Bacteria Knows No Border: Antimicrobial Resistance Across Africa

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Funded by CHW under the Global Health Program

Introduction

Antimicrobial resistance (AMR) is often cited as one of the biggest threats to global health. It is not limited to one country or region, yet one study reports surveillance data is not available for 42.6% of African countries (1). With a lack of data and spatiotemporal trends, local policies to improve antimicrobial use cannot be implemented.

Objective of the Study

The goal of this study is to help collect and analyze existing AMR data from locations across Western, Eastern, Central, and Southern Africa to better understand the burden of AMR. This study focused on finding the reported rates of each of the World Health Organization's 14 Priority Pathogens from existing literature. It also involved identifying the most robust rates when different studies reported different numbers.

Methods

- Systematically search through available and published literature for the reported rate of the WHO's Priority Pathogens in 14 African countries.
- Determine the limitations on the data collection for the different studies.
- Understand if the rates are indicative of hospital acquired infections, community acquired infections, or both.

Results

- The Mapping Antimicrobial Resistance and Antimicrobial Use Partnership (**MAAP**) focuses on 8 surveillance objectives in **14 countries in Africa**: Burkina Faso, Ghana, Nigeria, Senegal, Sierra Leone, Kenya, Tanzania, Uganda, Cameroon, Gabon, eSwatini, Malawi, Zambia & Zimbabwe.
- The **World Health Organization's 14 Priority Pathogen**s are divided into three classifications, based on urgency: **Critical, High, and Medium.**

Table 1: The Rates of the WHO Priority 1: Critical Pathogens in the 14 MAAP Countries

	Acinetobacter baumannii, carbapenem-resistant	*Pseudomonas aeruginosa,* carbapenem-resistant	Enterobacteriaceae, carbapenem-resistant, ESBL-producing
Burkina Faso	100%	13%	58 % 45.2%
Ghana	8.3% 48.88%	Present	15.1%
Nigeria	60%	13.2%	20.9%
Senegal	21.4%	x	0%
Sierra Leone	8.7%	0%	1.3%
Kenya	100%	64.9%	6.5%
Tanzania	1.3%	8.9%	0%
Uganda	31%	24 %	44.4%
Cameroon	21.6%	23.5%	82.8%
Gabon	40-50%	x	15.4% 25.8%
eSwatini	40-50%	x	x
Malawi	2.2%	x	x
Zambia	30-40%	6%	x
Zimbabwe	15.4%	2.9%	"Very low"

Table 3: The Rates of the WHO Priority 3:Medium Pathogens in the 14 MAAP Countries

	Streptococcus pneumoniae, penicillin-non-susceptible	*Haemophilus influenzae,* ampicillin-resistant	Shigella spp., fluoroquinolone-resistant
Burkina Faso	x	x	x
Ghana	45%* 0.69%	x	x
Nigeria	55.3%* 28.0%	x	<1%
Senegal	53.1%* 8.6%	x	1%
Sierra Leone	x	x	0%
Kenya	9%	x	29.9%
Tanzania	53%	x	0%
Uganda	83.5-100%	x	< 3%
Cameroon	7.6%	73.6%	2.7%
Gabon	x	x	x
eSwatini	x	x	x
Malawi	50%	84.6%	50%
Zambia	x	x	x
Zimbabwe	66%	x	x

Tables 1-3: The rates of the WHO Priority 1-3: Critical, High, & Medium Pathogens in the 14 MAAP Countries.

Table 2: The Rates of the WHO Priority 2: High Pathogens in the 14 MAAP Countries

	Enterococcus faecium, vancomycin-resistant	*Staphylococcus aureus,* methicillin-resistant; vancomycin-intermediate and resistant	*Helicobacter pylori,* clarithromycin-resistant	Campylobacter spp., fluoroquinolone-resistant	Salmonellae, fluoroquinolone-resistant	*Neisseria gonorrhoeae,* cephalosporin-resistant; fluoroquinolone-resistant
Burkina Faso	0%	10-20%	9.1%	x	50.0%	x
Ghana	0%	10-20%	x	x	6.6%*	81.8%
Nigeria	2.8%	40-50%	14.4%	41%	50%	62.3%
Senegal	x	40-50%	1%	x	0.24%	64%
Sierra Leone	0%	100% against methicillin 0% against vancomycin	x	x	x	0%
Kenya	0%	10-20%	~0%	x	x	85.7%
Tanzania	6.1%.	<5%	28.7%	x	x	x
Uganda	9.8%.	20-30%	29%	x	50%	100% to fluoroquinolone <25% to cephalosporin
Cameroon	0.7%	46.0%	55.3%	71.4%	9.5%	64.4%
Gabon	x	5.8%	x	x	x	x
eSwatini	x	10-20%	x	x	x	x
Malawi	x	10-20%	x	x	~75%	75% to fluoroquinolone ~100% to cephalosporin
Zambia	14.3%*	20-30%	x	x	x	x
Zimbabwe	100%	2.3-8.5%	x	x	x	18.6% to fluoroquinolone 0% to cephalosporins

An "x" indicates that no rate was found in the search and "" indicates intermediate resistance.*

References:

(1) Birkneh Tilahun Tadesse et al., "Antimicrobial Resistance in Africa: A Systematic Review," BMC Infectious Diseases 17, no. 1 (September 11, 2017): 616, https://doi.org/10.1186/s12879-017-2713-1.

Sources for Tables 1-3 can be found at this link: https://docs.google.com/document/d/1s2r64vl-JniBMtvCCgGMxAbomdgvj2q-iNyyNAMqp4A/edit?usp=sharing

Discussion

- Each of the WHO's Priority Pathogens can be found in Africa, and each MAAP country has reported the presence of at least one of these pathogens.
- Not all these studies are directly comparable, and, thus, the data should be interpreted with caution. For example, one study only had 3 isolates to test whereas another had 190 isolates. Furthermore, laboratories had variable testing capacity, retrieved their samples from different kinds of locations, and conducted studies of differing lengths.

Next Questions

- To what extent can the conclusions from this study be extrapolated to determine the presence of AMR across all of Africa? And across of the globe?
- With the limitations on the data collected across the countries, what is the level of quantitative analysis that can be performed to predict future trends across Africa?

Conclusion

While AMR is present in all the MAAP countries, the specific rates of each of the WHO's priority pathogens both appear to be on the rise and highly variable. Lastly, these bacteria are not exclusively found in clinical settings but also are found, in many cases, in the broader community as well.

Acknowledgements

I want to thank Dr. Geetanjali Kapoor from One Health Trust for all her help and guidance this summer. I want also acknowledge the support of Dr. Ramanan Laxminarayan and Ruchita Balasubramanian ('19).