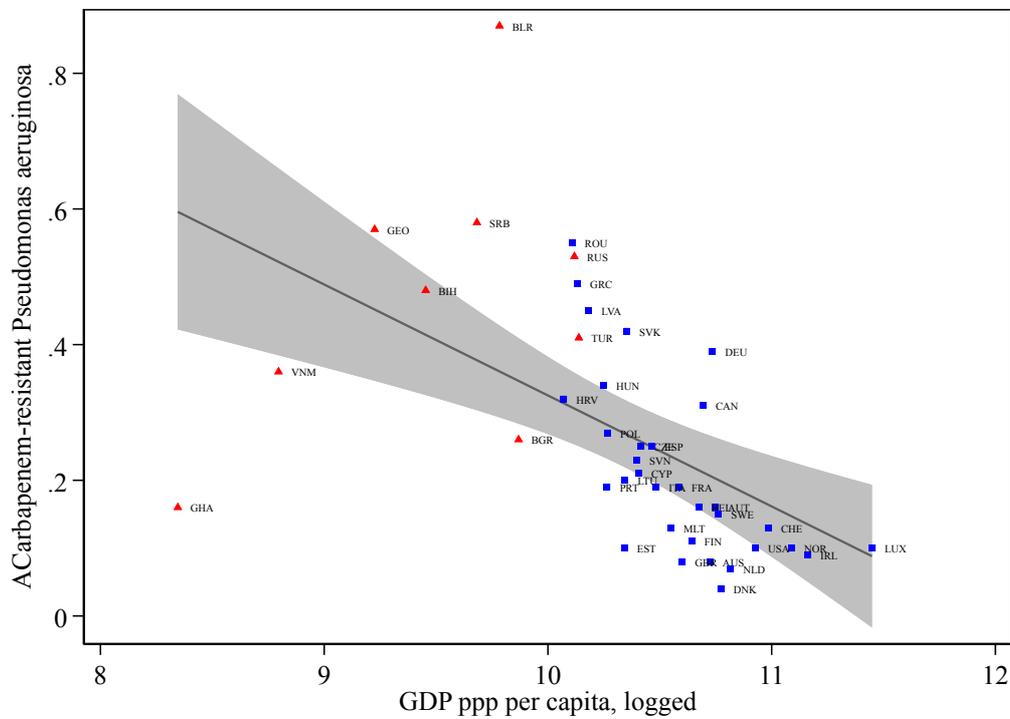
(G) 3rd generation cephalosporins *Escherichia coli (blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
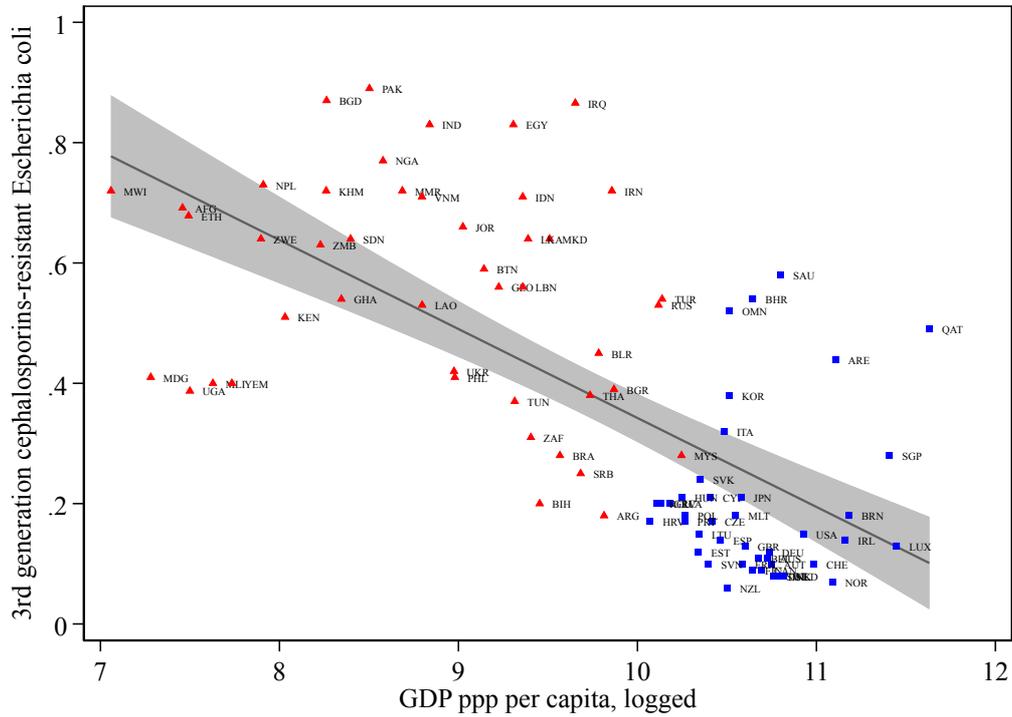
(H) 3rd generation cephalosporins *Klebsiella pneumoniae (blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
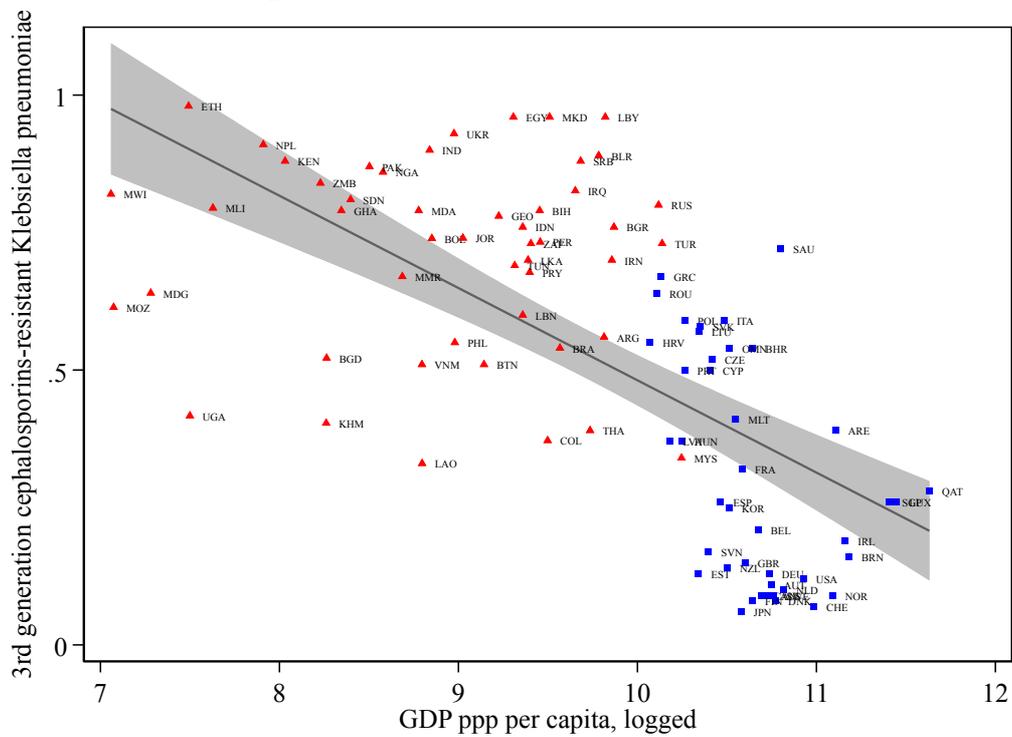
(I) Oxacillin-resistant *Staphylococcus aureus (blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
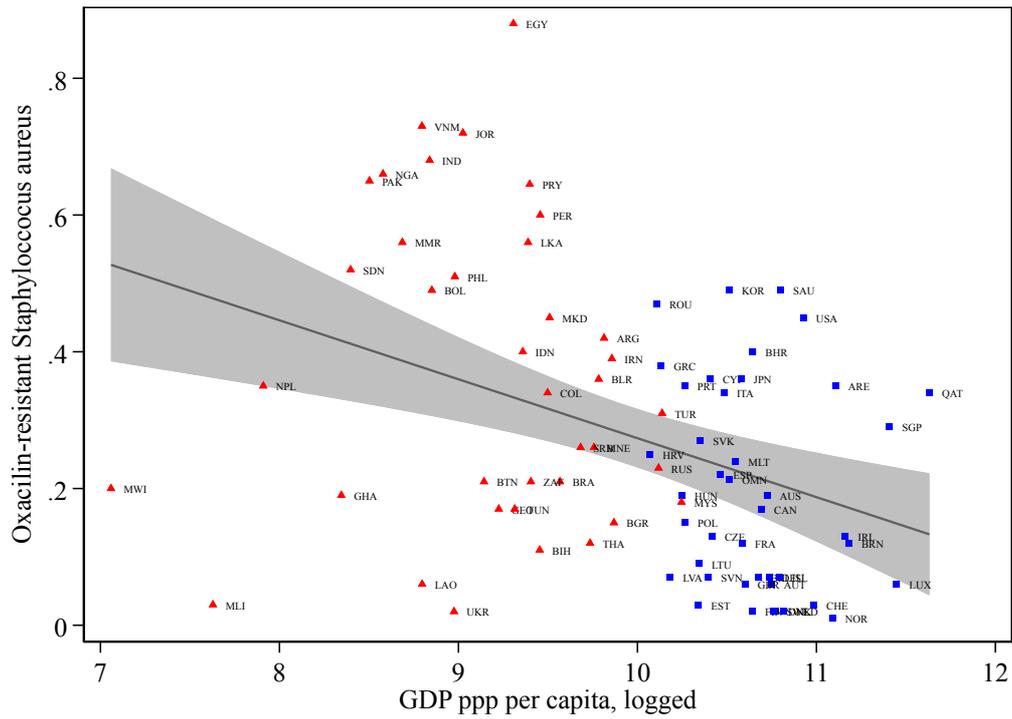
(J) Vancomycin-resistant *Enterococcus faecium (blue squares indicates high-income countries and red triangles low-and-middle income countries, countries ISO-code is shown)*
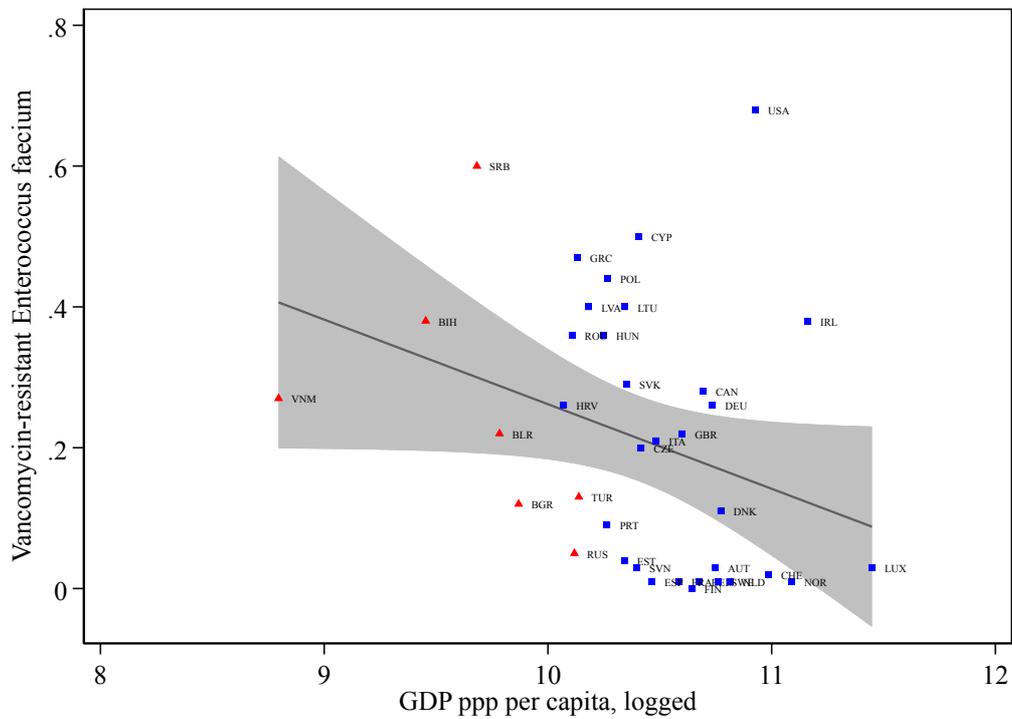
Notes: 95%CI linear fit was employed, presented by the shadowed area.

Figure S18: Marginal effects for GDP and PM2.5 on AMR levels among critical-priority pathogens in humans

(A) GDP ppp per capita (in USD)
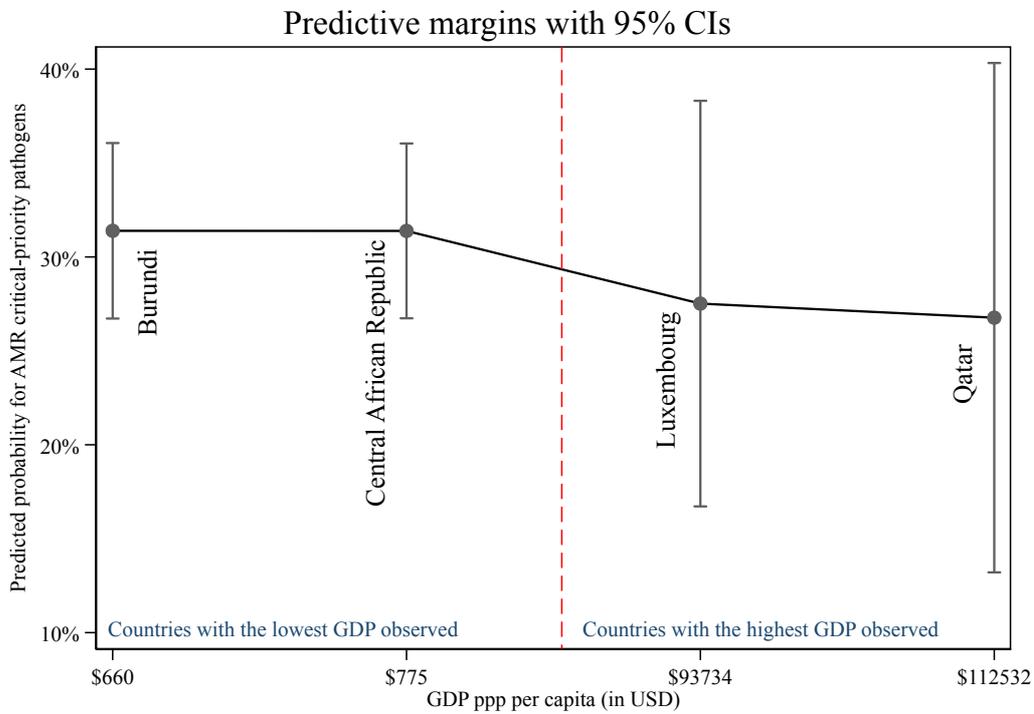
(B) PM2.5
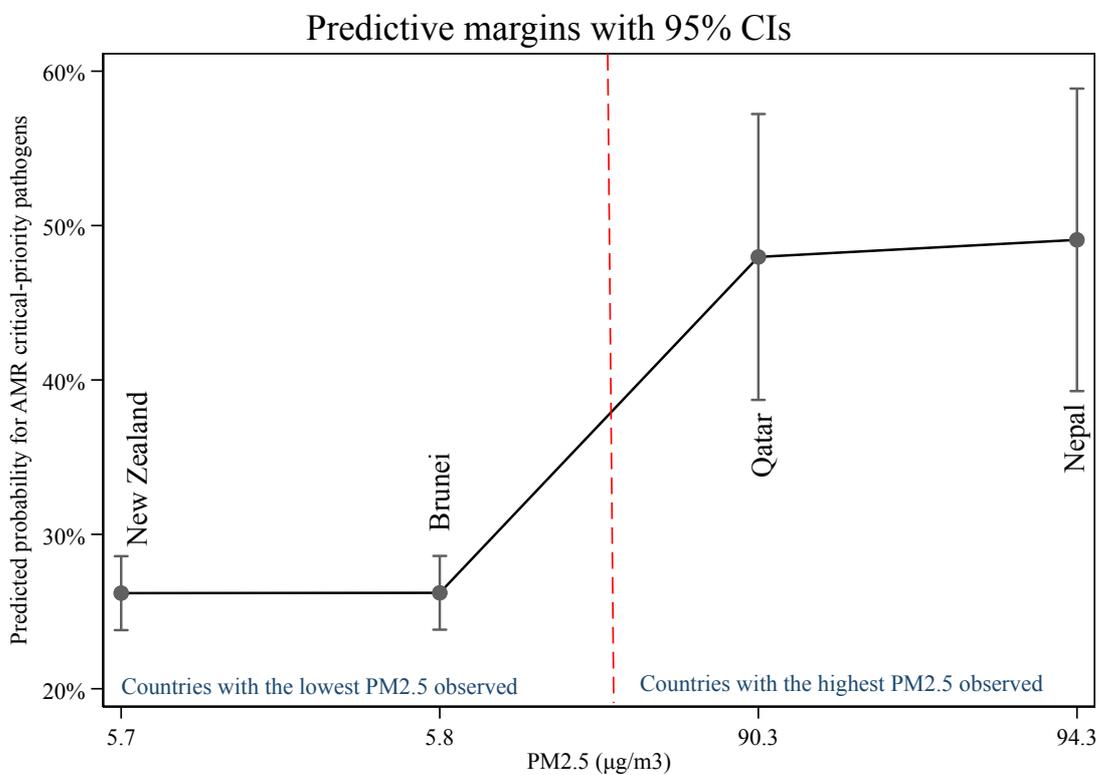
Table S19: Leave-out-out cross-validation output for the four final multivariable models

Method	Critical human pathogen model	High priority human pathogen model	Medium priority human pathogen model	Animal model
Root Mean Squared Errors	0.076	0.143	0.092	0.071
Mean Absolute Errors	0.055	0.113	0.069	0.053
Pseudo-R2	0.828	0.532	0.521	0.531

Method	Carbapenem-resistant *Acinetobacter baumanii*	Carbapenem-resistant *Pseudomonas aeruginosa*	3rd generation cephalosporins-resistant *Escherichia coli*	3rd generation cephalosporins-resistant *Klebsiella pneumoniae*
Root Mean Squared Errors	0.150	0.101	0.139	0.147
Mean Absolute Errors	0.109	0.074	0.080	0.120
Pseudo-R2	0.797	0.611	0.678	0.710

Method	Oxacillin-resistant *Staphylococcus aureus*	Vancomycin-resistant *Enterococcus faecium*
Root Mean Squared Errors	0.124	0.164
Mean Absolute Errors	0.092	0.134
Pseudo-R2	0.672	0.467

Table S20: Multivariable beta regression model results for the association between AMR in different food-producing animal species and associated risk factors

A. AMR in pigs (N=53)	OR	95% CI	p-value
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.20	1.06, 1.34	0.005
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.09	0.98, 1.21	0.098
GDP (ppp) (scale x10,000)	1.08	1.01, 1.15	0.025
Average temperature (°C)	1.02	0.99, 1.04	0.071
Current health expenditure (% of GDP)	1.04	0.99, 1.09	0.091
Rule of law	0.72	0.57, 0.91	0.006
Pig density (scale x100)	0.79	0.62, 0.96	0.016
Country policies and regulation on antimicrobial use for growth promotion in animals	1.11	0.89, 1.38	0.359
Arable land (% of land area) (scale x10)	1.07	1.01, 1.14	0.034
GINI index (scale x10)	1.03	0.89, 1.17	0.679
Constant term	0.13	0.06, 0.24	<0.001
B. AMR in chicken (N=49)	**OR**	**95% CI**	**p-value**
Antibiotic consumption in animals (mg/PCU) (scale x100)	0.99	0.82, 1.17	0.927
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.03	0.84, 1.21	0.766
GDP (ppp) (scale x10,000)	1.02	0.92, 1.12	0.631
Average temperature (°C)	0.99	0.97, 1.00	0.151
Current health expenditure (% of GDP)	0.94	0.89, 0.99	0.018
Rule of law	0.79	0.63, 0.98	0.035
Chicken density (scale x100)	1.03	1.01, 1.05	0.002
Country policies and regulation on antimicrobial use for growth promotion in animals	0.81	0.65, 1.01	0.062
Arable land (% of land area) (scale x10)	1.03	0.97, 1.08	0.389
GINI index (scale x10)	1.14	0.99, 1.3	0.068
Constant term	0.26	0.10, 0.68	0.006
C. AMR in cattle (N=60)	**OR**	**95% CI**	**p-value**
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.07	0.91, 1.24	0.379
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	0.94	0.69, 1.19	0.630
GDP (ppp) (scale x10,000)	1.05	0.97, 1.14	0.212
Average temperature (°C)	0.99	0.98, 1.01	0.491
Current health expenditure (% of GDP)	0.95	0.90, 0.99	0.064
Rule of law	0.87	0.68, 1.10	0.245
Cattle density (scale x100)	0.98	0.63, 1.34	0.925
Country policies and regulation on antimicrobial use for growth promotion in animals	0.83	0.65, 1.06	0.141
Arable land (% of land area) (scale x10)	1.08	0.96, 1.21	0.197
GINI index (scale x10)	0.97	0.80, 1.13	0.689
Constant term	0.50	0.16, 1.55	0.228

Notes: Adjusted for all other variables in the table. P-value derived from the Wald test. Coefficients have been scaled to allow all odds ratios to be rounded to two decimal places. Robust standard errors were used. mg/PCU = milligram per population correction units; PM = Particular Matter. * p<0·05.

The estimates of the effects of our independent variables on AMR rates in food-producing animals varied by animal species. Notably, antibiotic consumption was significantly associated with AMR in pigs, but not in chickens or cattle.

Table S21: Multivariable beta regression model results for the association between AMR in animals and associated risk factors, using antibiotic consumption data obtained from Tiseo *et al* 2020

A. AMR in animals: consumption data from TISEO et al 2020 (N=35)	OR	95% CI	p-value
Antibiotic consumption in animals (total sales in Kg) (scale x10,000,000)	1.60	1.38, 1.86	<0.001
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	0.78	0.30, 1.26	0.367
GDP (ppp) (scale x10,000)	1.07	0.95, 1.19	0.267
Average temperature (°C)	1.04	0.98, 1.10	0.183
Current health expenditure (% of GDP)	0.95	0.88, 1.02	0.162
Rule of law	0.56	0.31, 1.01	0.054
Cattle density (scale x100)	1.27	0.64, 1.91	0.405
Country policies and regulation on antimicrobial use for growth promotion in animals	1.00	0.99, 1.01	0.130
Arable land (% of land area) (scale x10)	1.04	0.95, 1.12	0.404
GINI index (scale x10)	1.13	0.90, 1.38	0.269
Constant term	0.24	0.13, 0.44	<0.001

Notes: Adjusted for all other variables in the table. P-value derived from the Wald test. Coefficients have been scaled to allow all odds ratios to be rounded to two decimal places. Model A includes data on antibiotic consumption in animals from Tiseo et al 2020.[33] Model B contains antibiotic consumption data from resistancebank for 2013[4,15], restricted to the same countries with data available in Tiseo et al 2020. Robust standard errors were used. mg/PCU = milligram per population correction units; PM = Particular Matter. * p<0·05.

Tiseo et al 2020[33] contains the most recent data available for antimicrobial consumption in animals. The sample is restricted to countries (mostly high-income) that have reported original sales of antimicrobials for use in animals (total sales in Kg). In contrast, the resistancebank[4] dataset is for 2013 only and relies on imputations of estimated antibiotic consumption in animals in mg/PCU, spanning low-income to high-income countries. The two datasets are highly correlated (r = 0.70, p < 0.001). We chose to use the Resistancebank dataset as our main source of consumption data as we believe it provides a more comprehensive view of global antibiotic consumption in animals and is more appropriate for our global ecological analysis of the One-Health drivers of AMR.

We reran our final animal model including the Tiseo consumption dataset and compared this with our final model using the Resistancebank dataset restricted to include only the countries available in the Tiseo dataset. Antibiotic consumption was significantly associated with rates of AMR in animals in either model. Hence, we can generalise these results on a global scale even when Tiseo *et al* only included high-income countries.

List of countries included in TISEO et al. 2020

Australia	Germany	Norway	Croatia	Japan	Sweden
Austria	Greece	Poland	Cyprus	Latvia	Switzerland
Belgium	Hungary	Portugal	Czech Republic	Lithuania	Thailand
Bulgaria	Iceland	Romania	Denmark	Luxembourg	United Kingdom
Canada	Iran	Slovakia	Estonia	Malta	United States
Chile	Ireland	Slovenia	Finland	Netherlands	
China	Italy	Spain	France	New Zealand	

Table S22: Multivariable beta regression model results for the association between AMR in human pathogens and associated risk factors, and AMR in animals and associated risk factors. Models contain imputed data.

A. WHO critical human pathogen AMR (N=98)	OR	95% CI	p-value
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.19	1.06, 1.32	0.004
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.32	1.07, 1.56	0.011
GDP (ppp) (scale x10,000)	0.95	0.91, 0.98	0.005
Control of corruption	0.89	0.79, 1.01	0.075
Cardiovascular death rate per 100,000 people (scale x100)	1.17	1.10, 1.23	<0.001
Current health expenditure (% of GDP)	0.99	0.96, 1.01	0.247
GINI index	1.01	0.99, 1.02	0.004
PM 2·5 (scale x10)	1.05	1.01, 1.08	0.005
National monitoring systems for sales, prescription and consumption of antibiotics in humans	1.10	0.90, 1.33	0.345
Constant term	0.22	0.11, 0.45	<0.001
B. WHO high priority human pathogen AMR (N=80)	**OR**	**95% CI**	**p-value**
Consumption of oxacillin and glycopeptides in DDD	1.03	1.01, 1.05	0.002
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.25	0.89, 1.62	0.178
GDP (ppp) (scale x10,000)	0.92	0.84, 0.99	0.030
Median age of population	0.99	0.97, 1.02	0.571
Average temperature (°C)	1.03	1.01, 1.05	0.006
Voice and accountability	0.79	0.68, 0.92	0.003
NetMigrationRateM	0.99	0.97, 1.01	0.176
dume	0.94	0.68, 1.3	0.702
Population density (scale x10,000)	1.45	0.81, 2.1	0.169
Constant term	0.22	0.06, 0.84	0.026
C. WHO medium priority human pathogen AMR (N=50)	**OR**	**95% CI**	**p-value**
Consumption of penicillins in DDD (scale x1000)	0.83	0.58, 1.08	0.194
Antibiotic consumption in animals (mg/PCU) (scale x100)	0.98	0.33, 1.65	0.961
GDP (ppp) (scale x10,000)	1.08	0.95, 1.21	0.236
PM 2·5 (scale x10)	0.92	0.77, 1.07	0.308
Regulatory quality	0.31	0.21, 0.46	<0.001
Mortality rate attributable to unsafe WASH (per 100,000 people)	0.99	0.99, 1.00	0.218
Constant term	0.34	0.18, 0.66	<0.001
D. AMR in food-producing animals (N= 164)	**OR**	**95% CI**	**p-value**
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.15	1.02, 1.28	0.028
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.21	1.09, 1.33	<0.001
GDP (ppp) (scale x10,000)	1.12	1.09, 1.15	<0.001
Average temperature (°C)	1.00	0.99, 1.01	0.501
Current health expenditure (% of GDP)	1.00	0.98, 1.02	0.998
Rule of law	1.04	0.96, 1.12	0.361
Cattle density (scale x100)	0.90	0.70, 1.11	0.347
Country policies and regulation on antimicrobial use for growth promotion in animals	1.08	0.97, 1.19	0.159
Arable land (% of land area) (scale x10)	1.03	0.99, 1.07	0.209

GINI index (scale x10)	0.97	0.90, 1.03	0.310
Constant term	0.22	0.16, 0.31	<0.001

Notes: Adjusted for all other variables in the table. P-value derived from the Wald test. Coefficients have been scaled to allow all odds ratios to be rounded to two decimal places. There were marginally fewer observations in the final models than the number of original observations for each dependent variable since some reference variables used during the multiple imputation process had a small number of missing observations. Robust standard errors were used. DDD= Defined Daily Doses per 1000 individuals; mg/PCU = milligram per population correction units; GDP= Gross Domestic Product; ppp = purchasing power parity; PM = Particular Matter; TB = Tuberculosis. * p<0·05.

Table S23: Multivariable beta regression model results for the association between AMR in human pathogens and associated risk factors, and AMR in animals and associated risk factors. Models contain imputed data.

A. Carbapenem-resistant *Acinetobacter baumanii* (N=66)	OR	95% CI	p-value
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.20	1.02, 1.38	0.025
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.82	1.19, 2.46	0.011
GDP (ppp) (scale x10,000)	0.78	0.46, 1.10	0.181
Control of corruption	0.62	0.41, 0.96	0.031
Net migration rate	0.93	0.89, 0.97	<0.001
Labour force participation rate	1.07	1.02, 1.12	0.003
National monitoring systems for sales, prescription and consumption of antibiotics in humans	1.41	0.82, 2.4	0.212
Obesity prevalence	1.09	1.04, 1.15	<0.001
Average temperature (°C)	1.03	0.99, 1.06	0.028
Hospital beds per 10,000 people (scale x100)	1.34	0.81, 1.86	0.207
Population density (scale x100)	1.05	0.98, 1.12	0.136
Constant term	0.47	0.06, 3.69	0.473
B. Carbapenem-resistant *Pseudomonas aeruginosa* (N=41)	**OR**	**95% CI**	**p-value**
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.25	0.96, 1.55	0.093
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.24	0.82, 1.66	0.260
GDP (ppp) (scale x10,000)	0.97	0.85, 1.09	0.618
Median age of population	1.02	0.96, 1.1	0.493
Hospital beds per 10,000 people (scale x10)	0.95	0.86, 1.05	0.327
Cardiovascular death rate per 100,000 people (scale x10)	1.04	1.02, 1.06	<0.001
Mortality rate attributable to unsafe WASH (per 100,000 people)	1.04	0.95, 1.12	0.401
National monitoring systems for sales, prescription and consumption of antibiotics in humans	1.05	0.71, 1.55	0.811
Voice and accountability	0.52	0.37, 0.73	<0.001
Constant term	0.06	0.00, 1.91	0.109
C. 3rd generation cephalosporins-resistant *Escherichia coli* (N=89)	**OR**	**95% CI**	**p-value**
Consumption of cephalosporins in DDD	1.11	1.05, 1.17	<0.001
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.02	0.78, 1.26	0.861
GDP (ppp) (scale x10,000)	0.98	0.88, 1.08	0.717
Regulatory quality	0.62	0.53, 0.73	<0.001
Mortality rate attributable to unsafe WASH (per 100,000 people)	1.00	0.99, 1.01	0.349
Country policies and regulation on antimicrobial use in humans	0.84	0.62, 1.14	0.259
Population density (scale x100)	1.02	1.01, 1.02	<0.001
GINI index (scale x10)	1.08	0.96, 1.19	0.195

National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.88	0.70, 1.1	0.262
Constant term	0.59	0.31, 1.10	0.099

D. 3rd generation cephalosporins-resistant *Klebsiella pneumoniae* (N=92)	OR	95% CI	p-value
Consumption of cephalosporins in DDD (scale x1000)	1.08	1.01, 1.15	0.023
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.12	0.85, 1.39	0.372
GDP (ppp) (scale x10,000)	0.91	0.86, 0.97	0.002
Regulatory quality	0.80	0.73, 0.89	<0.001
Cardiovascular death rate per 100,000 people (scale x10)	1.02	1.01, 1.03	<0.001
GINI index (scale x10)	1.01	0.99, 1.02	0.131
National monitoring systems for sales, prescription and consumption of antibiotics in humans	1.05	0.89, 1.23	0.594
Hospital beds per 10,000 people (scale x100)	1.01	0.72, 1.30	0.959
Constant term	0.51	0.23, 1.14	0.101

E. Oxacillin-resistant *Staphylococcus aureus* (N=80)	OR	95% CI	p-value
Consumption of oxacillin in DDD	0.99	0.97, 1.01	0.375
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.58	1.34, 1.83	<0.001
GDP (ppp) (scale x10,000)	0.87	0.81, 0.92	<0.001
National surveillance system for AMR in humans	0.84	0.74, 0.96	0.008
Homelessness due to natural disaster (scale x100)	1.02	1.01, 1.02	<0.001
PM 2·5 (scale x10)	1.12	1.06, 1.19	<0.001
Average temperature (°C)	1.02	1.01, 1.04	0.009
Population density (scale x1000)	1.07	0.99, 1.14	0.060
Constant term	0.28	0.14, 0.53	<0.001

F. Vancomycin-resistant *Enterococcus faecium* (N=37)	OR	95% CI	p-value
Consumption of glycopeptides in DDD	1.03	1.01, 1.05	0.004
Antibiotic consumption in animals (mg/PCU) (scale x100)	0.78	0.22, 1.33	0.430
GDP (ppp) (scale x10,000)	0.75	0.37, 1.14	0.216
National surveillance system for AMR in humans	0.58	0.43, 0.78	<0.001
Voice and accountability	1.04	0.61, 1.79	0.881
PM 2·5 (scale x10)	1.48	1.01, 1.97	0.043
Hospital beds per 10,000 people (scale x100)	2.05	0.38, 3.73	0.219
Constant term	0.81	0.13, 4.89	0.820

Notes: Adjusted for all other variables in the table. P-value derived from the Wald test. Coefficients have been scaled to allow all odds ratios to be rounded to two decimal places. There were marginally fewer observations in the final models than the number of original observations for each dependent variable since some reference variables used during the multiple imputation process had a small number of missing observations. Robust standard errors were used. DDD= Defined Daily Doses per 1000 individuals; mg/PCU = milligram per population correction units; GDP= Gross Domestic Product; ppp = purchasing power parity; PM = Particular Matter; TB = Tuberculosis. * p<0·05.

Table S24: Multivariable beta regression model results for the association between critical, high and medium priority pathogens AMR levels, AMR in animals and associated risk factors. Highly influential countries have been excluded.

A. WHO critical human pathogen AMR (N=58, India and the US excluded)	OR	95% CI	p-value
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.12	1.02, 1.23	0.026
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.18	1.02, 1.34	0.024
GDP (ppp) (scale x10,000)	0.96	0.88, 1.03	0.267
Control of corruption	0.63	0.53, 0.77	<0.001
Cardiovascular death rate per 100,000 people (scale x100)	1.14	1.07, 1.22	<0.001
Current health expenditure (% of GDP)	0.99	0.96, 1.02	0.371
GINI index	1.02	1.01, 1.03	<0.001
PM 2·5 (scale x10)	1.05	1.02, 1.09	0.005
National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.88	0.74, 1.06	0.175
Constant term	0.13	0.07, 0.23	<0.001
B. WHO high priority human pathogen AMR (N=54, excluding Egypt and Singapore)	**OR**	**95% CI**	**p-value**
Consumption of oxacillin and glycopeptides in DDD	1.03	1.01, 1.04	<0.001
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.53	1.09, 1.98	0.019
GDP (ppp) (scale x10,000)	0.95	0.92, 0.98	<0.001
Median age of population	1.02	0.99, 1.04	0.016
Average temperature (°C)	0.92	0.83, 1.01	0.096
Voice and accountability	0.89	0.76, 1.03	0.122
Net Migration Rate	0.93	0.90, 0.97	0.000
National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.73	0.55, 0.97	0.031
Population density (scale x10,000)	0.95	0.85, 1.06	0.384
Constant term	1.65	0.50, 5.50	0.411
C. WHO medium priority human pathogen AMR (N=37, excluding South Korea, United Arab Emirates and Luxembourg)	**OR**	**95% CI**	**p-value**
Consumption of penicillins in DDD (scale x1000)	0.85	0.55, 1.16	0.351
Antibiotic consumption in animals (mg/PCU) (scale x100)	0.87	0.27, 1.47	0.670
GDP (ppp) (scale x10,000)	1.24	0.99, 1.48	0.052
PM 2·5 (scale x10)	1.36	1.10, 1.63	0.006
Regulatory quality	0.25	0.13, 0.46	<0.001
Mortality rate attributable to unsafe WASH (per 100,000 people)	1.16	0.99, 1.35	0.049
Constant term	0.11	0.06, 0.21	<0.001
D. AMR in food-producing animals (N= 58, excluding Denmark, Kazakhstan, Lebanon, South Korea, and Venezuela)	**OR**	**95% CI**	**p-value**
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.18	1.07, 1.29	0.001
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.06	0.97, 1.16	0.202
GDP (ppp) (scale x10,000)	1.11	1.03, 1.19	0.005
Average temperature (°C)	1.02	0.99, 1.03	0.073
Current health expenditure (% of GDP)	1.02	0.98, 1.08	0.327
Rule of law	0.68	0.51, 0.89	0.006

Cattle density (scale x100)	0.98	0.77, 1.19	0.848
Country policies and regulation on antimicrobial use for growth promotion in animals	1.12	0.83, 1.49	0.464
Arable land (% of land area) (scale x10)	1.10	1.03, 1.18	0.005
GINI index (scale x10)	1.10	0.94, 1.26	0.238
Constant term	0.33	0.19, 0.57	<0.001

Notes: Adjusted for all other variables in the table. P-value derived from the Wald test. Coefficients have been scaled to allow all odds ratios to be rounded to two decimal places. Robust standard errors were used. DDD= Defined Daily Doses per 1000 individuals; mg/PCU = milligram per population correction units; GDP= Gross Domestic Product; ppp = purchasing power parity; PM = Particular Matter. * p<0·05. Highly influential countries were those with a Cook's Distance (CD) value of >.1.

Table S25: Multivariable beta regression model results for the association between specific bacterium-antibiotic pairs AMR levels in humans and associated risk factors. Highly influential countries have been excluded.

A. Carbapenem-resistant *Acinetobacter baumanii* (N=48, excluding Lebanon and South Korea)	OR	95% CI	p-value
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.08	0.85, 1.31	0.487
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.68	1.20, 2.16	0.005
GDP (ppp) (scale x10,000)	0.75	0.45, 1.06	0.110
Control of corruption	0.41	0.27, 0.62	0.000
Net migration rate	0.91	0.87, 0.94	<0.001
Labour force participation rate	1.06	1.02, 1.10	0.002
National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.80	0.57, 1.12	0.189
Obesity prevalence	1.10	1.05, 1.14	0.000
Average temperature (°C)	1.01	0.98, 1.04	0.646
Hospital beds per 10,000 people (scale x10)	0.93	0.84, 1.03	0.169
Population density (scale x100)	1.23	0.95, 1.50	0.107
Constant term	2.33	0.46, 11.75	0.304
B. Carbapenem-resistant *Pseudomonas aeruginosa* (N=34, excluding Vietnam)	**OR**	**95% CI**	**p-value**
Consumption of carbapenems and cephalosporins in DDD (scale x1000)	1.23	0.92, 1.53	0.143
Antibiotic consumption in animals (mg/PCU) (scale x100)	0.74	0.22, 1.26	0.327
GDP (ppp) (scale x10,000)	1.08	0.97, 1.2	0.145
Median age of population	1.10	1.01, 1.19	0.020
Hospital beds per 10,000 people (scale x10)	0.44	-0.29, 1.18	0.137
Cardiovascular death rate per 100,000 people (scale x10)	1.01	0.99, 1.04	0.285
Mortality rate attributable to unsafe WASH (per 100,000 people)	8.76	3.53, 21.73	<0.001
National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.72	0.47, 1.1	0.131
Voice and accountability	0.23	0.13, 0.39	<0.001
Constant term	0.01	0.00, 0.11	<0.001
C. 3rd generation cephalosporins-resistant *Escherichia coli* (N=55, excluding Singapore and South Africa)	**OR**	**95% CI**	**p-value**
Consumption of cephalosporins in DDD	1.09	1.01, 1.18	0.034
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.20	0.93, 1.47	0.140
GDP (ppp) (scale x10,000)	0.99	0.91, 1.08	0.891
Regulatory quality	0.47	0.4, 0.56	<0.001

|	OR	95% CI	p-value
Mortality rate attributable to unsafe WASH (per 100,000 people)	1.03	1.01, 1.04	<0.001
Country policies and regulation on antimicrobial use in humans	0.54	0.45, 0.64	<0.001
Population density (scale x100)	1.01	0.98, 1.04	0.512
GINI index (scale x10)	1.23	1.03, 1.44	0.024
National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.66	0.51, 0.87	0.003
Constant term	0.47	0.26, 0.84	0.012
D. 3rd generation cephalosporins-resistant *Klebsiella pneumoniae* (N=57, excluding Bangladesh and Singapore)	**OR**	**95% CI**	**p-value**
Consumption of cephalosporins in DDD (scale x1000)	1.08	0.98, 1.17	0.112
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.13	0.84, 1.43	0.367
GDP (ppp) (scale x10,000)	0.89	0.79, 0.98	0.023
Regulatory quality	0.62	0.51, 0.75	<0.001
Cardiovascular death rate per 100,000 people (scale x10)	1.02	1.01, 1.03	0.001
GINI index (scale x10)	1.02	0.99, 1.04	0.024
National monitoring systems for sales, prescription and consumption of antibiotics in humans	0.87	0.72, 1.05	0.157
Hospital beds per 10,000 people (scale x100)	1.00	0.66, 1.33	0.981
Constant term	0.36	0.14, 0.90	0.029
E. Oxacillin-resistant *Staphylococcus aureus* (N=46, excluding Sri Lanka and Singapore)	**OR**	**95% CI**	**p-value**
Consumption of oxacillin in DDD	1.02	0.99, 1.04	0.043
Antibiotic consumption in animals (mg/PCU) (scale x100)	1.37	1.12, 1.62	0.003
GDP (ppp) (scale x10,000)	0.83	0.72, 0.95	0.004
National surveillance system for AMR in humans	0.72	0.62, 0.83	<0.001
Homelessness due to natural disaster (scale x100)	1.09	1.01, 1.17	0.038
PM 2·5 (scale x10)	1.06	0.98, 1.14	0.150
Average temperature (°C)	1.03	1.01, 1.05	0.003
Population density (scale x100)	0.93	0.82, 1.05	0.247
Constant term	0.46	0.29, 0.75	0.002
F. Vancomycin-resistant *Enterococcus faecium* (N=31, excluding United States and Turkey)	**OR**	**95% CI**	**p-value**
Consumption of glycopeptides in DDD	1.04	0.99, 1.08	0.051
Antibiotic consumption in animals (mg/PCU) (scale x10)	0.97	0.89, 1.05	0.459
GDP (ppp) (scale x10,000)	0.77	0.38, 1.16	0.250
National surveillance system for AMR in humans	0.57	0.36, 0.92	0.021
Voice and accountability	1.12	0.58, 2.16	0.735
PM 2·5 (scale x10)	1.75	0.89, 2.68	0.089
Hospital beds per 10,000 people (scale x10)	1.11	0.90, 1.32	0.315
Constant term	0.48	0.06, 4.21	0.515

Notes: Adjusted for all other variables in the table. P-value derived from the Wald test. Coefficients have been scaled to allow all odds ratios to be rounded to two decimal places. There were marginally fewer observations in the final models than the number of original observations for each dependent variable since some reference variables used during the multiple imputation process had a small number of missing observations. Robust standard errors were used. DDD= Defined Daily Doses per 1000 individuals; mg/PCU = milligram per population correction units; GDP= Gross Domestic Product; ppp = purchasing power parity; PM = Particular Matter; TB = Tuberculosis. * $p<0·05$. Highly influential countries were those with a Cook's Distance (CD) value of >.1.

Figure S26. Relationship between predicted AMR levels in animals and predicted AMR levels in human critical pathogens by WB income group and WHO region, based on estimates from Table 2
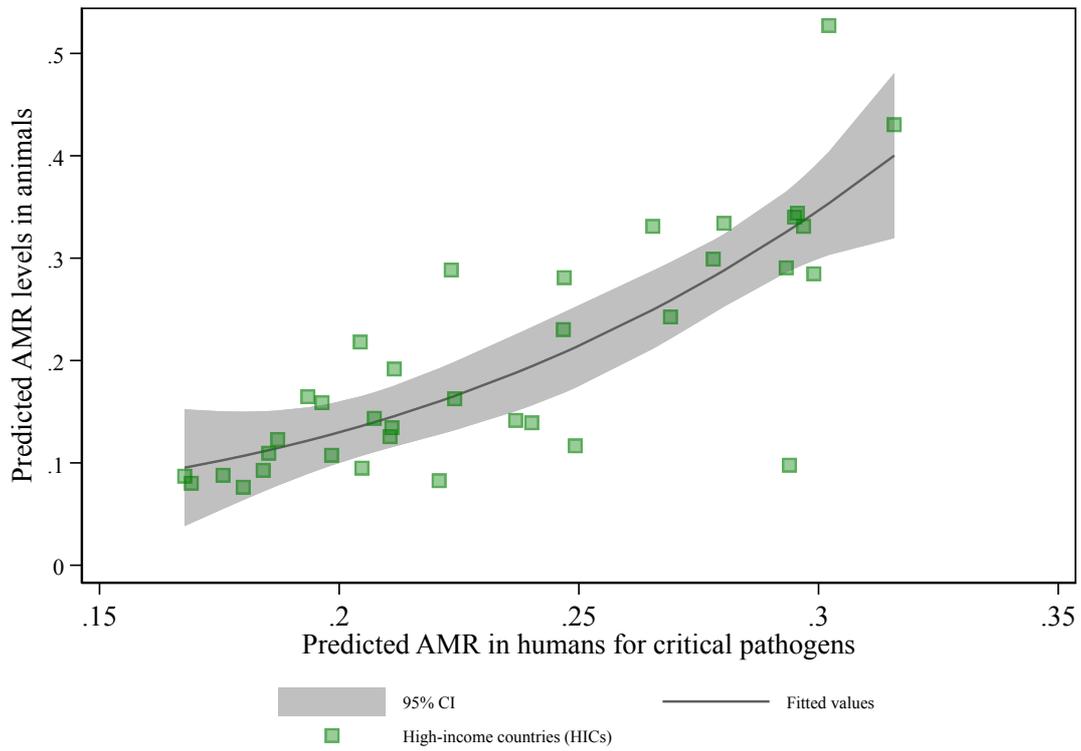
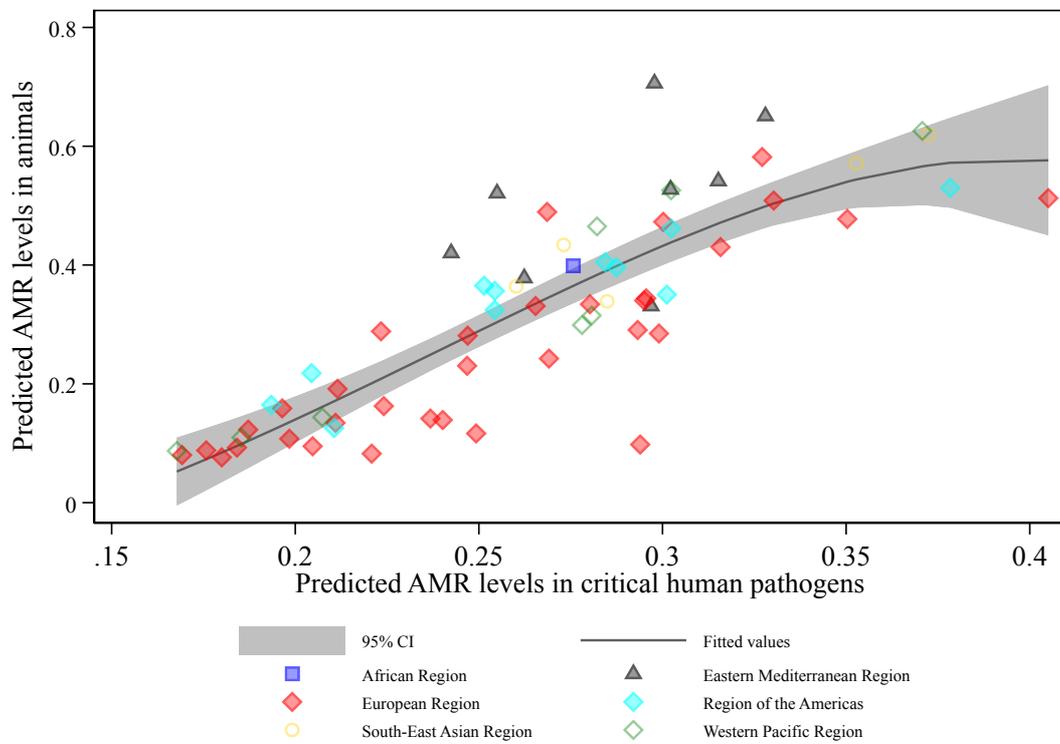### (A) Predicted AMR levels in animals and humans, differentiating by WB income group
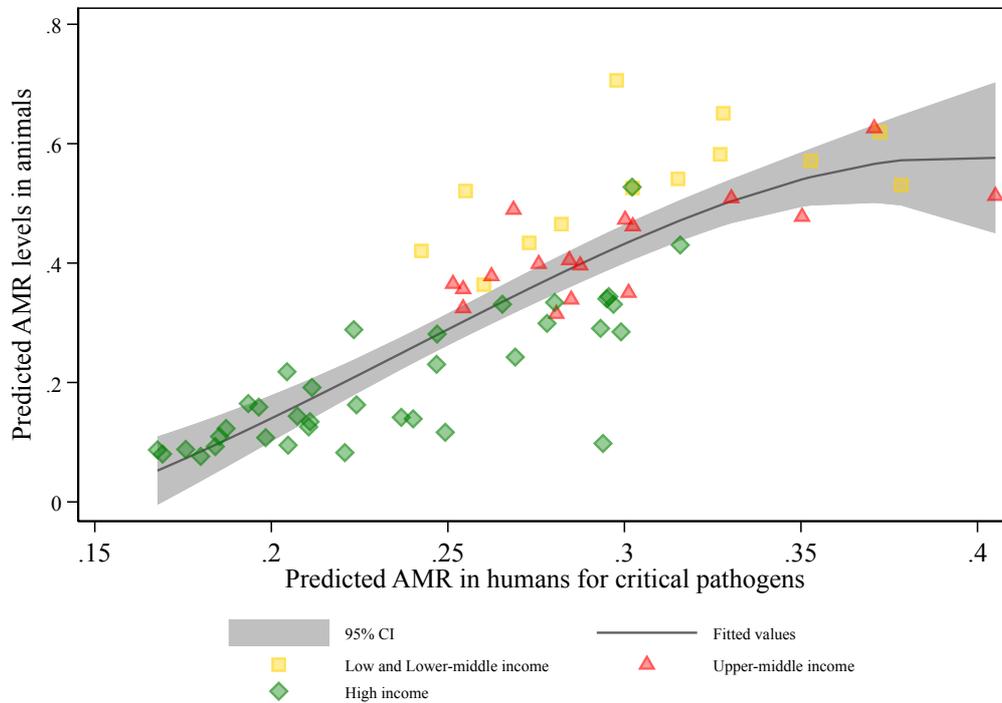
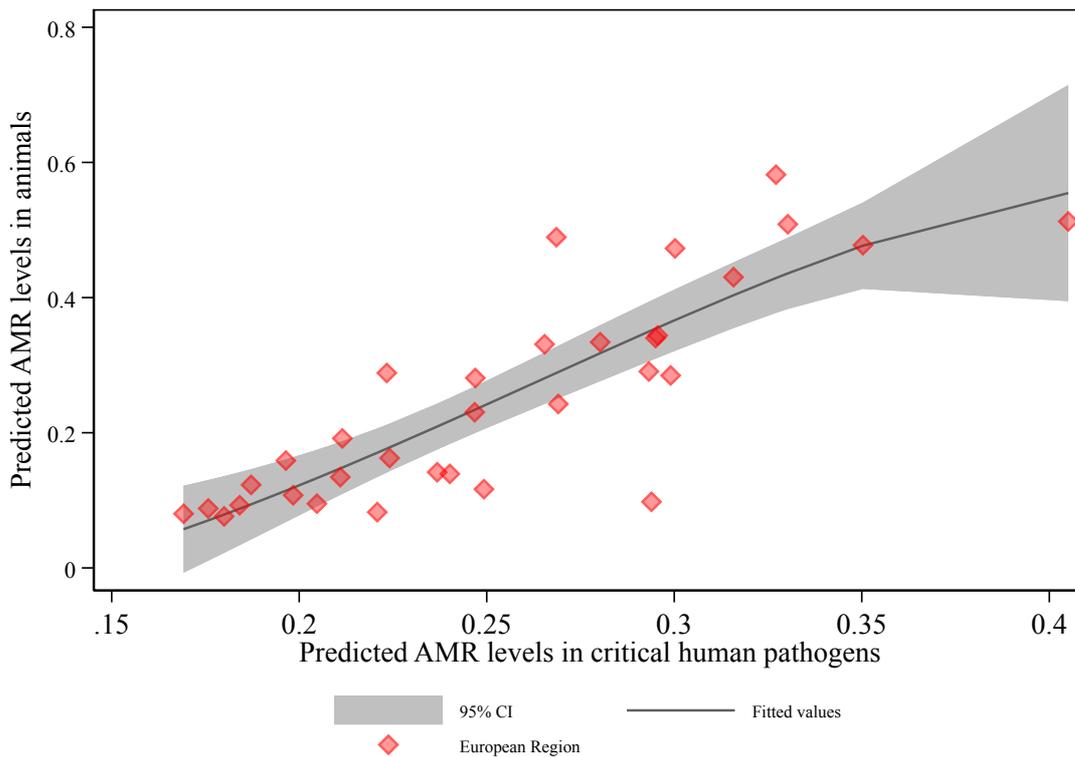### (B) Predicted AMR levels in animals and humans among LMICs
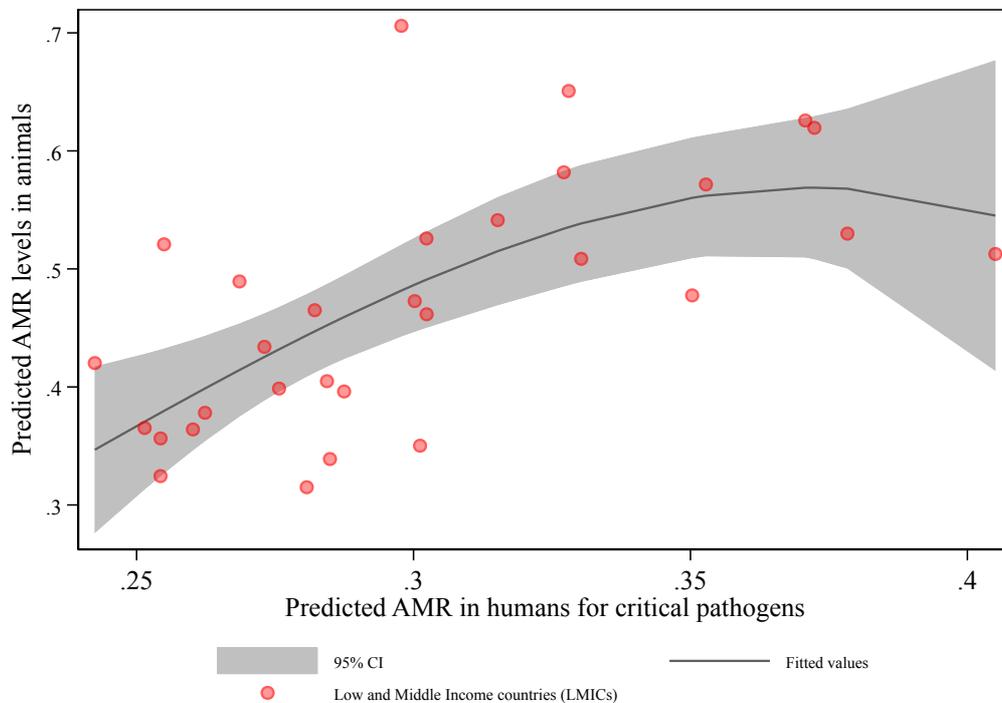
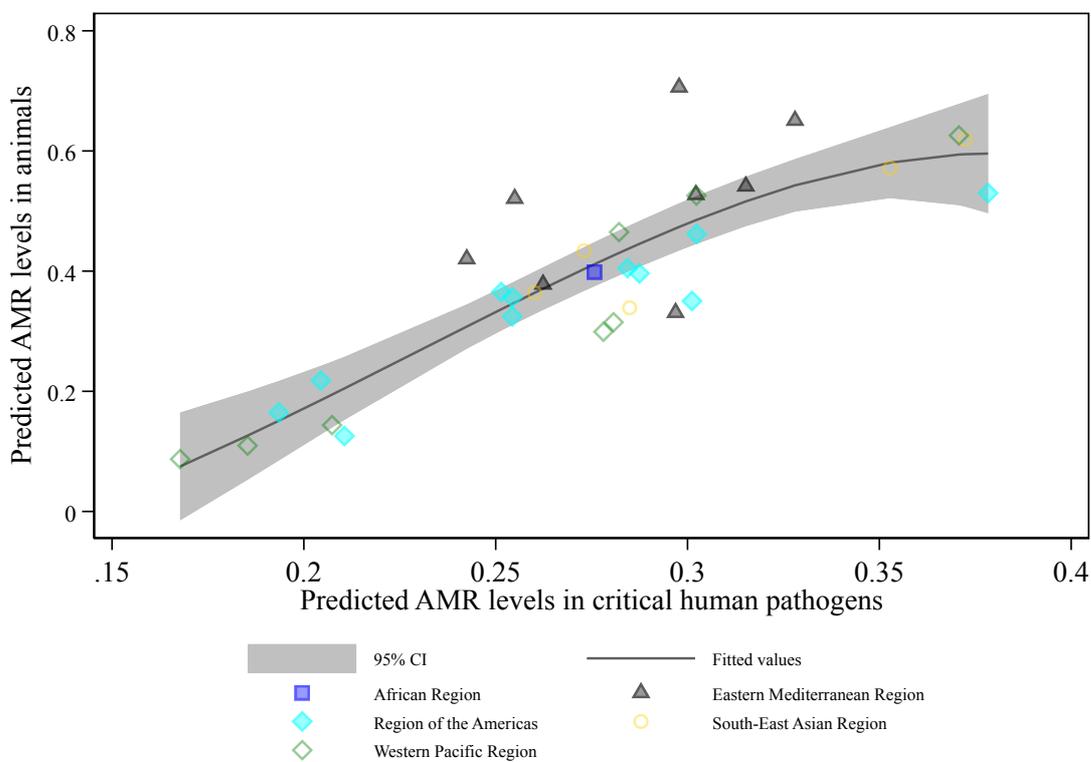**(C) Predicted AMR levels in animals and humans among HICs**

(D) Predicted AMR levels in animals and humans, by WHO region

(E) Predicted AMR levels in animals and humans in the European Region

(F) Predicted AMR levels in animals and humans in other than the European Region

Notes: Adjusted AMR estimates are derived from two multivariable beta regression models with robust standard errors (Table 2) We tried different function forms and beta binomial regression type model had the best goodness-of-fit based on its AIC value. Levels of AMR are recorded as proportions taking values between 0 and 1. WB=World Bank, WHO= World Health Organization.

Table S27. Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER)[34]

Checklist of information that should be included in new reports of global health estimates

Item #	Checklist item	Reported on page #
Objectives and funding		
1	Define the indicator(s), populations (including age, sex, and geographic entities), and time period(s) for which estimates were made.	Main text methods section and supplementary material (Tables S1-3)
2	List the funding sources for the work.	Main text funding and acknowledgements sections
Data Inputs		
For all data inputs from multiple sources that are synthesized as part of the study:		
3	Describe how the data were identified and how the data were accessed.	Main text methods section, and supplementary material
4	Specify the inclusion and exclusion criteria. Identify all ad-hoc exclusions.	Methods section, countries selected if they presented available information registered on publicly available sources
5	Provide information on all included data sources and their main characteristics. For each data source used, report reference information or contact name/institution, population represented, data collection method, year(s) of data collection, sex and age range, diagnostic criteria or measurement method, and sample size, as relevant.	Data presented in main text and supplementary material
6	Identify and describe any categories of input data that have potentially important biases (e.g., based on characteristics listed in item 5).	Main text limitations and sensitivity analyses presented in main manuscript and supplementary materials
For data inputs that contribute to the analysis but were not synthesized as part of the study:		
7	Describe and give sources for any other data inputs.	World Bank data, WHO data on the list of pathogens by CDDEP, and UN. All these sources are cited according methods section, and supplementary material Table S1.
For all data inputs:		
8	Provide all data inputs in a file format from which data can be efficiently extracted (e.g., a spreadsheet rather than a PDF), including all relevant meta-data listed in item 5. For any data inputs that cannot be shared because of ethical or legal reasons, such as third-party ownership, provide a contact name or the name of the institution that retains the right to the data.	Data are publicly available as for WHO, UN, and WB. For CDDEP data, data are publicly available under formal request. Contact Alisa Hamilton (hamilton@onehealthtrust.org)
Data analysis		
9	Provide a conceptual overview of the data analysis method. A diagram may be helpful.	Main text methods section.

10	Provide a detailed description of all steps of the analysis, including mathematical formulae. This description should cover, as relevant, data cleaning, data pre-processing, data adjustments and weighting of data sources, and mathematical or statistical model(s).	Method section and supplementary material.
11	Describe how candidate models were evaluated and how the final model(s) were selected.	Methods section.
12	Provide the results of an evaluation of model performance, if done, as well as the results of any relevant sensitivity analysis.	We employed different models, tested different distribution, and performed sensitivity analyses (see methods section)
13	Describe methods for calculating uncertainty of the estimates. State which sources of uncertainty were, and were not, accounted for in the uncertainty analysis.	Methods section.
14	State how analytic or statistical source code used to generate estimates can be accessed.	Methods section, all analyses were employed in Stata and R Studio.
Results and Discussion		
15	Provide published estimates in a file format from which data can be efficiently extracted.	Manuscript main Tables 1-3
16	Report a quantitative measure of the uncertainty of the estimates (e.g. uncertainty intervals).	95%CI provided for most estimates
17	Interpret results in light of existing evidence. If updating a previous set of estimates, describe the reasons for changes in estimates.	Introduction and discussion sections
18	Discuss limitations of the estimates. Include a discussion of any modelling assumptions or data limitations that affect interpretation of the estimates.	Discussion section, limitations subsection

This checklist should be used in conjunction with the GATHER statement and Explanation and Elaboration document, found on gather-statement.org

Additional references

1.   The Centre for Disease Dynamics Economics and Policy (CDDEP). ResistanceMap. 2021. https://resistancemap.cddep.org/ (accessed August 20th, 2021 2021).
2.   World Health Organisation. Global antimicrobial resistance surveillance system (GLASS) report: early implementation 2020. 2020: Geneva: World Health Organization.
3.   Pan American Health Organisation (PAHO). Antimicrobial Resistance. 2019 (accessed 20th August 2021 2021).
4.   Criscuolo NG, Pires J, Zhao C, Van Boeckel TP. resistancebank.org, an open-access repository for surveys of antimicrobial resistance in animals. *Scientific Data* 2021; **8**(1): 189.
5.   European Food Safety Authority. Biological Hazards Reports. 2021. https://www.efsa.europa.eu/en/data-report/biological-hazards-reports (accessed 26/12/2021 2022).
6.   European Food Safety Authority & European Centre for Disease Prevention and Control. European Union Summary Report on Antimicrobial Resistance in Zoonotic and Indicator Bacteria from Humans, Animals and Food in 2018/2019 [Data set]. *Zenodo* 2021.
7.   Abraham S, Jordan D, Wong HS, et al. First detection of extended-spectrum cephalosporin- and fluoroquinolone-resistant Escherichia coli in Australian food-producing animals. *Journal of Global Antimicrobial Resistance* 2015; **3**(4): 273-7.
8.   Shurgold J, Avery B, Volling C, et al. Canadian Antimicrobial Resistance Surveillance System Report: Public Health Agency of Canada, 2020.
9.   Shimazaki Y, Ozawa M, Matsuda M, et al. Report on the Japanese Veterinary Antimicrobial Resistance Monitoring System 2016–2017 Ministry of Agriculture, Forestry and Fisheries, 2020.
10.   Makarov D, Ivanova O, Karabanov S, Gergel M, Pomazkova A. Antimicrobial resistance of commensal Escherichia coli from food-producing animals in Russia. *Veterinary World* 2020; **13**(10): 2053-61.
11.   Kim S-J, Chan Moon D, Fikru Mechesso A, et al. Nationwide Surveillance on Antimicrobial Resistance Profiles of Staphylococcus aureus Isolated from Major Food Animal Carcasses in South Korea During 2010–2018. *Foodborne Pathogens and Disease* 2021; **18**(6): 388-97.
12.   Food and Drug Administration (FDA). NARMS Now. https://www.fda.gov/animal-veterinary/national-antimicrobial-resistance-monitoring-system/narms-now-integrated-data. (accessed 26/12/2021 2021).
13.   NORM/NORM-VET 2020. Usage of Antimicrobial Agents and Occurrence of Antimicrobial Resistance in Norway. Tromsø / Oslo, 2021.
14.   DANMAP 2019. Use of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark. ISSN 1600-2032: Statens Serum Institut, National Food Institute, Technical University of Denmark, 2020.
15.   Van Boeckel TP, Glennon EE, Chen D, et al. Reducing antimicrobial use in food animals. *Science* 2017; **357**(6358): 1350-2.
16.   Van Boeckel TP, Pires J, Silvester R, et al. Global trends in antimicrobial resistance in animals in low- and middle-income countries. *Science* 2019; **365**(6459): eaaw1944.
17.   United Nations - Department of Economic and Social Affairs - Population Division. World Population Prospects 2019. 2019. https://population.un.org/wpp/ (accessed 20th August 2021 2021).
18.   The World Bank. World Development Indicators. 2021. https://data.worldbank.org/indicator (accessed 20th August 2021 2021).
19.   United Nations - Department of Economic and Social Affairs - Population Division. World Population Prospects: The 2017 Revision, Key Findings and Advance Tables, 2017.
20.   United Nations Development Program. Human Development Data Centre. 2021. http://data.un.org/DocumentData.aspx?id=419 (accessed 20th August 2021 2021).
21.   World Health Organisation. The global health observatory, indicator metadata registry list. 2021. https://www.who.int/data/gho/indicator-metadata-registry (accessed 20th August 2021 2021).
22.   NOAA National Centres for Environmental Information. Climate at a Glance: Global Time Series. 2020. https://www.ncdc.noaa.gov/ (accessed 20th August 2021 2021).
23.   World Health Organisation. Global Health Observatory Data Repository. 2021. https://apps.who.int/gho/data/node.main (accessed 20th August 2021 2021).

24.   Our World in Data. Agricultural Land per capita. 2022.
https://ourworldindata.org/grapher/agricultural-area-per-capita?tab=table%3Chttps://protect-
eu.mimecast.com/s/F9nmCR1NGcQVAq8tQOKHW?domain=nam12.safelinks.protection.outlook.co
m%3E%3Chttps://nam12.safelinks.protection.outlook.com/?url=https%3A%2F%2Fourworldindata.or
g%2Fgrapher%2Fagricultural-area-per-
capita%3Ftab%3Dtable&data=05%7C01%7C%7Cb23f7a06062b4bf2e09108dac658b180%7C84df9e
7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C638040383165547823%7CUnknown%7CTWFpbGZsb
3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C300
0%7C%7C%7C&sdata=h7Y0xulK5Ni4WTSmVyPoQIsxfSK%2FMpJtnKtcRjWNiKc%3D&reserved
=0%3Chttps://protect-
eu.mimecast.com/s/F9nmCR1NGcQVAq8tQOKHW?domain=nam12.safelinks.protection.outlook.co
m%3E (accessed 20 November 2022).
25.   Institute for Health Metrics and Evaluation (IHME). GBD Compare Data Visualization.
Seattle, WA: IHME, University of Washington. 2020. http://www.healthdata.org/data-
visualization/gbd-compare (accessed 20th August 2021 2021).
26.   Gilbert M, Nicolas G, Cinardi G, et al. Global distribution data for cattle, buffaloes, horses,
sheep, goats, pigs, chickens and ducks in 2010. *Scientific data* 2018; **5**(1): 1-11.
27.   Gilbert M, Nicolas G, Cinardi G, Van Boeckel T, Vanwambeke S, Wint W. Global cattle
distribution in 2010 (5 minutes of arc)[Internet]. Harvard Dataverse; 2018. 2018.
https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/GIVQ75.
28.   Gilbert M, Nicolas G, Cinardi G, et al. Global chicken distribution in 2010 (5 minutes of arc).
2018. https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/SUFASB3).
29.   Gilbert M, Nicolas G, Cinardi G, Van Boeckel T, Vanwambeke S, Wint W. Global pig
distribution in 2010 (5 minutes of arc)[Internet]. Harvard Dataverse; 2018 2018.
https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/33N0JG.
30.   World Bank. Databank: Worldwide Governance Indicators. 2022.
https://databank.worldbank.org/source/worldwide-governance-indicators# (accessed 20 November
2022).
31.   World Organization for Animal Health. Surveillance and control measures. 2022.
https://wahis.woah.org/#/dashboards/control-measure-dashboard (accessed 20 November 2022).
32.   World Bank W, FAO, UN. Global Database for Tracking Antimicrobial Resistance (AMR)
Country Self- Assessment Survey (TrACSS). 2022. https://amrcountryprogress.org/#/map-view
(accessed 20 November 2022).
33.   Tiseo K, Huber L, Gilbert M, Robinson TP, Van Boeckel TP. Global Trends in Antimicrobial
Use in Food Animals from 2017 to 2030. *Antibiotics* 2020; **9**(12): 918.
34.   Stevens GA, Alkema L, Black RE, et al. Guidelines for Accurate and Transparent Health
Estimates Reporting: the GATHER statement. *PLOS Medicine* 2016; **13**(6): e1002056.