

Economic impact of inappropriate antibiotic use: the case of upper respiratory tract infections in Ghana

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**Introduction**

- An important driver of antibiotic resistance in low and middle-income countries (LMICs) is inappropriate antibiotic use.
- Inappropriate antibiotic use is prevalent in LMICs due to inadequate access to approved healthcare accentuated by a high disease burden.
- Recent studies have shown that lack of knowledge and not being able to recognise antibiotics may play a considerable role in inappropriate use.
- The estimated future AMR cost are potentially large, imposing a major cost to the world economy especially, in LMICs.
- However, very little is known about the potential economic impact of inappropriate antibiotic use in LMICs.
- The objective of this study was to perform an economic impact analysis of inappropriate antibiotic use, related to upper respiratory tract infections (URIs) treated with antibiotics in Ghana.

**Methods**

- A top-down, retrospective economic impact analysis of inappropriate antibiotic use for URIs was conducted.
- Two inappropriate antibiotic use situations were considered: 1. URIs treated with antibiotics, against recommendations from clinical guidelines; and 2. URIs that should have been treated with antibiotics according to clinical guidelines, but were not.
- The analysis included data collected in Ghana during the ABACUS project (household surveys and exit-interviews among consumers buying antibiotics), scientific literature and stakeholder consultations.
- Cost data was recorded in Ghanaian cedi (GHS), adjusted to 2020 price levels where relevant and subsequently converted into United States dollars (USD) using the average annual 2020 exchange rate.
- First, all variables were combined to calculate the total annual health care cost, productivity loss, travel cost, cumulative cost and cumulative cost per capita. Second, we determined the cost drivers.
- Additionally, cost saving projections were computed based on potential effects of future interventions that improve antibiotic use.

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**Results**

**Inappropriate antibiotic use: total annual cost and cost drivers**

The total annual cost for inappropriate use situations 1 and 2 are presented in Table 1.

- For situation 1, the total annual cumulative cost (689 million (M) USD) mainly consisted of productivity loss (654 M USD – 95%), followed by health care cost (18 M USD – 3%) and, lastly, travel cost (17 M USD – 2%).
- Regarding situation 2, the total annual cumulative cost (286 M USD) was also mostly accounted for by productivity loss (277 M USD – 97%), followed by travel cost (7 M USD – 3%) and, lastly, health care cost (2 M USD – 1%).

Table 1. Economic analyses inappropriate use situations 1 & 2: outcomes – 2020, rounded

Total annual cost	Inappropriate use situation 1			Inappropriate use situation 2		
	VARIABLE	VALUE (USD)	% of CC	VARIABLE	VALUE (USD)	% of CC*
	Health care cost	17,758,000	3	Health care cost	1,606,000	1
	Productivity loss	654,044,000	95	Productivity loss	276,852,000	97
	Travel cost	17,094,000	2	Travel cost	7,236,000	3
	Cumulative cost (CC)	688,896,000		Cumulative cost (CC)	285,694,000	
	Cumulative cost per capita <sup>†</sup>	22.25		Cumulative cost per capita <sup>†</sup>	9.23	

USD: United States dollar. \*: Sum exceeds 100% due to rounding. Projected population of Ghana in 2020: 30,955,204.

**Cost saving projections**

Different cost saving projections for both situations are presented in Table 2, based on hypothesised reductions in situation occurrences due to future efforts that reduce inappropriate antibiotic use.

- Possible cumulative cost savings are higher for situation 1 (69 M USD – 482 M USD) than for 2 (29 M USD – 200 M USD) at national level for Ghana.
- For both situations, preventing productivity loss offers most room for cost reductions.

Table 2. Potential effects of reducing inappropriate antibiotic use: cost saving projections – rounded

	Inappropriate use situation 1. Projected reduction rates (%) & associated cost savings (millions)					Inappropriate use situation 2. Projected reduction rates (%) & associated cost savings (millions)				
	- 0% (baseline*)	- 10%	- 30%	- 50%	- 70%	- 0% (baseline*)	- 10%	- 30%	- 50%	- 70%
Number of situation occurrences	19	17	14	10	6	8	7	6	4	2
Health care cost savings (USD)	0	2	5	9	12	0	0.2	0.5	0.8	1
Productivity loss savings (USD)	0	65	196	327	458	0	28	83	138	194
Travel cost savings (USD)	0	2	5	9	12	0	0.7	2	4	5
Cumulative cost savings (USD)	0	69	207	344	482	0	29	86	143	200

USD: United States dollar

**Conclusion**

- This study demonstrates that inappropriate antibiotic use leads to substantial economic cost in a LMIC setting that could have been prevented.
- We recommend investment in novel strategies to counter these unnecessary expenditures. As the projections indicate, this may result in considerable cost reductions.
- By tackling inappropriate use, progress can be made in combatting antimicrobial resistance.

