MAKERERE UNIVERSITY

IDI INFECTIOUS DISEASES INSTITUTE

Technical Brief
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The Economic Burden of Antimicrobial Resistance on the Human Health Sector in Uganda: Insights from a Cost-of-Illness Study

Background

Antimicrobial resistance (AMR) is a significant public health concern, leading to higher mortality compared to HIV, Malaria, and Tuberculosis.[1] Antimicrobial-resistant organisms are more difficult — or impossible — to treat, leading to prolonged hospital stays and increased healthcare costs.[2] It is, therefore, essential that we preserve the currently available antibiotics to ensure the continuity of clinical care, which is highly dependent on the availability of efficacious antibiotics. Using evidence-based and data-driven approaches, the Centres for Antimicrobial Optimisation Network (CAMO-Net) is creating and nurturing a sustainable and equitable ecosystem for global research to optimise the use of antimicrobials in humans through strengthening South-South and South-North partnerships.

Problem Statement

AMR is now the leading cause of death[3] and is largely driven by inappropriate use of antibiotics in human and animal health. Other drivers of AMR include: limited access to quality-assured medicines and diagnostics, inadequate infection prevention and control measures, and insufficient surveillance systems to track resistance patterns.[4]

AMR has been documented for every antibiotic that is currently used in clinical practice.[5] This not only threatens but is actively eroding the current and future benefits of antibiotics, leading to longer hospital admissions and a higher risk of morbidity or mortality related to the burden of bacterial illnesses.

AMR also indirectly affects labour productivity by reducing workforce productivity and participation due to morbidity and premature mortality, thereby limiting economic growth and human capital development.[6] Notably, the economic burden of AMR may potentially extend beyond direct healthcare (health system) costs, intangible costs (such as pain and suffering), and indirect costs (including lost productivity) to impact Uganda's economic development, as measured by the Human Development Index (HDI).

A decline in life expectancy due to drug-resistant or untreatable infections negatively impacts the health component of the HDI, while reduced labour productivity affects both the income and education indicators in the long term.

[1] Global burden of bacterial antimicrobial resistance in 2019
[2] WHO - Antimicrobial Resistance
[3] Burden of infectious diseases and bacterial antimicrobial resistance in China
[4] Are antibiotic prescription practices in Eastern Uganda concordant with the national standard treatment guidelines?
[5] WHO - Antimicrobial Resistance Fact sheet

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The Centre for Global Development's recent estimates indicate that AMR increases the annual global healthcare cost by $66 billion—and may potentially rise to $159 billion—if interventions to mitigate AMR are not implemented.[7] This report also indicates that low- and middle-income countries bear the greatest burden of AMR. Although concerns about AMR in Uganda are increasing, implementing policies to reduce its impact requires evidence of its economic burden.

Unfortunately, most studies have focused on middle- and high-income countries, highlighting evidence, empirical, and action-knowledge gaps that limit the development and implementation of health policies in low-income countries, like Uganda. This study provides insights into the economic burden of AMR in Uganda, underscoring the need for urgent interventions to mitigate its economic and public health implications.

Technical Approach

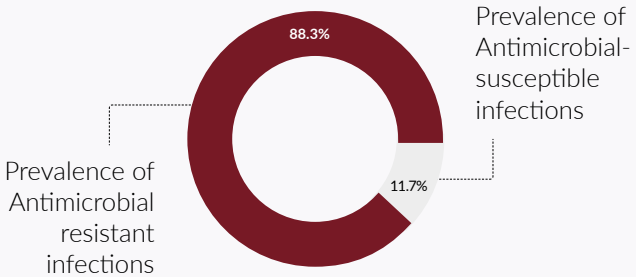
To address these knowledge and empirical evidence gaps on the economic costs of AMR and build capacity towards investment in AMR containment, CAMO-Net conducted a prevalence-based cost-of-illness study to quantify the economic burden of AMR in Uganda. The study utilized:

- A societal perspective, combining the viewpoint of the health system and the patient
- Clinical outcomes and cost data from nine regional referral hospitals (RRHs)
- The reference case for estimating economic costs for global health services and interventions and other costing guidelines.
- An item-based bottom-up (micro-costing) approach to estimate direct medical (health system) costs, including reduced hospital capacity, capital costs (space used by AMR patients, medical and non-medical equipment, fleet and associated costs, and training), recurrent costs (personnel, sundries-antibiotics, laboratory supplies and consumables, utilities, maintenance of medical equipment and waste management), and reduced hospital capacity, as recommended by the one health costing framework.
- The human capital approach, where future productivity is used as a proxy for lost future income, to determine the impact of AMR-related morbidity and premature mortality on the workforce, including early retirement, sick leave, and premature mortality.
- Healthcare system analysis to evaluate the financial strain on hospitals and public health programs.
- Patient perspective analysis to evaluate the economic impact of AMR on patients and their families, relatives, and friends, including the costs of informal care provided by relatives and friends, foregone leisure time, presenteeism (reduced productivity at work), absenteeism, and out-of-pocket expenses.
- All costs from the literature were adjusted for inflation to 2024 US dollars using local consumer price indices and then converted to international US dollars based on purchasing power parity (PPP).
- Data was collected from healthcare facilities, national health databases, published and grey literature, and policy reports to provide a holistic view of AMR's economic impact.

Results and Achievements

Clinical Outcomes

- Prevalence: The prevalence of antimicrobial-resistant infections was 88.3%, whereas antimicrobial-susceptible infections had a prevalence of 11.7%.
- Length of hospital stay: Patients with AMR infections spent a median of 19 days in the hospital, compared to 14 days for patients with susceptible infections.
- Recovered with complications: 16 patients with AMR infections recovered with complications, compared to one patient with susceptible infections.
- Number of deaths: 33 patients with AMR infections died, compared to one patient with susceptible infections.



[6] Antimicrobial Resistance: Implications and Costs
[7] Forecasting the Fallout from AMR: Economic Impacts of Antimicrobial Resistance in Humans
[8] Reference Case for Estimating the Costs of Global Health Services and Interventions
[9] Methods for the Economic Evaluation of Health Care Programmes. 4th Edition
[10] A one health framework to estimate the cost of antimicrobial resistance

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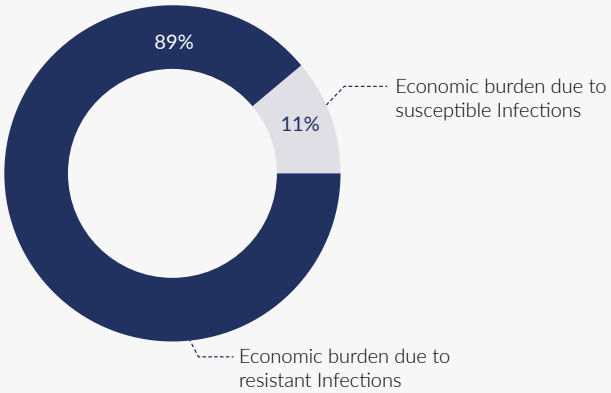
Economic Burden Estimates

Annual societal cost of AMR:

- Annual societal cost of AMR: The annual cost of treating bacterial infections was estimated at $25,152,120 across nine RRHs.

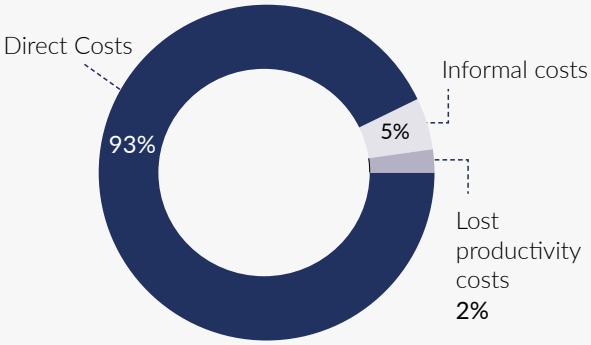
AMR Infections Account for 89% of Total Treatment Costs

- Patients with AMR infections contributed $22,297,235, accounting for 89% of the total costs, while patients with susceptible infections contributed $2,854,886, representing 11%.



Distribution of the economic burden of AMR by cost category

Direct healthcare (health system) costs accounted for 93% of the total economic burden, lost productivity costs accounted for 5%, and informal care costs accounted for 2%.



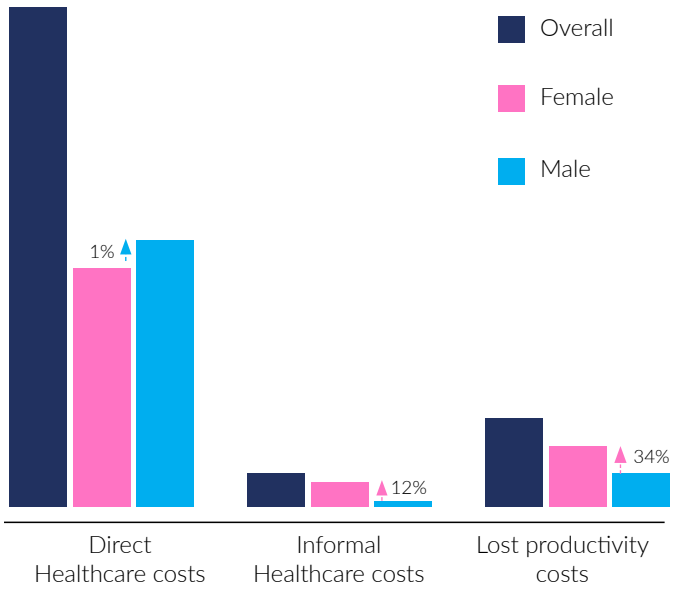
- Of the estimated total direct healthcare costs of $23,527,860, recurrent costs accounted for 85%, while capital costs contributed 10%.
- Of the estimated total direct healthcare costs of $23,527,860, personnel and sundries/antibiotics contributed 40% and 38%, respectively.
- Of the total patient costs of $1,624,261, lost productivity costs accounted for 75%, while informal care costs contributed 25%.
- Of the estimated total informal care costs of $400,168, foregone leisure accounted for 50%, while accommodation, food and out-of-pocket expenses contributed 22%, followed by presenteeism at 20%.
- Of the estimated total lost productivity costs of $1,223,642, premature mortality costs accounted for 62%, while granted early retirement contributed 37%.

Per-patient costs:

- Annual societal cost per AMR patient was $77,391, with an AMR patient contributing $77,691, while a patient with a susceptible infection contributed $74,528.
- Annual health system cost per AMR patient was $72,393, with an AMR patient contributing $72,387, while a patient with a susceptible infection contributed $72,441.
- Annual patient cost per AMR patient was $4,998, with an AMR patient contributing $5,304, while a patient with a susceptible infection contributed $2,087.

Gender disparity

- Direct healthcare costs were 1% higher in males ($20,869,211) than in females ($20,680,987).
- Informal care costs were 12% higher in females ($188,549) than in males ($165,348).
- Lost productivity costs were 34% higher in females ($621,567) than in males ($409,769).



Lessons Learned

CAMO-Net's experience has generated the following key lessons:

- Implement national AMR action plans with clear funding mechanisms.
- Foster collaboration among healthcare providers, researchers, and policymakers to develop sustainable, cost-effective AMR mitigation strategies.
- Policymakers must prioritize funding for AMR surveillance and public awareness campaigns.
- Strengthening antimicrobial stewardship programs is critical to reducing unnecessary antimicrobial use.
- Strengthen regulatory frameworks to control the distribution and use of antibiotics.
- Increase public education on the responsible use of antibiotics and the risks associated with AMR.
- Further research is needed to: (1) assess the economic burden of AMR across other One Health sectors, including animal health, water, and the environment; and (2) apply an incidence-based cost-of-illness approach to track AMR patients over an extended period to estimate final outcomes and associated costs.

Conclusion

The societal cost of AMR is substantial and appears to be marginally greater in females than in males. Direct healthcare and lost productivity costs were major contributors to the societal economic burden of AMR. The economic impact of AMR in Uganda underscores the urgent need for coordinated action to combat resistance. Strengthening healthcare policies, investing in preventive measures, and promoting responsible antibiotic use can significantly reduce the AMR burden, improving public health and macroeconomic outcomes in the long term.

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About CAMO-Net

The Centres for Antimicrobial Optimisation Network (CAMO-Net) is a unique global research partnership. Our aim is to address antimicrobial resistance and support antimicrobial optimisation for human use. This research is underpinned by the values of equity, local leadership, co-production of activities, knowledge mobilisation, mutual cross-regional learning, training, capacity and capabilities strengthening, and output sharing. The vision of CAMO-Net is a world where the appropriate, evidence-based use of antimicrobials is commonplace, supported by equitable availability and accessibility.

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