A maternal Klebsiella pneumoniae *vaccine could avert $6.9 billion across 107 low- and middle-income countries each year*

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Potential economic impact of a maternal *K. pneumoniae* vaccine in 107 low- and middle-income countries (LMICs)

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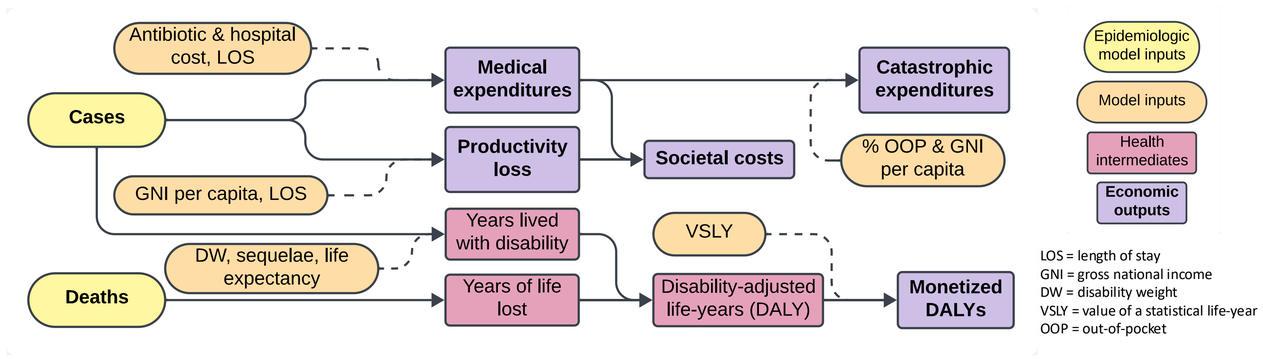
Background

Globally, there are an estimated 1.3-3.9 million neonatal sepsis cases annually, with *K. pneumoniae* being one of the leading causes in LMICs (1). *K. pneumoniae* can display resistance to common antibiotics and ranks among the top six pathogens causing deaths related to antimicrobial resistance (2). Modelling estimates show that a maternal vaccine against *K. pneumoniae* could substantially reduce the health burden associated with neonatal sepsis (3). In this study, we estimate the economic burden that could be averted by such a vaccine in 107 LMICs.

Methods



Key takeaways

- Through a maternal *K. pneumoniae* vaccine, countries could avert an average of US$1.17 per capita in monetized DALYs (*Figure 1*).
- Among common antibiotics, aggregate avertable losses across 107 countries are highest when considering resistance to ampicillin, a first-line treatment (*Table 1*).
- Countries in the African region would benefit the most from a maternal *K. pneumoniae* vaccine on a per capita basis when accounting for resistance to first- and second-line treatments (*Figure 2*).
- Low- and lower-middle income countries are disproportionately affected by the increasing costs associated with antibiotic resistance in the form of relatively higher antibiotic prices (*Figure 3*).

Findings

Across 107 countries, a *K. pneumoniae* maternal vaccine could avert US$6.9 billion (95% CI: 5.6-8.3) in monetized DALYs annually, including resistant and susceptible cases.

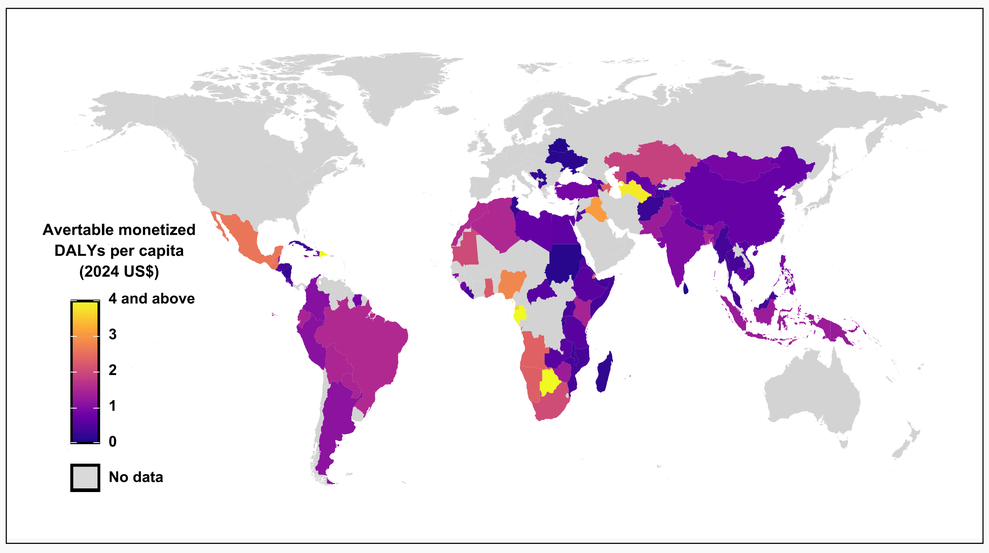


Figure 1. Annual vaccine-avertable monetized DALYs per capita.

DALY = disability-adjusted life-year

Table 1. Annual vaccine-avertable economic burden, 2024 US$ (95% CI)

Resistance type	Monetized DALYs, *in billions*	Societal costs, *in millions*	
		Medical expenditures	Productivity loss
Ampicillin	5.4 (4.3-6.6)	97.0 (35.6-200.9)	27.1 (18.9-37.0)
Gentamicin	4.3 (3.2-5.6)	73.1 (26.6-153.8)	19.2 (12.6-27.4)
Ceftazidime	4.0 (2.8-5.2)	62.0 (22.8-132.9)	15.5 (9.7-23.2)
Meropenem	2.6 (1.7-3.6)	47.7 (17.2-102.4)	12.4 (7.7-18.6)

CI = confidence interval

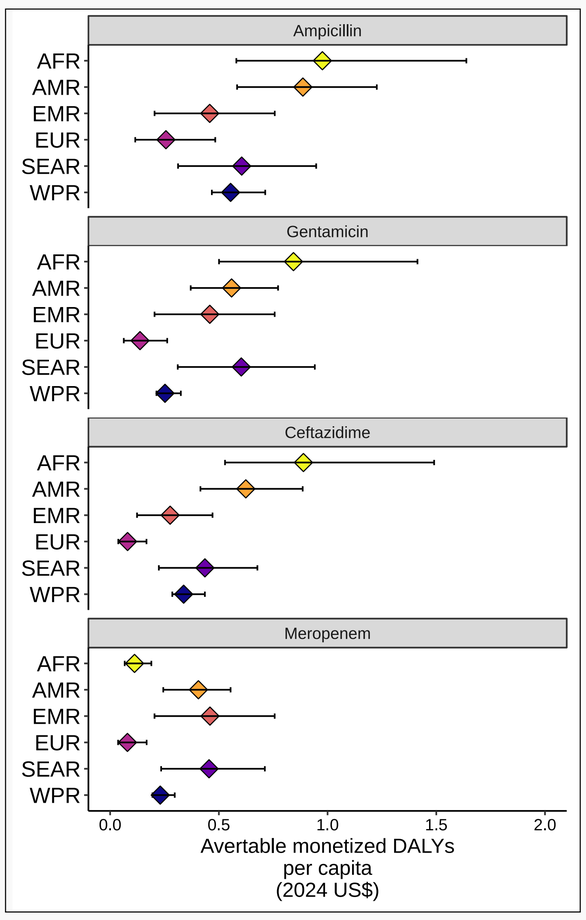


Figure 2. Annual vaccine-avertable monetized DALYs per capita, by resistance type and region.

DALY = disability-adjusted life-year, AMR = Americas, AFR = Africa, EMR = Middle-East, EUR = Europe, SEAR = South-East Asia, WPR = Western Pacific

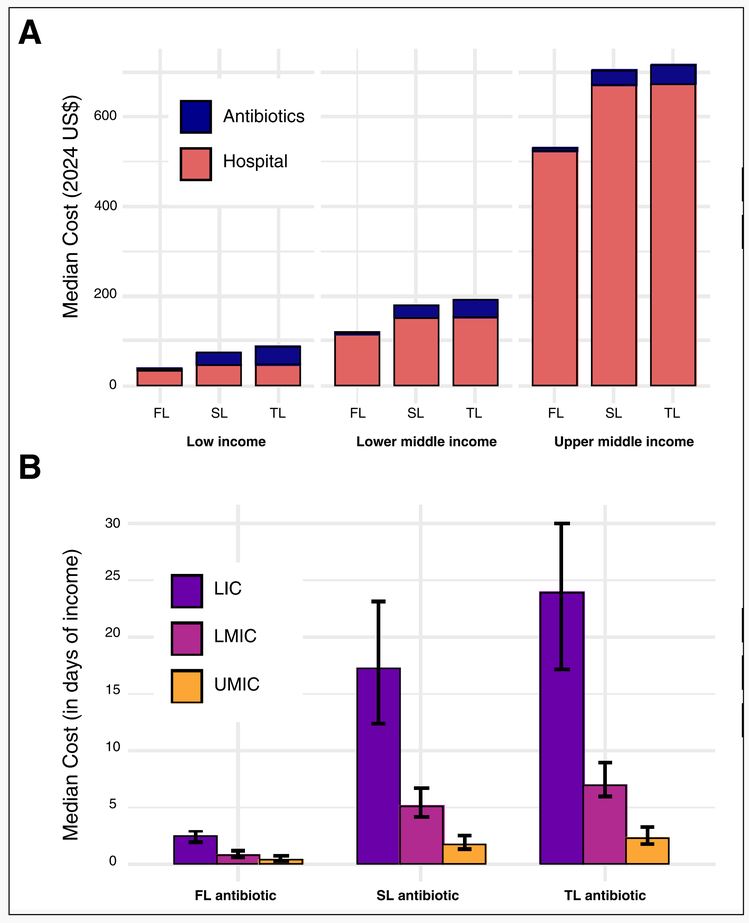


Figure 3. A) Median composition of medical expenditures per case; B) Median cost of antibiotic treatment (in days of income) per case.

FL = first-line, SL = second-line, TL = third-line, LIC = low-income country, LMIC = lower-middle income country, UMIC = upper-middle income country

Discussion

Our results indicate that a maternal *K. pneumoniae* vaccine could address disparities associated with the burden of neonatal sepsis in LMICs by substantially reducing the societal economic burden and catastrophic health expenditures. Given increasing resistance to third-line treatments globally, investing in the development of a safe and effective maternal *K. pneumoniae* vaccine should be an international priority. The framework provided in this study could be used for other vaccines to provide regional and country-specific estimates to inform vaccine prioritization and decision-making.

Additional Information

Model assumptions: 70% vaccine efficacy, coverage equivalent to maternal tetanus vaccine
Data sources: Avertable case and death estimates (3), antibiotic resistance prevalence (3), GNI per capita (4), hospital LOS (5,6), antibiotic costs (7-9), life expectancy (4), disability weights (10), risk of sequelae (11), % OOP (12).
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