Introduction

The rise of antimicrobial resistant (AMR) pathogens is an emerging problem in third world countries. Generally, it results from the overprescription of antibiotics to combat high disease burden. In India, the threat of AMR is not well characterized.

Objective

To characterize the threat of AMR in India in a spatiotemporal fashion and to determine potential risk factors that govern prevalence of AMR.

Methods

- Data concerning resistance rates of *E. coli* and *S. aureus* were consolidated in a redbank database from studies published from 2000 to present. Information regarding study location in decimal coordinates, time of study, strain type, number of isolates, drug type, and drug class were included.
- Studies were not included if they did not specify resistance values, time or location.
- Statistical, spatial and data analysis and modelling was conducted in R.

Results

- For every study, the PN50 value was calculated as denoted by the formula:

\[ \text{PN50} = \frac{\text{No. of drugs with resistance rate} > 50}{\text{No. of drugs tested}} \]

- The geographic distribution of studies was discerned, where the size of each circle correspond to number of isolates tested and the darkness of the circle represents the PN50 value.

- To extrapolate PN50 values in geographic locations not sampled from the studies collected, inverse distance interpolation was employed.

- Raster layers of potential risk factors that could predict the trend PN50 values were imported from governmental satellite data resources including NASA and SEDAC.
- Universal Kriging was used to update the spatial PN50 prediction based on the imported layers.

- GAM and GLM models constructed after introducing pseudo-absence (PN50 values of 0) points based on sites with urban population and correlating values with human population density.
- Found Purchasing Power Parity, Solar Radiation, Aerosol Optical Depth, Precipitation, and PN50 values collected from animal studies to be significant.

Discussion/Conclusions

- From this work, we have identified potential risk factors that could potentially contribute to antimicrobial resistant patterns among humans in India. Specifically, we can see how factors including socioecomic status and precipitation are potentially predictors of antibiotic resistance. As a result, we can see that factors beyond overprescription of antibiotics could potentially propagate the spread of AMR. These results in turn could inform future policy decisions in India that address these identified factors that potentially have an affect on AMR.
- However, these associations could be explained by more relevant confounding variables, so areas for future investigation include looking to see whether other more relevant factors influence PN50 distribution, including urbanicity, corruption, sanitation/access to clean water.

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