

# Attributable societal cost of antimicrobial resistance in Ghana: A microsimulation study

**Evans Otieku, PhD<sup>1,2\*</sup>**, Ama Pokuaa Fenny, PhD<sup>1</sup>, Monica Jejeti, MPH<sup>3</sup>,  
Appiah-Koran Labi PhD<sup>4,5</sup>, George Kwesi Hedidor, PhD<sup>6</sup>,  
Robert Ofori Amoah, MPH<sup>2</sup>, Ulrika Enemark, PhD<sup>7</sup>

<sup>1</sup>Economics Division, Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Accra, Ghana; <sup>2</sup>Department of Public Health, Ghana Christian University College, Accra, Ghana

<sup>3</sup>Department of Health Policy Planning and Management, University of Ghana, Accra, Ghana; <sup>4</sup>Department of Medical Microbiology, Korle-Bu Teaching Hospital, Accra, Ghana

<sup>5</sup>Department of Medical Microbiology, University of Ghana Medical School, Accra, Ghana; <sup>6</sup>World Health Organization Country Office for Ghana, P.O. Box MB 142, Accra, Ghana

<sup>7</sup>Department of Public Health, Aarhus University, Aarhus, Denmark



2025 CONGRESS PRESENTATION  
BALI, INDONESIA. JULY 19-23, 2025

# What did we study?

---



**Background:** A compelling argument for investing in antimicrobial resistance (AMR) is essential to encourage governments to commit resources for implementing national action plans against AMR.



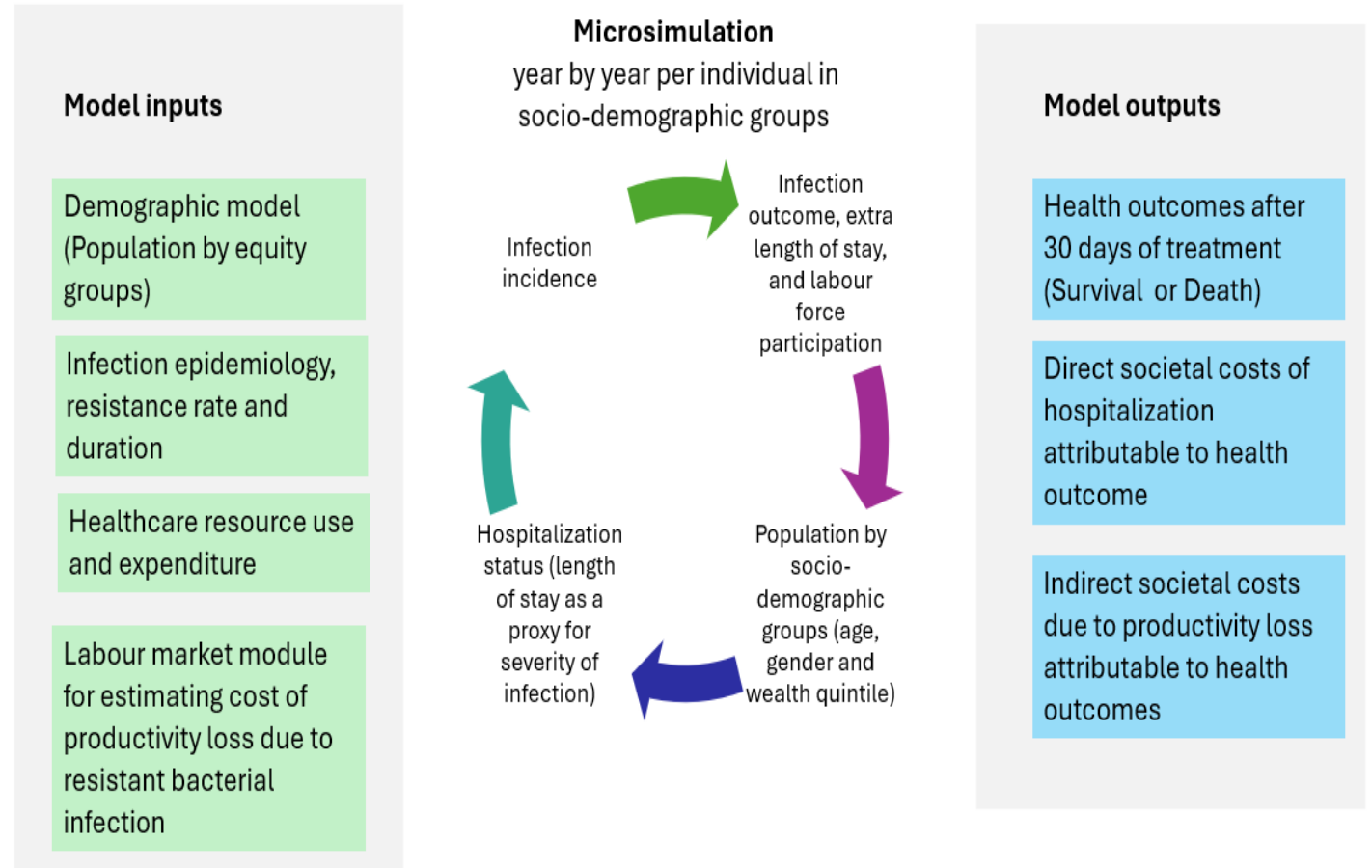
Therefore, we performed a microsimulation analysis predicting the potential societal cost savings for reducing the prevalence of AMR in Ghana.



Outcomes were the potential health effects and the attributable societal cost due to AMR.

# What procedures were followed?

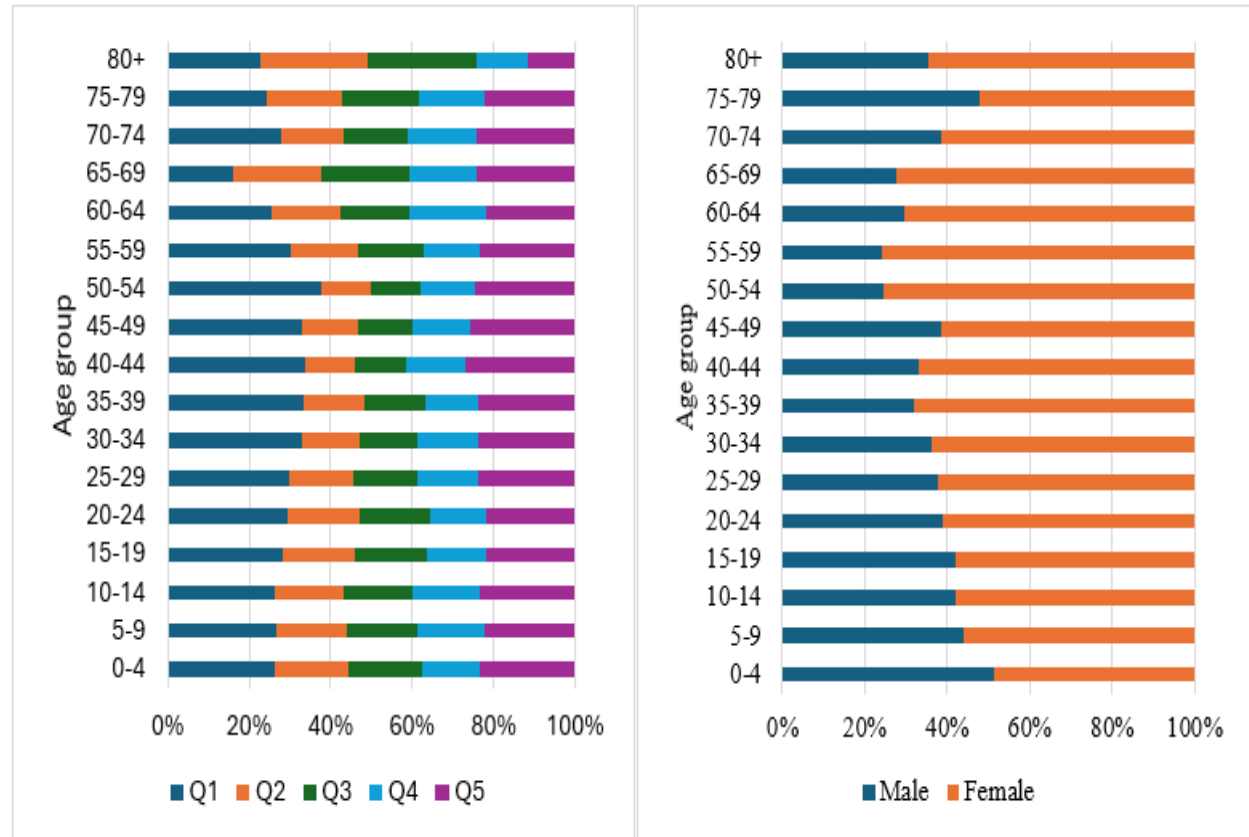
- We adopted the OECD SPHeP microsimulation model, considering a 7-year time horizon, 5% discount rate, 2.1% annual population growth rate, age, wealth quintile and gender-specific resistance risk profile across 24 AMR causative pathogens.
- The simulation was performed in R programming ([Krijkamp et al., 2018](#)).



Source: [OECD, 2023](#)

# Key findings 1: Predicted annual episode of AMR infections by wealth quintile and gender, 2030

- ✓ The simulation predicted 77,760 resistant bacterial infections annually based on the age-specific resistant risk profile, of which about 60% occur in children under 5 years and 13.1% in the older population over 60 years old in a business-as-usual scenario.
- ✓ Excluding Mycobacterium TB, 66% of the predicted resistant infections are hospital-acquired, driven mostly by MRSA, Streptococcus pneumoniae, E. coli, and K. pneumoniae.
- ✓ Subgroup analysis shows that resistant infections are relatively higher in males under 5 years than in females.



Note: Q1 – poorest quintile, Q5 – wealthiest quintile

## Key finding 2: Predicted annual mortalities due to AMR infections

- Up to 6,269 people may succumb to AMR infections each year.
- The analysis by infection syndrome suggests that bloodstream infections, regarded as the most severe type, could account for approximately 41.1% of these deaths, followed by 24.4% for lower respiratory tract infections (LRI) and 16.7% for peritoneal and abdominal infections.

Infection syndrome	Gram negative resistant bacterial infections	Gram positive resistant bacterial infections	Total
	N (%)	N (%)	N (%)
Bloodstream	1981 (53.5)	597 (23.3)	2,578 (41.1)
Lower respiratory infections & thorax*	-	1532 (59.8)	1532 (24.4)
Peritoneal & abdominal infection	835 (22.5)	209 (8.1)	1044 (16.7)
Tuberculosis**	407 (11.0)	-	407 (6.5)
Meningitis & central nervous system infection	339 (9.1)	-	339 (5.4)
Bacterial skin infection	-	199 (7.8)	199 (3.2)
Urinary tract infection & pyelonephritis <sup>β</sup>	93 (2.5)	2 (0.05)	95 (1.5)
Endocarditis & cardiac infection	21 (0.6)	17 (0.7)	38 (0.6)
Diarrhea	19 (0.5)	5 (0.2)	24 (0.4)
Bones & joints infections	11 (0.3)	2 (0.05)	13 (0.2)
Predicted annual mortalities	3,706 (100.0)	2563 (100.0)	6,269 (100.0)

\*Predominantly caused by *Streptococcus pneumoniae*, \*\*Highly controversial mycobacterium organism in terms of classification under gram negative and gram positive bacterial [22], <sup>β</sup>Mostly caused by *E. coli* infection.

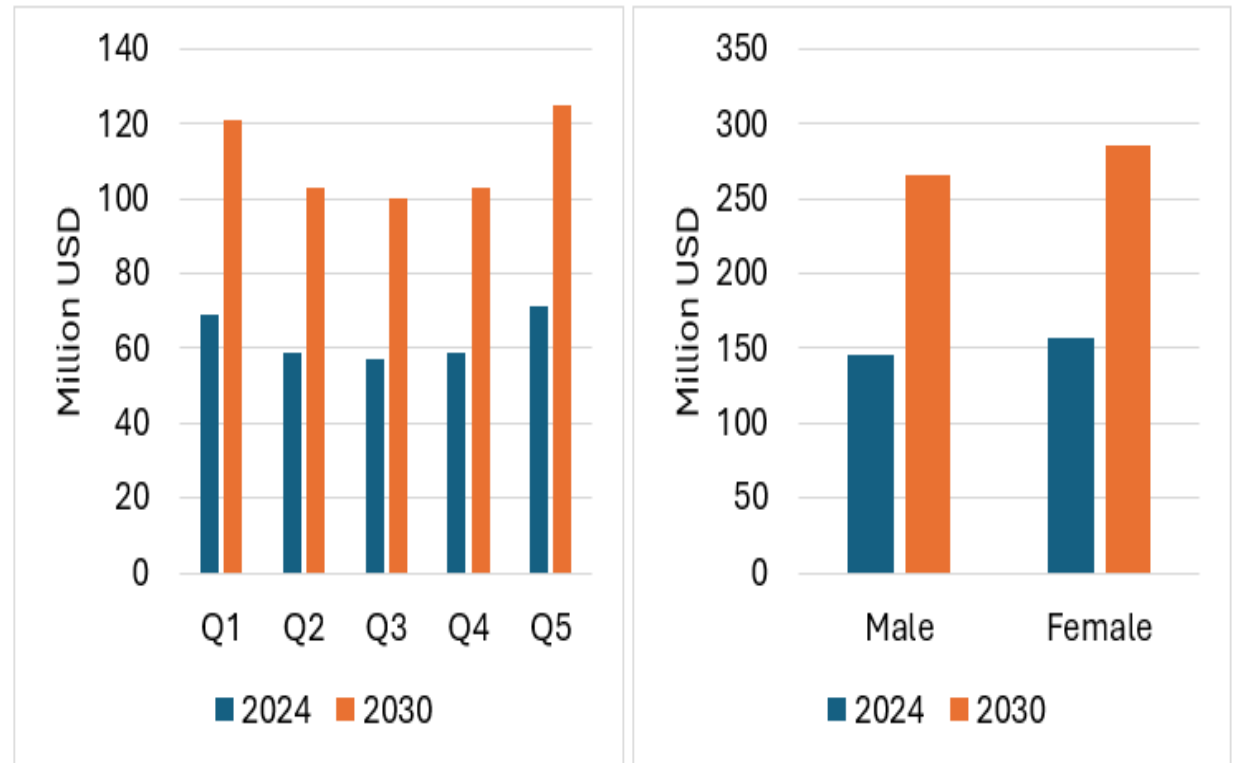
## Key finding 3a. Summary of predicted annual societal costs attributable to AMR (2024 PPP adjusted in international US\$)

- From a societal perspective, the modelling results indicate that AMR infections may cost Ghana an estimated average of \$435 million annually between 2024 and 2030.
- AMR-attributable mortality accounted for 40.6% of the predicted endpoint cost, followed by costs to healthcare providers (24.1%), direct medical costs to patients and caregivers (22.4%), productivity loss for surviving patients and caregivers (10.4%), and direct non-medical costs to patients and caregivers (2.6%).

Cost components	Predicted average cost over study duration (in million USD)	Predicted average cost in 2024 (in million USD)	Predicted average cost in 2030 (in Million USD)	% of total cost
Patient out-of-pocket expenditures				
Direct medical cost	97.5	67.9	123.5	22.4
Direct non-medical cost	11.3	7.8	14.2	2.6
Provider costs	104.4	73.2	132.9	24.0
<b>Sub-total Direct costs</b>	<b>213.2</b>	<b>148.9</b>	<b>270.7</b>	
Indirect costs (productivity loss)				
Indirect cost for surviving patients	45.2	31.7	57.5	10.4
Indirect cost due to mortality	176.6	123.3	224.1	40.6
<b>Sub-total Indirect costs</b>	<b>221.9</b>	<b>155.0</b>	<b>281.6</b>	
<b>Total</b>	<b>435.1</b>	<b>303.9</b>	<b>552.3</b>	<b>100.0</b>

## Key finding 3b. Simulated societal cost by gender and wealth quintile (2024 PPP adjusted in international US\$)

- We observed that although the populations in the fourth and fifth quintiles may have a lower rate of infections, they contribute to 41.3% of the estimated annual societal costs due to the higher value of a day of lost work.
- Additionally, the projected annual societal cost is about seven million dollars higher for males under five than for females (108 versus 101 million).

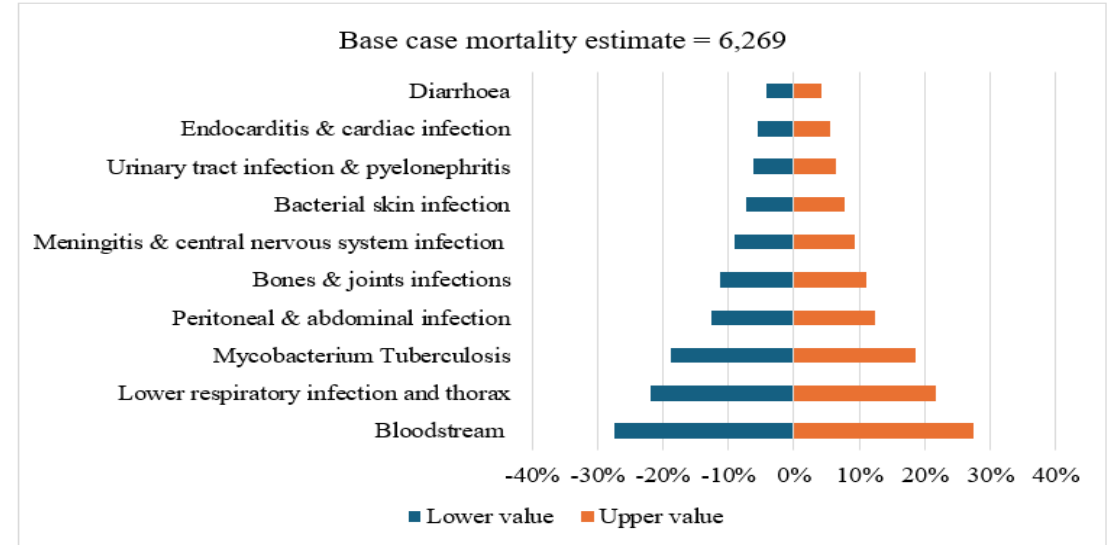


Note. Q1 – poorest quintile, Q5 – richest quintile

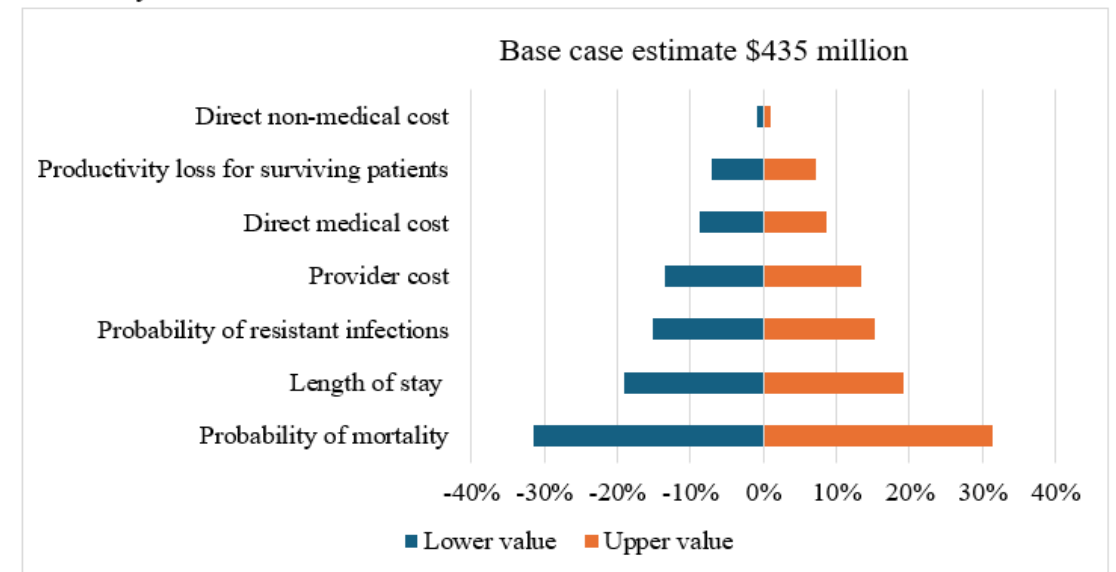
# Key finding 4. Sensitivity results

- Results from the multiway sensitivity analysis show that the estimated number of AMR-attributable mortalities could range between 1,567 and 9,113 if all lower and upper uncertainty values replace the mean mortality estimate, respectively.
- Additionally, we observed that the estimated annual societal cost is about 31% sensitive to the probability of mortality, followed by length of stay (19.4%), and the risk of resistant infection (15%), among others.

Sensitivity result for simulated mortality estimate



Sensitivity result for simulated societal cost estimate





GHANA CHRISTIAN  
UNIVERSITY COLLEGE  
ADVANCING EXCELLENCE BY TRANSNATIONAL LEADERSHIP

# Collaborations



**THANK YOU FOR  
LISTENING**

- **LET'S FIGHT AMR  
TOGETHER**

