The Role of Vaccines in Mitigating Antimicrobial Resistance in Mozambique

GARP-Mozambique Policy Brief

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ABBREVIATIONS AND ACRONYMS

AIDS	acquired immunodeficiency syndrome
AMR	antimicrobial resistance
BCG	Bacillus Calmette-Guérin
DALY	disability-adjusted life year
Hib	*Haemophilus influenzae* type B
GDP	gross domestic product
HIV	human immunodeficiency virus
LRTI	lower respiratory tract infection
MCV	measles-containing vaccine
OOP	out-of-pocket
PCV	pneumococcal conjugate vaccine
RR-TB	rifampin-resistant tuberculosis
TB	tuberculosis
TCV	typhoid conjugate vaccine
WHO	World Health Organization

KEY MESSAGE

Antimicrobial resistance (AMR) is a global health challenge that poses a substantial burden on communities and health systems worldwide. Although AMR is driven by antibiotic overuse and misuse, it is exacerbated by factors that affect infectious disease burden, including poor health care access and inadequate water, sanitation, and hygiene infrastructure. By preventing infections in the first place and reducing antimicrobial use, vaccines tackle key drivers of AMR and reduce infectious disease burden.

COUNTRY PROFILE

Mozambique has a population of 34.6 million as of 2024 (World Bank 2026a), with approximately 64 percent residing in rural areas (World Bank 2026b). Life expectancy at birth has increased, reaching 64 years in 2023, up from 49 in 2000 (World Bank 2026c). Despite this progress, communicable diseases—along with maternal, prenatal, and nutritional conditions—accounted for over half (54 percent) of total deaths in 2019 (World Bank 2026d). In 2023, the leading causes of death were human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), neonatal disorders, malaria, lower respiratory tract infections, and tuberculosis (TB) (Table 1) (Institute for Health Metrics and Evaluation 2025a).

Health system financing in Mozambique remains constrained. In 2023, health care expenditure was 8.5 percent of gross domestic product (GDP) (World Bank 2025a), yet per capita spending was low, with government health expenditure at US$14.01 and out-of-pocket (OOP) expenditure at US$5.49 (World Bank 2025b, 2025c). The Universal Health Coverage service coverage index was 50 out of 100, and 30 percent of the population faced financial hardship due to OOP health expenditure in 2022 (World Bank 2026e).

AMR has a substantial impact on infectious disease burden in Mozambique, which ranks among the top 10 globally in age-standardized mortality rates associated with AMR (Institute for Health Metrics and Evaluation 2025b). In 2021, AMR contributed to 5,760 deaths and was associated with 24,500 others (Institute for Health Metrics and Evaluation 2025a). Though AMR research in Mozambique is limited, available studies reveal widespread resistance to multiple antibiotics, with *Staphylococcus aureus* and *Escherichia coli* comprising the most frequently isolated bacteria (Vubil et al. 2017). *S. aureus* isolates from pediatric inpatients under 15 in

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secondary health care facilities in the Maputo province showed high resistance to penicillin (89–90 percent) and tetracycline (48–59 percent) (Vubil et al. 2017). In animal health, isolates from dairy cows exhibited high resistance to penicillin (43 percent) and lower resistance to tetracycline (16 percent) and erythromycin and clindamycin (3 percent) (Nhatsave et al. 2021). Drug-resistant *E. coli* and *Klebsiella* spp. were also detected in drinking water in some studies, raising concerns about the safety of both tap water and bottled water sold on the streets (Salamandane et al. 2021; 2022).

These findings across hospitalized patients, animals, and water sources highlight the potential One Health risks of nosocomial infections, zoonotic transmission, community spread, and environmental contamination by resistant bacteria (Lv et al. 2024; Tobin and Zahra 2026). Although comparing resistance rates across studies is challenging due to the diversity of methods and variables, the evidence emphasizes the need for improvements in antimicrobial susceptibility data collection, antibiotic stewardship, infection prevention and control measures, and water, sanitation, and hygiene infrastructure (World Health Organization 2024a).

Table 1. Mortality Due to Common Infections in Mozambique, 2016–2021

Causative pathogen	Disease	Number of deaths	Year
Rotavirus	Diarrheal diseases (in children under 5)	1,216	2016
Streptococcus pneumoniae	LRTI	16,083	2023
Mycobacterium tuberculosis	TB	14,074	2024
Plasmodium falciparum	Malaria	17,946	2025
HIV	AIDS	44,000	2024

AIDS = acquired immunodeficiency syndrome; HIV = human immunodeficiency virus; LRTI = lower respiratory tract infection; TB = tuberculosis

Source: Troeger et al. 2018; Institute for Health Metrics and Evaluation 2023; World Health Organization 2024b, 2025; UNAIDS 2025

ROLE OF VACCINES IN MITIGATING AMR

Despite a well-established track record of reducing infection rates and lowering antibiotic use, vaccines have historically received less attention as tools in the fight against AMR (Jansen et al. 2018). By reducing the incidence and transmission of infections and the need for treatment, vaccines indirectly tackle a key driver of AMR: the overuse and misuse of antibiotics (Figure 1). Optimizing the use of existing vaccines and developing new ones against priority pathogens could avert more than half a million deaths annually associated with AMR (World Health Organization 2023).

Mozambique's commitment to childhood immunization is reflected in its comprehensive vaccination schedule, which aims to protect children against vaccine-preventable diseases from birth through adolescence. The schedule, supported by the Ministry of Health and partners, including Gavi, the vaccine alliance, and the United Nations Children's Fund, includes vaccines against TB, polio, diphtheria, pertussis (whooping cough), tetanus, hepatitis B, pneumonia, rotavirus, among others.

Despite notable progress, additional efforts are required to ensure that vaccines reach target populations and sustain subnational coverage across regions. For instance, coverage rates for vaccines against measles, pneumococcal, and rotavirus infections have been historically low and inconsistent, falling short of the international target of 90 percent (Figure 2) (WHO/UNICEF Estimates of National Immunization Coverage, (WUENIC) 2026)

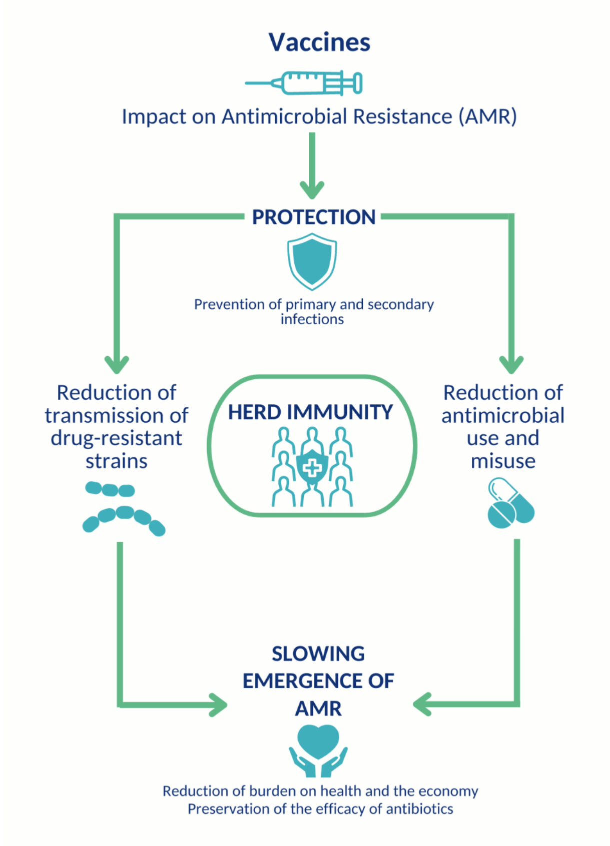

Figure 1. How vaccines address antimicrobial resistance

Source: Kalanxhi et al. 2023

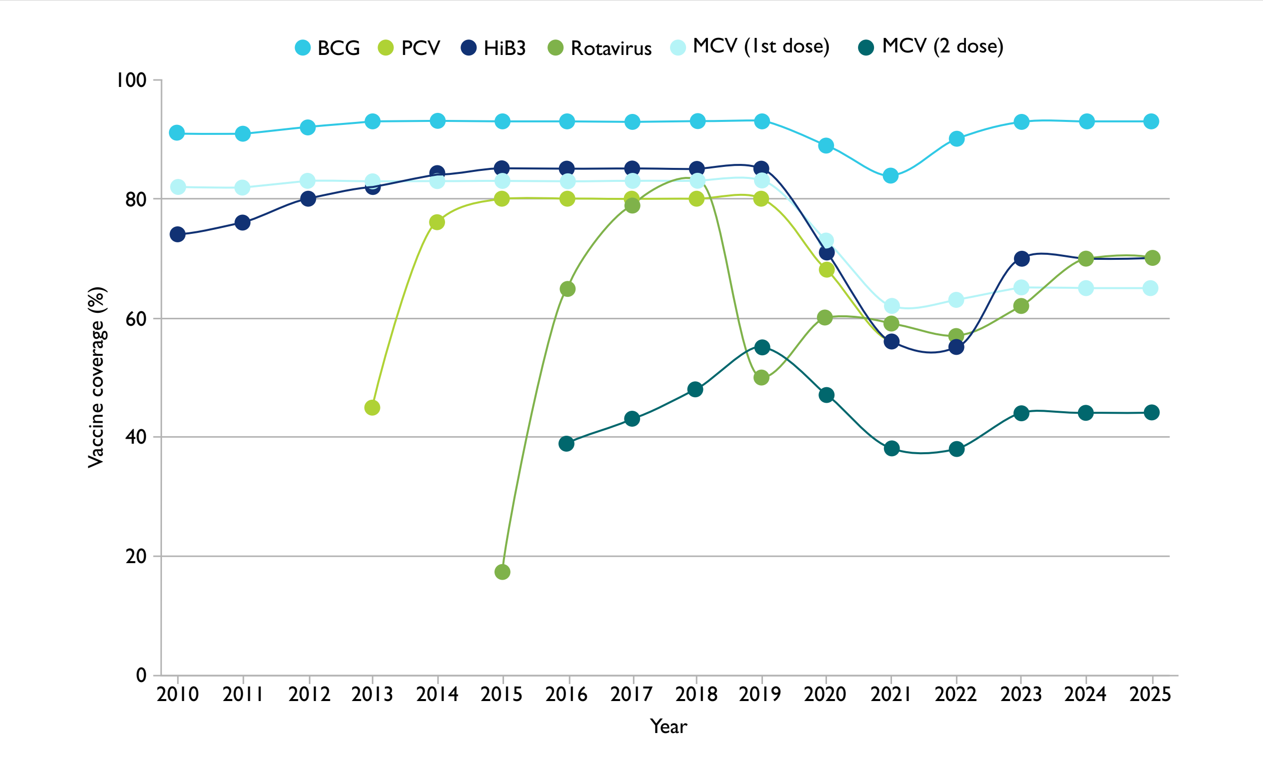

Figure 2. Vaccine coverage estimates in Mozambique, 2025

BCG = Bacillus Calmette-Guérin; Hib = *Haemophilus influenzae* type B; MCV = measles-containing vaccine; PCV = pneumococcal conjugate vaccine

Source: WHO/UNICEF Estimates of National Immunization Coverage 2026

KEY VACCINES THAT ADDRESS AMR

The World Health Organization action framework on leveraging vaccines to reduce antibiotic use and combat AMR highlights that certain licensed and in-development vaccines—aligned with its bacterial priority pathogens list—can play a significant role in addressing AMR (World Health Organization 2021, 2024b; Kalanxhi et al. 2023). The framework emphasizes that increasing vaccine coverage, especially in high-burden areas, helps prevent infections, lowers the demand for antimicrobials, and reduces overuse and misuse. This strategy decreases selective pressure on microbial populations and slows AMR development. In Mozambique, key vaccines, such as pneumococcal conjugate vaccine (PCV10), TB, typhoid conjugate vaccine (TCV), rotavirus, and malaria, could play a crucial role in combating AMR (Kalanxhi et al. 2023).

POTENTIAL OF VACCINES IN MOZAMBIQUE

Between 2016 and 2020, the rotavirus vaccine (Rotarix®) in Mozambique prevented an estimated 4,628 deaths and averted US$3.1 million in health care costs, demonstrating high cost-effectiveness at US$70 per disability-adjusted life year (DALY) averted (Guimarães et al. 2022). Additionally, rotavirus vaccination has been estimated to prevent 7.2 cases (56 percent) of antibiotic-treated diarrhea per 100 children aged 0–23 months (Lewnard et al. 2020). These findings highlight both the positive impact of the rotavirus vaccine and the need for ongoing surveillance and optimization of immunization strategies.

Estimates of the incidence of acute respiratory infection among children aged 24–59 months in Mozambique indicated that 19.4 of 100 cases were attributable to PCV10/13-type *Streptococcus pneumoniae*, and 15.5 of these could be prevented by immunizing children with the PCV (Lewnard et al. 2020). This demonstrates how immunization could substantially reduce antibiotic use, potentially slowing the emergence of AMR.

Furthermore, according to a 2022 mathematical modeling study, adopting routine immunization with TCV would prevent 207,000 cases of multidrug-resistant typhoid in Mozambique over 10 years (Birger et al. 2022). A similar model reported that a routine post-exposure TB vaccination program with 50 percent efficacy, paired with improved disease management measures from 2020 to 2035, would prevent 5.2 percent of rifampicin-resistant tuberculosis (RR-TB) cases and 24 percent of RR-TB deaths (Fu et al. 2021).

Recent modeling data (Hamilton et al. 2023) highlights the potential economic and public health benefits of widespread malaria vaccination. Specifically, maintaining vaccine efficacy at around 40 percent over a decade could avert approximately 48,595 malaria cases, 29 drug-resistant infections, and 124 deaths per 100,000 children vaccinated (Hamilton et al. 2023). The model assumes that children will receive three doses of the vaccine in their first year of life and anticipates that benefits will be even greater if the vaccine is implemented alongside improved malaria diagnostics, treatment, and vector control measures.

ECONOMIC CASE FOR MALARIA VACCINATION

Building on the model by Hamilton et al. (Hamilton et al. 2023), preliminary research from One Health Trust indicates significant health and economic benefits from malaria vaccine implementation over 3-, 5-, and 10-year periods in Mozambique. The vaccine program is also projected to mitigate catastrophic health care expenditure in a crisis scenario. Over a three-year period, the vaccination program is projected to avert 12,400–18,700 cases of catastrophic health care expenditures, saving approximately US$32.7–49.4 million in societal costs and US$4.46–6.79 million in monetized DALYs. Over five years, it could prevent at least 15,000 cases of catastrophic health expenditures, US$38.5–44.9 million in societal costs, and US$5.1–5.9 million in DALY-associated costs. After 10 years, these benefits expand significantly, to prevent 17,700–29,000 cases of catastrophic expenditures, societal costs of approximately US$42.4 million (even with low vaccine efficacy), and US$5.3–8.29 million in DALY-related costs. OOP expenditures associated with resistant malaria could be reduced by up to US$1,500, further emphasizing the economic and public health value of vaccine implementation. In low-resource settings like Mozambique, where reliable diagnostics for febrile illnesses are limited, malaria often mimics bacterial infections, leading to empirical antibiotic use. By preventing malaria episodes, vaccines reduce unnecessary antibiotic prescriptions and lower overall antimicrobial demand.

KEY RECOMMENDATIONS FOR LEVERAGING VACCINATIONS TO ADDRESS AMR IN MOZAMBIQUE

- Strengthen immunization programs to increase vaccine coverage, and implement targeted catch-up vaccination campaigns, particularly for under immunized populations and regions with historically low uptake of vaccines such as measles, PCV, and rotavirus.

- Integrate clear, specific, and measurable vaccination targets into broader AMR strategies, including updates to the National Action Plan on AMR. Policymakers should be actively engaged to prioritize these targets, building on existing frameworks and aligning with WHO guidance on vaccines as a tool for reducing antibiotic demand.

- Incorporate childhood vaccination sensitization into grassroots and community AMR awareness campaigns, highlighting how routine immunization prevents infections, reduces unnecessary antibiotic use, and helps mitigate health and economic costs related to hard-to-treat drug-resistant infections.

*Photo courtesy of Mara Soares

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Initiated in 2008, the Global Antibiotic Resistance Partnership (GARP) has played a critical role in advancing country-led national strategies and policies to address antimicrobial resistance (AMR) in several countries in Africa and Asia.

GARP's current focus is generating cross-disciplinary evidence highlighting the impact of vaccines on AMR in country-specific contexts.

This policy brief lays out the situation in Mozambique and recommends policy measures to use vaccines as tools to control AMR in the country.

 Related research and additional information on vaccines and antimicrobial resistance are available at onehealthtrust.org.

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