Observational Study on Global Data Availability of Antibiotic Resistance Drivers

Identifying Gaps in Data Collection

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Aim & Research Questions

Aim: To assess the data availability and completeness of antibiotic resistance drivers, and their correlation with network centrality measures.

RQ 1

Where are there gaps in data in relation to antibiotic resistance drivers?

RQ 2

Are centrality and distalness measures associated with data availability and completeness?

RQ 3

How do data availability and completeness compare between regions and income groups?

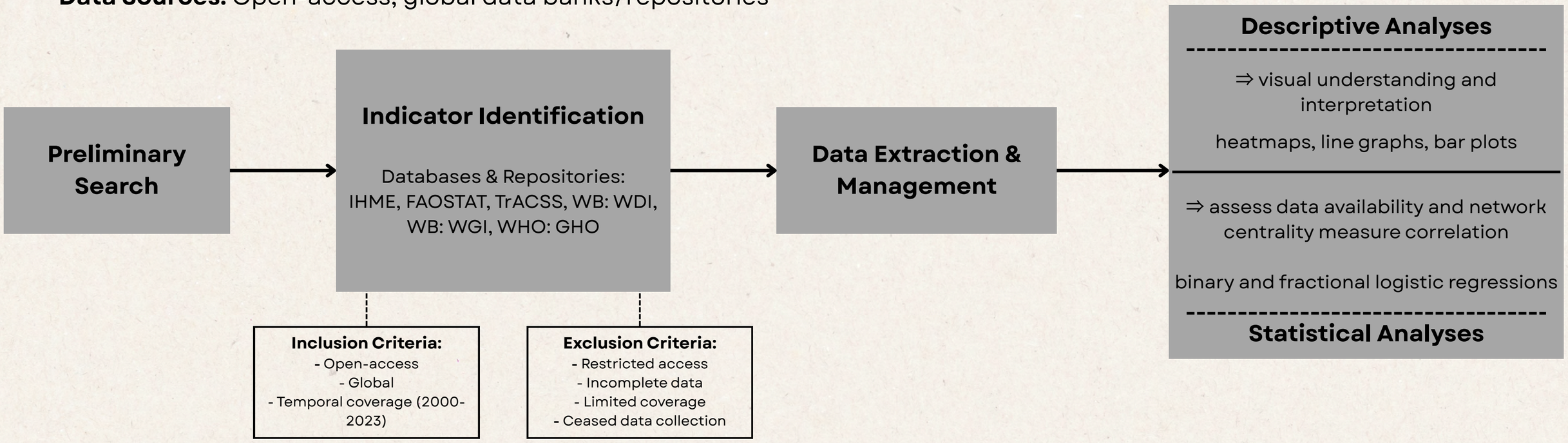
Methodology

Study Design: Observational ecological study

Setting: Global, based on national data

Coverage: Attempted broadest geographical coverage; 2000-2023

Data Sources: Open-access, global data banks/repositories



IHME - Institute for Health Metrics and Evaluation; **FAOSTAT** - Food & Agriculture Organisation Statistics; **TrACSS -** Global Database for Tracking Antimicrobial Resistance Country Self-Assessment Survey; **WB: WDI -** World Bank: World Development Indicators; **WB: WGI -** World Bank: World Governance Indicators; **WHO: GHO** - World Health Organisation - Global Health Observatory

Human Drivers

Excluded

- **H.2 - DMC** disrupted health services and supply chain
- **H.10 - DCP** doctor-patient relationship
- **H.11 - PGP** economic incentives from prescribing antibiotics
- **H.13 - PKA** patient's knowledge and attitude about AMR
- **H.14 - PAH** patient expectations and health seeking behaviours
- **H.15 - SCN** social cultural factors
- **H.16 - ARD** decline in antibiotic R&D
- **H.17 - LPR** economic obstacles in antibiotic R&D
- **H.18 - PQA** availability of quality antibiotics in the market
- **H.19 - DPP** drug promotion by pharmaceutical company
- **H.20 - OTC** ease of access to antibiotics over the counter
- **H.21 - PDP** profit-driven pharmacy
- **H.22 - INF_H** risk of infection/colonisation by resistant bacteria in humans

Included

- **H.1 - HCQ** substandard healthcare provision
  - **H.1.1.** Healthcare Quality and Access Index
  - **H.1.2.** Adverse Effects of Medical Treatment
  - **H.1.3.** Hospital Bed Density
  - **H.1.4.** Medical Doctor Density
  - **H.1.5.** Nursing and Midwifery Personnel Density
- **H.3 - LHC** limited access to healthcare
  - **H.3.1.** Coverage of Essential Health Services (UHC 1/2)
  - **H.3.2.** Population Health Expenditure >10% (UHC 1/2)
- **H.4 - IPC** inadequate infection control measures in hospital
  - **H.4.1.** TrACSS: IPC
- **H.5 - PHM** insufficient public health measures
  - **H.5.1.** Health Expenditure (% GDP)
  - **H.5.2.** DTP3 Vaccination Coverage
- **H.6 - LCH** limited laboratory capacity in human medicine
  - **H.6.1.** TrACSS: SUH
- **H.7 - SUH** poor ABR surveillance system in humans
  - **H.7.1.** TrACSS: SUH
- **H.8 - DPR** inappropriate prescribing by doctor
  - **H.8.1.** Antibiotic Use: 60% Access Target
- **H.9 - DKA** doctor's knowledge and attitude about ABR
  - **H.9.1.** TrACSS: DKA
- **H.12 - PCS** patient health status
  - **H.12.1.** Healthy Life Expectancy

Global Data Banks + Repositories:

IHME **FAOSTAT** **WB: WDI** **WB: WGI** **WHO: GHO**

Thematic Data Banks + Repositories:

JMP **TrACSS** **UNDP**

Alternative Data Banks + Repositories:

CSIRO Natural History Museum

Our World in Data

ABR - Antibiotic Resistance; **AMR** - Antimicrobial Resistance; **CH_4** - methane; **DTP3** - three doses of the combined diphtheria, tetanus toxoid, and pertussis vaccine; **GDP** - Gross Domestic Product; **GNI** - Gross National Income; **K** - potassium; **N** - nitrogen; **N_2O** - nitrous oxide; **P** - phosphorus; **PM** - particulate matter; **R&D** - research and development; **UHC** - Universal Health Coverage; **UNICEF** - United Nations International Children's Emergency Fund; **WASH** - water, sanitation, and hygiene

Animal-Food Drivers

Excluded

AF.3 - FAM
farm model and financial conditions

AF.4 - VPR
inappropriate prescribing by veterinarian

AF.10 - INF_A
risk of infection/colonisation by resistant bacteria in animals

Included

AF.1 - AGI
expansion of intensive husbandry farming

- **AF.1.1.** Crop Production Index (per capita)
- **AF.1.2.** Livestock Production Index (per capita)
- **AF.1.3.** Crop Emissions (CH_4, N_2O)
- **AF.1.4.** Livestock Emissions (CH_4, N_2O)

AF.2 - FMP
adoption of good husbandry practices

- **AF.2.1.** TrACSS: FMP

AF.5 - VKA
veterinarian knowledge and attitude about AMR

- **AF.5.1.** TrACSS: VKA

AF.6 - FKA
farmer's knowledge and attitude about AMR

- **AF.6.1.** TrACSS: FKA

AF.7 - AVS
substandard veterinary system

- **AF.7.1.** TrACSS: AVS

AF.8 - SUV
poor ABR surveillance system in veterinary medicine

- **AF.8.1.** TrACSS: SUV

AF.9 - LCV
limited laboratory capacity in veterinary medicine

- **AF.9.1.** TrACSS: LCV

AF.11 - FTR
food-trading activities

- **AF.11.1.** Important Quantity (Food Products)
- **AF.11.2.** Export Quantity (Food Products)
- **AF.11.3.** Import Quantity (Live Animals)
- **AF.11.4.** Export Quantity (Live Animals)

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Environmental Drivers

Excluded

E.2 - WDL
wildlife-associated AMR transmission

Included

AF.1 - AGI
expansion of intensive husbandry farming

- **E.1.1.** PM2.5 Air Pollution
- **E.1.2.** Biodiversity Intactness Index
- **E.1.3.** Biodiversity Habitat Index
- **E.1.4.** Cropland Nutrient Balance (N,K,P)
- **E.1.5.** Precipitation Anomalies
- **E.1.6.** Temperature Anomalies

E.3 - SEW
discharge of waste from anthropogenic sources

- **E.3.1.** TrACSS: SEW

E.4 - REW
reuse of untreated animal waste in aqua- and agriculture

- **E.4.1.** TrACSS: REW

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Other Drivers

Excluded

- **O.1 - SES** individual socio-demographic status
- **O.3 - SHA** sharing common habitats between humans and animals
- **O.2 - LVC** local living conditions
- **O.8 - HTM** human travel and migration
- **O.9 - CRE** crisis events

Included

- **O.4 - WAS** poor access to WASH sanitation
  - **O.4.1.** Drinking Water: Service Level
  - **O.4.2.** Sanitation: Service Level
  - **O.4.3.** Hygiene: Service Level
- **O.5 - PVT** country development status
  - **O.5.1.** Poverty (National Poverty Lines)
  - **O.5.2.** Poverty (Societal Poverty Lines)
  - **O.5.3.** GNI per capita (ATLAS)
  - **O.5.4.** Life Expectancy
  - **O.5.5.** Human Development Index
- **O.6 - PGE** population growth and economic development
  - **O.6.1.** Urbanisation (% population)
  - **O.6.2.** Population Growth (annual %)
  - **O.6.3.** Population Density
- **O.7 - DAF** demand for animal food
  - **O.7.1.** Food Supply Quantity (kg/capita/year)
- **O.10 - LEG** gaps in policy adoption, implementation, enforcement
  - **O.10.1.** TrACSS: LEG
- **O.11 - PGA** leadership and governance capacity
  - **O.11.1.** WGI: Corruption
  - **O.11.2.** WGI: Government Effectiveness
  - **O.11.3.** WGI: Voice & Accountability

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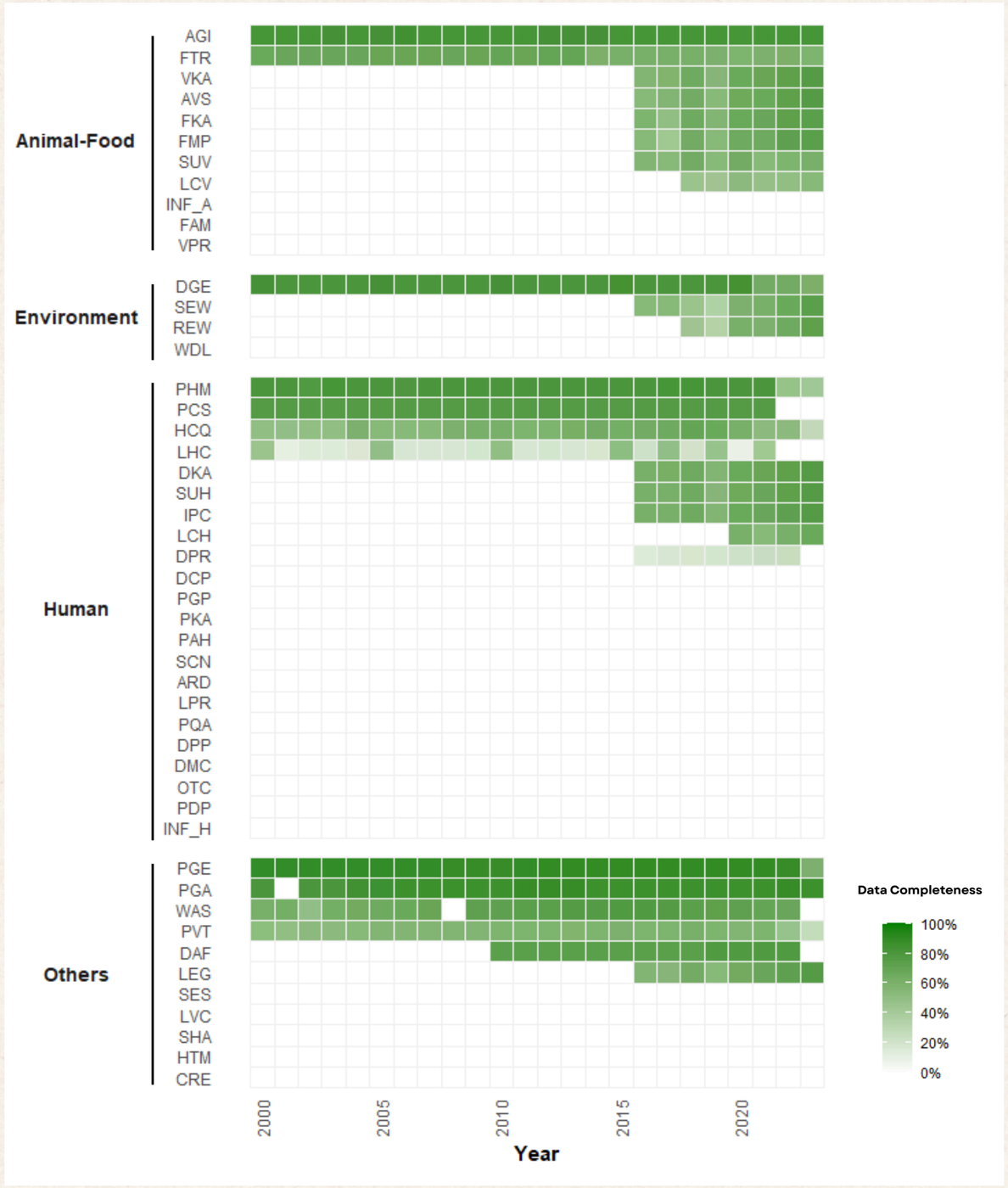
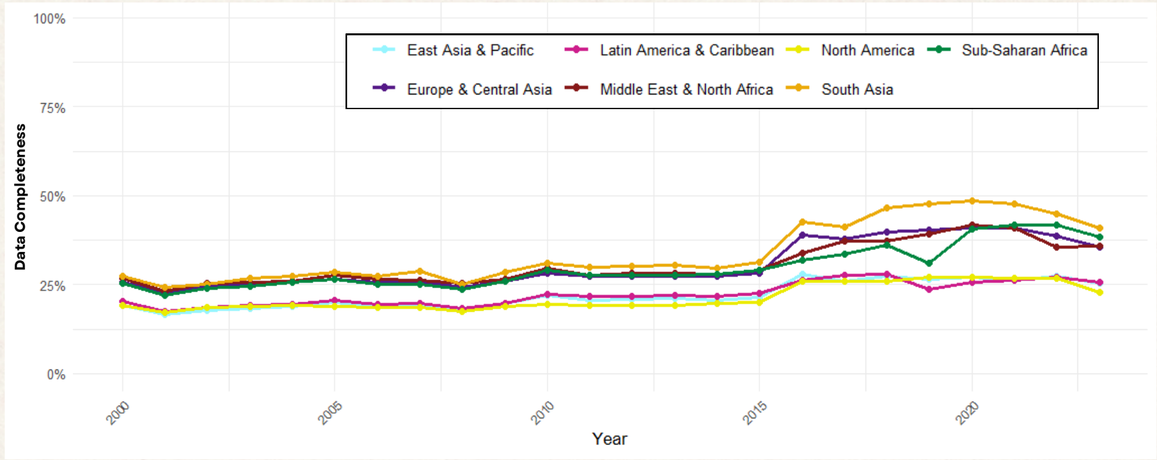
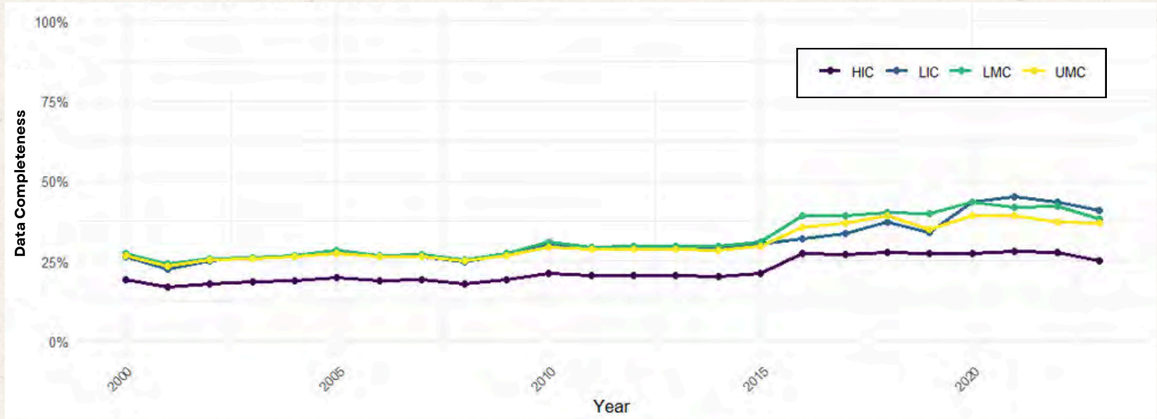


Main Findings

DESCRIPTIVE





Main Findings

STATISTICAL

Data Availability - does the data exist?

Positive Correlation: Distalness; Eigenvector

Negative Correlation: Betweenness; Closeness

Data Completeness - if the data exists, how complete is it?

Positive Correlation: Distalness

Negative Correlation: Betweenness; Closeness, Eigenvector

	OR	p-value	95% CI
(Intercept)	0.12	< 0.001	[0.12 – 0.13]
Distalness Index	7.26	< 0.001	[6.77 – 7.79]
Betweenness Centrality Index	0.99	< 0.001	[0.99 – 0.99]
Eigenvector Centrality	2.05	< 0.001	[1.93 – 2.16]
Closeness	0.26	< 0.001	[0.23 – 0.29]

Binary Logistic Regression

	OR	p-value	95% CI
(Intercept)	7.69	< 0.001	[6.70 – 8.83]
Distalness Index	3.50	< 0.001	[3.05 – 4.03]
Betweenness Centrality Index	0.96	< 0.001	[0.96 – 0.97]
Eigenvector Centrality	0.09	< 0.001	[0.08 – 0.09]
Closeness	0.04	< 0.001	[0.03 – 0.05]

Fractional Logistic Regression