The Value of Vaccines in Mitigating Antimicrobial Resistance in Kenya

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LIST OF ABBREVIATIONS AND ACRONYMS

AGE	acute gastroenteritis
AIDS	acquired immunodeficiency syndrome
AMR	antimicrobial resistance
ARI	acute respiratory infection
BCG	Bacillus Calmette-Guérin
CHWs	community health workers
DALY	disability-adjusted life year
ECF	East Coast fever
ESBL	extended-spectrum beta-lactamase
FQNS	fluoroquinolone nonsusceptible
GARP	Global Antibiotic Resistance Partnership
Gavi	Global Alliance for Vaccine and Immunization
GDP	gross domestic product
GSK	GlaxoSmithKline
Hib	*Haemophilus influenza* type b
HIV	human immunodeficiency virus
IPD	invasive pneumococcal disease
IPV	inactivated polio vaccine
KEPI	Kenya Expanded Program on Immunization
LMICs	low- and middle-income countries
MCV	meningococcal conjugate vaccine
MCV2	measles-containing vaccine
MDR	multidrug resistant
MoH	Ministry of Health
MR	measles rubella

NAP	National Action Plan
NTDs	neglected tropical diseases
OPV	oral polio vaccine
PCV	pneumonia conjugate vaccine
PPS	point prevalence survey
PR	predictive interval
RI	routine immunization
RR-TB	rifampicin resistant tuberculosis
RV	rotavirus vaccine
RVA	group A rotaviruses
SIA	supplementary immunization activity
TB	tuberculosis
TCV	typhoid conjugate vaccine
TWG	Technical Working Group
UI	uncertainty interval
VPD	vaccine-preventable disease
WHO	World Health Organization

GLOSSARY OF TERMS

Disability-adjusted life year (DALY)	Disease burden in terms of years of life lost prematurely and loss of productive years due to ill health
Catch-up vaccination	The action of vaccinating an individual who has missed or not received doses of vaccines for which they are eligible, per the national immunization schedule
Cold chain	A system of ensuring that vaccines are maintained at the required low temperatures from production until they reach the consumer; refers to all the equipment, processes, and mechanisms used to store and transport vaccines from producer to user (including vaccine carriers, cold boxes, refrigerators, freezers, and cold rooms) by air, road and over water bodies
Defined Daily Dose (DDD)	A standardized indicator that estimates the average maintenance dose of a drug used for its main indication in adults.
Health worker/s	Health professionals–clinicians and nonclinicians engaged in providing health services but not management and support workers who have no specific training in health matters (for example, administrators, accountants, and clerical workers in health institutions)

EXECUTIVE SUMMARY

Antimicrobial resistance (AMR) is a growing global public health crisis that threatens to undo decades of progress. In 2021, an estimated 1.14 million deaths worldwide were attributed to bacterial AMR, with adults aged 70+ experiencing a more than 80 percent increase in AMR-related mortality. AMR occurs when microorganisms, such as bacteria, viruses, parasites, or fungi, become resistant to antimicrobial treatments to which they were susceptible. One of the primary drivers of AMR is the overuse and misuse of antibiotics in both human medicine and agriculture. In many countries, including Kenya, antibiotics are sometimes prescribed unnecessarily or used incorrectly. This can lead to the survival and proliferation of resistant bacteria.

The best approach to mitigate the rising AMR burden is to significantly reduce infection vulnerabilities across human and animal populations through vaccination. Vaccines safeguard people and animals by preventing infections and their onward transmission, whether antimicrobial resistant or not. This reduces the need for antimicrobial treatments, which lowers the selective pressure on microbial populations that drives the development and spread of resistance. The vaccination approach is cost-effective and an appropriate strategy in Kenya, where healthcare resources are limited and health systems already under significant financial strain. Surveillance data from a Kenyan hospital showed a decline in penicillin-resistant *Streptococcus pneumoniae* prevalence from 28 percent in 2009 to 12 percent in 2014, following the introduction of the pneumococcal conjugate vaccine (PCV). By 2019, Kenya reported a 92 percent reduction in PCV-10-type invasive pneumococcal disease among children under five years and a 74 percent reduction in unvaccinated children aged 5–14 years. Separately, a 39 percent reduction in malaria incidence was reported among children aged 5–7 months who received three doses of malaria vaccine. Efforts to combat AMR in humans through vaccination require a One Health approach, with similar vaccination efforts extended to animals because of the inevitable spread of microbes between humans and animals.

Although the role of vaccines in combating AMR is well recognized, it remains underutilized in national AMR action plans. For instance, Kenya's 2023–2027 plan emphasizes investment in research for new medicines and vaccines but lacks a defined strategy for adopting and integrating available vaccines into AMR control efforts. Addressing this gap through explicit vaccine deployment strategies is essential for strengthening the country's AMR mitigation framework. This policy brief leverages the expertise of the AMR Technical Working Group (TWG) and current data to highlight Kenya's AMR status and propose vaccine adoption as a solution to the growing AMR threat.

*Photo source: Billy 2022

Key Recommendations for Vaccines as an AMR Mitigation Tool

1. Vaccination should be leveraged to combat AMR by preventing infections and reducing antibiotic misuse.

2. Addressing vaccine hesitancy is essential for the success of immunization programs.

3. Maintaining existing vaccines within Kenya's immunization schedule while increasing their coverage is essential for sustained public health impact.

4. Increase coverage of newly introduced vaccines, such as the typhoid conjugate vaccine (TCV), to address endemic diseases and reduce the burden on healthcare systems.

5. Addressing gaps in vaccine accessibility and distribution is necessary to achieve equitable health outcomes and strengthen AMR mitigation efforts.

VACCINE-PREVENTABLE DISEASES (VPDs) HIGHLY IMPACTED BY AMR IN KENYA

Kenya, like many developing nations, grapples with a substantial burden of VPDs, as outlined in Table 1. These diseases pose a significant threat to public health, particularly among children and vulnerable populations. The burden of VPDs is exacerbated by the growing challenge of AMR (Micoli et al. 2021). AMR complicates the treatment of diseases that are otherwise preventable by vaccination, leading to increased morbidity, mortality, and healthcare costs (Salam et al. 2023).

Table 1. Infectious Disease Burden in Kenya

Rank[a]	Category	Percentage of total deaths	Percentage of total DALYs
1	Respiratory infections, TB	29.15	20.04
3	HIV/AIDS, STIs	9.23	9.81
8	Enteric infections	4.24	5.48
12	NTD, malaria	2.36	3.92
14	Other infectious diseases	2.21	2.57

DALYs – disability-adjusted life years; TB – tuberculosis; HIV – human immunodeficiency virus; AIDS – acquired immunodeficiency syndrome, STIs – sexually transmitted infections; NTD – Neglected tropical diseases

Source: Global Burden of Disease (IHME 2025).

a) Ranking in comparison to all causes of DALYs

VPDs Commonly Prevalent in Kenya

a) Pneumococcal Disease

Streptococcus pneumoniae is the primary cause of severe pneumonia, meningitis, and sepsis, particularly in children under five, with a case fatality of up to about 50 percent (Wang et al. 2023). In 2021, pneumonia caused more than 700,000 fatalities among children in low- and middle-income countries (LMICs). Children aged 5–14 with pneumonia accounted for 11.7 percent of all medical admissions and 7.9 percent of mortality recorded at district-level medical facilities in Kenya (Macpherson et al. 2019). *S. pneumoniae* bacteria have developed resistance to several antibiotics, including penicillin, which was once the first-line treatment (Schrag et al. 2004). Penicillin resistance in pneumococcal strains has been reported, reducing its effectiveness (von Specht et al. 2021). Resistance to macrolides, such as erythromycin, has also been observed, complicating the treatment of such infections as pneumonia, meningitis, and otitis media (Cillóniz et al. 2018). Acute respiratory infections are the second leading cause of death in all ages, with pneumonia the largest contributor to the burden of disease among children living in slums (Breiman et al. 2015). *S. pneumoniae* has been recorded to be resistant to chloramphenicol and cotrimoxazole in children and doxycycline, penicillin, and cotrimoxazole in adults (Kobayashi et al. 2017).

b) Measles and Rubella

Measles outbreaks are occasionally caused by gaps in immunization coverage, which continues to be a serious public health risk (Mburu et al. 2021). Between 2003 and 2016, Kenya reported confirmed measles cases with an annual incidence ranging from 2 to 65 cases per million people, with urban residents generally experiencing a higher prevalence than those in rural areas (Lee et al. 2019). By mid-2024, Kenya reported 1,536 cases, including 199 confirmed cases and 11 fatalities (WHO African Region 2024). Measles is a highly contagious viral illness that, especially in young children, can result in serious complications, such as pneumonia, encephalitis,

and even death (Leung et al. 2018). As a virus, it is not immediately curable with drugs; nonetheless, because bacterial infections frequently accompany it, measles is crucial in conversations regarding AMR. It can impair immunity, increasing the risk of secondary bacterial infections, including those caused by *Staphylococcus aureus, S. pneumoniae* and *Haemophilus influenzae*–induced otitis media (Bonagura and Rosenthal 2020). Treatment choices are made more difficult by reports of resistance to ampicillin and other beta-lactam antibiotics in Kenya.

c) Typhoid Fever

The global estimate of typhoid fever burden is 11–21 million cases and 128,000–161,000 deaths annually (WHO 2025b). Increasing AMR complicates treatment and control in endemic regions (Bello et al. 2024). Typhoid fever caused by *Salmonella enterica* serotype typhi (*S. typhi*) is a significant public health issue in Kenya (Ochieng et al. 2022). It is endemic, with the highest burden observed in urban informal settlements and rural areas with inadequate sanitation infrastructure (Ng'eno et al. 2023). It is primarily spread through contaminated food and water, making it prevalent in areas with poor sanitation and limited access to clean water.
If untreated, typhoid fever can lead to severe complications, including intestinal perforation, hemorrhage, and systemic infections, which can be fatal (Ray and Raha 2021). The case-fatality rate in untreated cases can be as high as 10–30 percent (Adesegun et al. 2020). Even with treatment, the case-fatality rate is 1–4 percent, depending on the availability of medical care and emergence of drug-resistant strains.

A growing concern in Kenya is the rise of AMR in *S. typhi* multidrug-resistant (MDR) strains; resistance to first-line antibiotics, such as chloramphenicol, ampicillin, and trimethoprim-sulfamethoxazole, has been increasingly reported (Marchello et al. 2020).

More recently, strains have emerged that are resistant to fluoroquinolones, the current standard treatment, and even third-generation cephalosporins, such as ceftriaxone (Klemm et al. 2018). This resistance complicates treatment protocols and increases the cost and duration of treatment. The AMR of *S. typhi* is also changing, with extensively drug-resistant strains exhibiting simultaneous resistance to fluoroquinolones, third-generation cephalosporins, ampicillin, chloramphenicol, and trimethoprim/sulfamethoxazole spreading globally (Marchello et al. 2020).

d) TB

TB, caused by *Mycobacterium tuberculosis,* remains a major public health challenge. In 2023, the World Health Organization (WHO) estimated that it caused 1.09 million and 161,000 deaths among HIV-negative and HIV-positive people, respectively, worldwide (WHO 2025a). Kenya is among the 30 countries with the highest burden (Abdullahi et al. 2019). The Ministry of Health (MoH) reports indicate that about 139,000 people develop TB annually (35,000 are HIV positive), and 21,600 people die from it (Stop TB Partnership 2025). As of 2020, TB was the fourth-highest cause of death in Kenya (Waruru et al. 2022). Approximately 30 percent of patients are coinfected with HIV, which complicates treatment and significantly increases the risk of mortality (Ngari et al. 2023).

Multidrug-resistant tuberculosis (MDR-TB), defined as resistance to at least the two primary first-line drugs, isoniazid and rifampicin, was observed in 3.6 percent of new and 18 percent of previously treated cases, with an overall prevalence of 5.6 percent (MacNeil 2019). It requires a prolonged regimen combining second-line drugs, which are generally less effective, associated with higher rates of adverse effects, and significantly more expensive (Seung et al. 2015).

In Kenya, TB disproportionately affects the male population, with the highest prevalence among those aged 24–34 (Kenya MoH 2018). Urban areas, particularly informal settlements, bear the brunt of TB, with Nairobi County contributing 15 percent. MDR-TB is estimated to be twice as common in men and affects approximately 2.3 percent of children under 15. By 2020, Kenya had achieved a TB treatment coverage of 51 percent, with a case-fatality ratio of 6 percent (Vassall 2025). Nearly 2.6 percent of all cases are MDR, a trend that jeopardizes the WHO's End TB Strategy that aims to reduce TB mortality by 90 percent and new cases by 80 percent by 2030 while ensuring that no family is burdened with catastrophic expenses.

The economic burden of TB extends beyond direct healthcare costs to include the indirect costs borne by households, such as transportation to healthcare facilities and the loss of income due to illness (Dememew et al. 2024). For many families, TB could lead to catastrophic health expenditures, pushing them further into poverty.

e) Malaria

Malaria continues to be a major public health issue in Kenya, even with expanded intervention measures (Amboko et al. 2020). Annually, the country records approximately 6.7 million clinical malaria cases (Elnour et al. 2023), with 70 percent of the population at risk (Sultana et al. 2017). The disease claims an estimated 4,000 lives each year, predominantly affecting children, and accounts for 13–15 percent of outpatient visits to healthcare facilities (Elnour et al. 2023).

Malaria is one of the leading causes of fetal morbidity and mortality, especially in sub-Saharan Africa (Ebohon et al. 2024). Over the past five years, significant efforts have been made by the government and its partners to combat the disease through prevention and treatment initiatives (Division of National Malaria Programme Kenya and ICF 2021). These efforts include mass and routine distribution of mosquito nets to achieve universal coverage, intermittent preventive treatment for pregnant women, and the parasitological diagnosis and treatment of malaria cases.

Antimalarial drug resistance, particularly in *Plasmodium falciparum,* challenges the treatment and control of malaria. Resistance to aminoquinolines and antifolates is long-standing, yet with greatly decreased use of chloroquine to treat malaria, the prevalence of resistance to it has reduced (Conrad and Rosenthal 2019). Kenya is a hotspot for the emergence of drug resistance in Africa. The resistance of *P. falciparum* to chloroquine diphosphate and later to sulfadoxine-pyrimethamine has been well documented (Akala et al. 2011).

ANTIMICROBIAL RESISTANCE IN KENYA

Although antimicrobials have traditionally been used to treat infections and improve health outcomes, resistance to commonly used ones have posed one of the most serious global public health threats of our time (WHO 2021). The frequently cited *Review on Antimicrobial Resistance* estimates that AMR could lead to 10 million lives lost annually by 2050, in addition to significant clinical and economic consequences (O'Neill 2016). The Global Research on Antimicrobial Resistance project assessed the impact of AMR by estimating deaths and disability-adjusted life years (DALYs) that could be avoided if all drug-resistant infections were replaced with susceptible infections or no infections. In 2019, the study estimated 1.27 million deaths (95 percent uncertainty interval (UI): 0.91–1.7) and 47.9 million DALYs (95 percent UI: 35–64) directly attributable to and 4.95 million deaths (95 percent UI: 3.6–6.6) and 192 million DALYs (95 percent UI: 146–248) associated with bacterial AMR (Murray et al. 2022). AMR is a global challenge affecting all countries regardless of socioeconomic status. In 2021, an estimated 1.14 million deaths were attributed to bacterial AMR. Although AMR-related mortality declined by more than 50 percent in children under five, it increased by 80 percent in adults 70+. Also, resistance of Gram-negative bacteria to carbapenems increased significantly, with attributable deaths rising from 127,000 in 1990 to 216,000 in 2021 (Naghavi et al. 2024).

Sub-Saharan Africa bears the world's largest burden of bacterial AMR (Murray et al. 2022), partly due to the prevailing high levels of poverty, which result in a high burden of infectious diseases, poor regulation of antimicrobial use, and a lack of alternatives to ineffective antimicrobials (Kariuki et al. 2022). The prevalence of AMR as a public health concern is comparable to, and in certain situations exceeds, that of HIV/AIDS and malaria. Kenya, in particular, has been identified as an AMR hotspot. A major contributing factor to its increasing antibiotic resistance problem is the ineffective implementation of regulations, which has led to widespread overuse and misuse of antibiotics across sectors, including agriculture, livestock production, and human health. Point prevalence surveys (PPSs) in Kenyan health facilities reveal concerning trends in antibiotic use. For instance, one study reported that 62 percent of hospitalized patients were on antibiotics, with 42 percent of these from the WHO "Watch" category, indicating higher potential to drive resistance (Kamita et al. 2022). Furthermore, the problem is exacerbated by the uncontrolled release of antibiotics into the environment (Kariuki et al. 2013; Ayukekbong et al. 2017).

The availability of antibiotics without prescription and poorly controlled supply chains contribute to their misuse (Kemp et al. 2021). Inadequate infection prevention control procedures, poor sanitation, and inappropriate food handling techniques all contribute to the persistent spread of AMR, which is prevalent in humans, animals, food products, and the environment (Rware et al. 2024). Tackling AMR requires a

*Photo source: Sqofield 2017

multifaceted and cohesive approach that encompasses understanding of mechanisms and drivers at the individual and population levels, surveillance, antimicrobial stewardship, improved infection prevention and control measures, strengthened global policies, and developing novel antimicrobial therapies (Ho et al. 2024).

The rising threat of AMR in Kenya is particularly concerning, as the country is already grappling with multiple challenges. First, most of the population lives in poverty, and access to quality care remains a challenge (Lokuruka 2020). Second, the public healthcare system is under immense strain due to high workloads, frequent healthcare worker strikes, recurring shortages of essential medicines and supplies, and lack of capacity for routine microbiology testing (Mohiddin et al. 2022; Bahati et al. 2025). Last, Kenya faces other pressing health issues, including elevated rates of maternal and child mortality and a substantial burden of infectious diseases, such as HIV, tuberculosis, and malaria. Consequently, the rise in AMR to commonly used first-line drugs and increasing infections from life-threatening pathogens needs urgent attention (Kalanxhi et al. 2023).

Local PPSs indicate that third-generation cephalosporins and penicillins are among the most commonly prescribed antibiotics in Kenyan hospitals. For example, one study found that penicillin G accounted for 32.2 percent of prescriptions for community-acquired infections, followed by third-generation cephalosporins at 27.6 percent (Kamita et al. 2022). Another PPS reported that ceftriaxone was the most commonly used antibiotic, prescribed in 34.5 percent of cases (123 out of 237 prescriptions) (Nyaboke et al. 2025). These prescribing patterns may contribute to the selective pressure driving resistance in Gram-negative organisms, including carbapenem-resistant *Enterobacterales* and ESBL producers. According to recent research, 7–17 percent of hospitalized patients are impacted by these pathogens, with 39 percent of isolates identified as having "difficult-to-treat resistance" (Ita et al. 2022). The challenge is exacerbated by inadequate routine surveillance and methodological limitations, which undermine the reliability and applicability of local data on antibiotic resistance and usage (GARP 2011). Although Kenya has had AMR surveillance since the 1980s, the lack of microbiology laboratories in numerous healthcare facilities continues to be a significant barrier to effectively monitoring AMR trends.

Data on AMR in Kenya are frequently derived from single-center surveillance studies or point prevalence estimates in tertiary care facilities, which may not accurately reflect the broader population (Kariuki et al. 2022). These facilities often cater to more severe cases or specific socioeconomic and urban populations. Despite these constraints, the data reveal alarmingly high levels of resistance, including multidrug and extensive drug resistance among common pathogens in certain instances. The absence of quantitative data on antimicrobial use and consumption, particularly in agriculture, poses a significant challenge in Kenya and beyond (Mshana et al. 2021).

In 2019, Kenya recorded 8,500 deaths directly attributable and 37,300 deaths associated with AMR (IHME 2023). It ranks 28th out of 204 nations in terms of age-standardized mortality due to AMR. Five key pathogens are associated with AMR and significant mortality (number of deaths): *Klebsiella pneumoniae* (6,200), *Escherichia coli* (5,900), *S. pneumoniae* (5,600), *S. aureus* (5,000), and *S. typhi* (2,400). These are commonly linked to lower respiratory, thoracic, bloodstream, and peritoneal or intra-abdominal infections (IHME 2023; Byarugaba et al. 2024). The high levels of extended-spectrum cephalosporin resistance and MDR among *Enterobacteriaceae* isolates are concerning (Lord et al. 2021; Ogalo et al. 2016).

In 2018, the MoH introduced the AMR Surveillance Strategy (2018–2022). Its main objective was to assess the national burden of AMR among priority pathogens, including *E. coli*, *K. pneumoniae, Acinetobacter baumannii, S. aureus, S. pneumoniae, Shigella* species, *Salmonella* species, and *Pseudomonas aeruginosa,* through laboratory-based monitoring. These pathogens were based on the WHO priority pathogen list and organisms of local priority (WHO 2024b). Five major ones—*S. aureus, E. coli, S. pneumoniae, K. pneumoniae,* and *P. aeruginosa* —accounted for 54.9 percent of deaths globally attributed to the bacteria studied (Ikuta et al. 2022). The most fatal infectious syndromes and pathogens differed based on age and geographical location.

THE ROLE OF VACCINES IN MITIGATING AMR

Vaccines are among other strategies aimed at fighting AMR (Micoli et al. 2021; Jansen et al. 2018), by stimulating the immune system to recognize and respond to specific pathogens, thereby preventing infections from occurring in the first place. The COVID-19 pandemic highlighted the critical importance of vaccination, as the rapid development of safe and effective vaccines became an urgent global priority (Costanzo et al. 2022; Farhud and Zokaei 2021). An antibiotic is designed against a specific target, but vaccines are directed against multiple targets, which makes resistance episodes in the vaccinated population very rare. Additionally, the duration of the protection and herd immunity, if reached, make vaccines more efficient and reliable tools than antibiotics.

Vaccines are used prophylactically and thus effective before bacteria start to multiply following the initial infection (low pathogen burden) and different tissues and organs are affected, which substantially reduces the likelihood that resistance-conferring mutations will emerge and spread. By reducing the incidence of infectious diseases, vaccines decrease the need for antibiotics, which are often overprescribed or misused, leading to the emergence and spread of AMR (Ukuhor 2021).

This reduction in antibiotic usage helps to mitigate the selective pressure driving the development of AMR. Vaccines can also prevent secondary infections that arise as a complication (Costanzo and Roviello 2023). For instance, a single-blind study among 6–60-month-old children in Turkey (Ozgur et al. 2006) established that children with influenza vaccination experienced a significant reduction in acute otitis media, otitis media with effusion, and total otitis compared to the unvaccinated group, confirming the usefulness of vaccination in preventing secondary infections.

Vaccines are also used in veterinary medicine to prevent infectious diseases in livestock and poultry. Antibiotics are extensively used in agriculture, including livestock farming, thereby contributing to the emergence of AMR (Kasimanickam et al. 2021). In Kenya, where agriculture is a significant sector, livestock vaccines can reduce the need for antibiotic use in animals, curbing the spread of resistant bacteria to humans through the food chain (Mudenda et al. 2023).

Vaccines are often regarded as one of the most cost-effective and impactful public health interventions, saving millions of lives each year when implemented at the national level. Over the past 40 years, vaccination has successfully eradicated smallpox and eliminated measles, diphtheria, tetanus, pertussis, and poliomyelitis in populations that have maintained high implementation rates in their programs (Miller and Sentz 2006). Several licensed vaccines targeting bacterial pathogens, such as *H. influenzae* type b, *S. pneumoniae*, and *S. typhi*, and viral pathogens, such as influenza virus and rotavirus, have proven effective in combating AMR. They achieve this by reducing unnecessary antibiotic use, lowering the prevalence of antibiotic-resistant bacterial strains, and fostering herd immunity (Jansen et al. 2021).

The introduction and distribution of vaccines often necessitate strengthening the healthcare infrastructure, including cold chain systems, surveillance, and vaccination programs (Ashok et al. 2017). This indirectly enhances overall healthcare delivery, which can have a positive impact on AMR containment efforts. Vaccine campaigns provide an opportunity to educate the public and healthcare professionals about the prudent use of antibiotics, importance of completing prescribed courses, and dangers of antibiotic misuse (Almutairi et al. 2023). This awareness can help in promoting responsible antibiotic use and combating AMR.

Investing in vaccine research and development can lead to new vaccines targeting pathogens that are becoming increasingly resistant to existing treatments. By developing vaccines against priority pathogens, researchers can help to address gaps in infectious disease prevention and control, ultimately reducing the reliance on antibiotics and combating AMR (WHO 2016). A recent WHO report reveals that vaccines targeting 23 pathogens (excluding gonorrhea) could reduce global antibiotic use by 22 percent, equivalent to 2.5 billion defined daily doses annually. This finding highlights the crucial role of vaccination in combating AMR. Although

some of these vaccines are already available but remain underutilized, others still need to be developed and rapidly introduced to the market (WHO 2024a). Unfortunately, most of the vaccines developed against the main resistant pathogens are still under preclinical and clinical evaluation due to the complexity of pathogens and technical difficulties (Costanzo and Roviello 2023).

VACCINE IMPACT ON AMR IN KENYA

Vaccines have a great potential to mitigate AMR through the reduction of AMR cases, AMR-related deaths, and DALYs. Table 2 shows examples of vaccines and their impacts on AMR in Kenya, demonstrating their crucial role in combating this growing public health threat.

Table 2. Estimated Impact of Vaccines on AMR Burden

Vaccine	Averted AMR cases		Averted deaths		DALYs
	number	percent	number	percent	
TCV[a] (10-year prediction)	*Fluoroquinolone-nonsusceptible (FQNS) typhoid fever*				
Kenya[a]	151,000	71.2	1,266	76.3	65,000
Sub-Saharan Africa	6,819,000	68.8	65,762	65.8	3,093,000
Lower-income countries[b]	42,515,000	61	506,026	59.6	27,923,000
TCV (10-year prediction)	*Multidrug-resistant typhoid fever*				
Kenya[a]	570,000	74.8	4,674	73.3	243,000
Sub-Saharan Africa	14,392,000	68	173,735	65.9	8,019,000
Lower-income countries[b]	21,218,000	65.8	342,725	71.5	16,508,000
Tb[c] **vaccine** (15-year prediction)	*Rifampicin-resistant TB (RR-TB)*				
Kenya	2,100	8	460	6.3	—
Africa	66,000	7.7	18,000	6.5	—
Global[d]	620,000	10	119,000	7.3	—

*Photo source: Macheroux-Denault 2019

a) Estimates of typhoid conjugate vaccines on FQNS and multidrug-resistant typhoid fever (Birger et al. 2022)
b) Average for 73 Gavi-eligible lower-income countries (Birger et al. 2022)
c) Estimates of the effect of TB vaccines with and without an additional improvement program for RR-TB management (Fu et al. 2021)
d) Average for the top 30 countries contributing to 90 percent of global RR-TB burden (Fu et al. 2021)

Vaccines for Bacterial Infections

a) PCV

Pneumococcal diseases are a leading cause of morbidity and mortality among children globally, and their burden might be worsened by AMR (Andrejko et al. 2021). Pneumonia kills more children than any other infectious disease, claiming the lives of over 700,000 children under five, including 190,000 newborns every year and about 2,000 children every day (UNICEF 2024).

In 2011, with support from Gavi, Kenya became one of the first countries in Africa to introduce PCV and the first to use ten-valent pneumococcal conjugate vaccine (PCV10). PCV10 delivered at 6, 10, and 14 weeks of age was introduced in January 2011, accompanied by a catch-up campaign in Kilifi County for children under 5 (Hammitt et al. 2019). Immediately before PCV10 was introduced, the county's annual incidence of clinically defined pneumonia was 1,220 per 100,000. After PCV10, this was reduced by 329 per 100,000 (Silaba et al. 2019).

In Kenya, a 92 percent reduction in PCV-10 type invasive pneumococcal disease has been reported in children up to five and 74 percent in unvaccinated children aged 5–14 (Hammitt et al. 2019). This reduction is linked to decreased antibiotic prescriptions for respiratory infections. Surveillance data show that the PCV10-GSK vaccine has contributed to a reduction in overall pneumococcal colonization and carriage of vaccine-type serotypes (Verani et al. 2024). After PCV10, the carriage of serotypes targeted by it (PCV10-type) decreased in both children under 5 and adults; however, PCV10-type serotypes and penicillin-nonsusceptible pneumococci continued to persist among children, regardless of whether they received catch-up vaccination. This suggests that although the vaccine has reduced carriage, it has not completely eliminated PCV10-type serotypes or antibiotic-resistant strains, potentially due to factors such as incomplete vaccine coverage, natural reservoirs of these strains, or limited efficacy against some serotypes.

b) TCV

Typhoid fever is a major health concern in Kenya, with 97,762 reported cases in 2016; a significant majority (62 percent) occurred in children under 15, indicating that children are particularly vulnerable (Simiyu and Jamka 2018). In 2019, Kenya had 126,098 cases, equivalent to 251 per 100,000 population. Typhoid caused 1,568 deaths in 2019, an increase from the 1,075 reported in 2016; 54 percent of these were among children under 15, indicating that it remains a significant cause of mortality in this age group (Coalition Against Typhoid 2021). In 2024, a study in a Nairobi slum found that 5 percent of patients presenting with typhoid-like symptoms at four local health facilities tested positive for typhoid, with more than a quarter being MDR (Kasiano et al. 2024). An analysis of typhoid samples from three regions in Kenya showed that 82.4 percent were resistant to all five commonly used antibiotics: ampicillin, chloramphenicol, tetracycline, streptomycin, and cotrimoxazole (Coalition Against Typhoid 2021). This indicates an alarmingly high prevalence of MDR typhoid, rendering many first-line treatment options ineffective. Additionally, an analysis of typhoid samples from Nairobi Kenya found that 37 percent were MDR; resistance to ciprofloxacin and nalidixic acid was 43 and 52 percent, respectively (Kasiano et al. 2024). A sharp increase in the latter is an indication of reduced susceptibility to fluoroquinolones, which are the recommended drugs. Genetic analysis showed that MDR typhoid strains in Kenya are part of the lineage linked to MDR typhoid across Asia (Coalition Against Typhoid 2021). This finding suggests that the spread of MDR strains is not limited to Kenya but part of a broader intercontinental transmission of resistant clones.

Typhoid vaccination can reduce the need for antibiotics, slow the expansion of drug-resistant strains, and save lives.

Three large Phase 3 efficacy studies in Bangladesh, Malawi, and Nepal showed that TCV prevented 85, 84, and 79 percent of cases in children 9 months to 16 years old, respectively (Coalition Against Typhoid 2022). A Phase 3 study of the EuTCV (a TCV candidate) was launched by a Kenya Medical Research Institute team in Kericho in 2022. Compared to older vaccines, TCVs have longer-lasting protection, require only one dose, and are suitable for children under two.

Routine immunization (RI) with TCV at age 9 months with a catch-up campaign up to age 15 was predicted to avert 46–74 percent of all typhoid fever cases in 73 countries eligible for Gavi support. Vaccination was predicted to reduce the relative prevalence of antimicrobial-resistant typhoid fever by 16 percent. TCV introduction with a catch-up campaign was predicted to avert 42.5 million cases and 506,000 deaths caused by fluoroquinolone-nonsusceptible (FQNS) typhoid fever and 21.2 million cases and 342,000 deaths from MDR-TB over 10 years (Birger et al. 2022). In July 2025, Kenya added the TCV vaccine to its routine immunization schedule and launched a nationwide campaign to introduce the TCV to over 21 million children aged 9 months to 14 years (Kenya MoH 2025). The initiative aims to reduce drug-resistant typhoid (Kenya MoH 2025).

c) TB Vaccine

In 2021, Kenya recorded an estimated 133,000 TB cases, with approximately 32,000 deaths attributed to it; 76,010 TB cases were reported, and 64 percent of all notified bacteriologically confirmed cases underwent testing for rifampicin resistance (Kenya MoH 2022). Kenya is among the 22 high-burden TB countries with an estimated incident rate of 268 cases per 100,000 (WHO 2013). The COVID-19 pandemic led to social stigma and discrimination, causing people to hide illnesses, such as TB. Barriers to community TB case finding include inadequate motivation, lack of equipment, inconsistent engagement, resource allocation, knowledge gaps, and weak referral linkages (Kenya MoH 2022). Kenya's National Tuberculosis Program has been active in implementing strategies to combat TB, including widespread case detection, treatment, and public awareness campaigns.

Bacillus Calmette-Guérin (BCG), developed in 1921, is the most widely used licensed TB vaccine, preventing 76 percent of cases in 2002 when administered at birth or shortly after (Costanzo and Roviello 2023). BCG protection can last up to 15 years, but information is limited beyond this due to short follow-ups or few events if follow-up is long (Nguipdop-Djomo et al. 2016). Hence, the vaccine is less effective in preventing pulmonary TB, which is the most common form in adults.

Hospitals now administer life-saving BCG vaccinations to all children through the Kenya Expanded Program on Immunization (KEPI), in line with the WHO's essential medicines list. The Kenyan MoH (2014) recommends BCG vaccination at birth or first clinical contact, except for preterm and low-birthweight infants, who should be vaccinated at discharge.

New vaccines to prevent adolescent and adult TB are urgently needed. M72/AS01E, an immunogenic fusion protein-based vaccine, demonstrated high efficacy in a 2018 Phase 2b trial, effectively preventing TB in HIV-negative adult patients—protecting about 50 percent after 36 months of treatment (Tait et al. 2019; Costanzo and Roviello 2023). Similarly, a Phase 2b trial of M72/AS01E in Kenya, South Africa, and Zambia showed a significant protective effect against TB, with a 50 percent point estimate efficacy (WHO 2018).

M72/AS01E has demonstrated substantial efficacy in preventing progression to active pulmonary TB in individuals with latent infection, which can significantly reduce new cases and therefore the need for antibiotics (Tait et al. 2019). M72/AS01E can significantly lower transmission rates within communities, which means lower cases and antibiotic use, helping to curb the development and spread of antibiotic-resistant strains (Beresford and Sadoff 2010). MDR-TB requires complex, prolonged, and expensive treatment regimens, which contribute to the challenge of AMR. The vaccine candidate pipeline includes whole cell, adjuvanted proteins, and recombinant subunit vector vaccines for prevention, early life immunization, posttreatment, and immunotherapeutic adjuncts to reduce treatment duration (WHO 2018). Preventing TB deaths could lead to substantial life expectancy gains, with 74 percent of

these concentrated in Kenya and nine other countries: Mozambique, South Africa, Angola, Democratic Republic of Congo, Nigeria, Papua New Guinea, Myanmar, India, and Indonesia (Silva et al. 2021).

d) *H. Influenzae* Type b (Hib) Vaccine

Hib causes 95 percent of invasive *H. influenzae* infections in unimmunized populations, leading to severe and fatal infections, especially in young children (European Centre for Disease Prevention and Control 2023). Routine immunization has reduced serious *H. influenzae* disease and virtually eliminated meningitis (Khattak and Anjum 2023). Before the introduction of the Hib vaccine, Hib was a leading cause of bacterial meningitis and pneumonia in children under five globally, causing 3 million episodes of serious disease each year and half a million deaths (Watt et al. 2009; Peltola 2000). The widespread use of Hib conjugate vaccines has led to nearly eliminating Hib disease in countries where it has been widely used (Fitzwater et al. 2019).

In Kilifi, Kenya, *H. influenzae* causes 5 percent of inpatient deaths among young children; *S. pneumoniae* and malaria account for 9 and 22 percent, respectively (Berkley et al. 2005). The Hib vaccine, introduced in 2001 as part of the routine childhood immunization program, has significantly reduced the incidence of Hib-related diseases (Cowgill et al. 2006), which reduced incidence among children aged <5 to 12 percent of its baseline level. This impact was not observed until the third year after the vaccine was introduced. Before that, Hib was responsible for 50–60 percent of bacterial meningitis cases in children under five (Heikki Peltola 2001). A study in Kilifi, Kenya, observed an 88 percent reduction in Hib meningitis cases postvaccine (Akumu et al. 2007). National surveillance data indicated a decrease in Hib pneumonia and meningitis cases by more than 90 percent in vaccinated children. The Hib vaccine has played a crucial role in mitigating AMR by reducing the need for antibiotics (Costanzo and Roviello 2023).

Vaccines for Viral Infections

a) Rotavirus Vaccine (RV)

Globally, group A rotaviruses (RVAs) are the primary causative agents of acute gastroenteritis (AGE) requiring hospitalization among infants and children under five (Troeger et al. 2018; Luchs and Timenetsky 2016) and estimated to be responsible for nearly 30 percent of all antibiotic-treated diarrhea in under-five children in sub-Saharan Africa. For every 16 appropriately prescribed antibiotics to treat diarrhea, 12 are inappropriately prescribed (Lewnard et al. 2020). RV rollout is estimated to have a considerable impact on inappropriate antibiotic use; a 77 percent coverage rate among children under two across 18 LMICs could avert 13.6 million antibiotic-treated diarrheal cases every year.

In Kenya, before the introduction of RV, RVA caused more than 3,908 infant deaths, 3,015 outpatient visits, and 279 hospitalizations per 100,000 children under 5 annually, with an annual cost of US$10.8 million to the healthcare system (Wandera et al. 2017). The primary benefit of vaccination is the reduction of severe gastroenteritis. Genotypic studies in Nairobi County reveal a shift in circulating rotavirus genotypes, with G3 becoming the predominant type with a 40 percent detection rate among HIV+ children with rotavirus infections, highlighting the need for continuous monitoring and identification (Gikonyo et al. 2017; Gikonyo et al. 2020).

Live-attenuated RV (Rotarix) was introduced in July 2014 into KEPI for all newborns at 6 and 10 weeks of age and aimed at protecting more than 1.5 million children from severe diarrhea through co-financing with Gavi (Wandera et al. 2017). Postintroduction data indicated a notable decline in rotavirus and all-cause AGE hospitalizations and a shift in strain dominance among Kenyan children (Mutua et al. 2023; Wandera et al. 2017). Before the vaccine, the monthly median number of all-cause AGE cases was 97, which decreased to 24, representing a 75.3 percent reduction. This included a 53.4 percent reduction in rotavirus-specific AGE prevalence, with the largest improvements in hospitalizations among vaccine-eligible children (<12 months). Thus, vaccination has provided a platform to assess the real-world impact in preventing and reducing the health burden of severe childhood diarrhea in the country.

b) Measles-Rubella (MR) Combined Vaccine

Despite the effectiveness of the measles vaccine and a 79 percent decrease in global deaths from measles since 2000, it remains a leading cause of vaccine-preventable deaths worldwide (Kasidet and Davis 2017). Kenya has been actively working toward eliminating measles, following the World Health Assembly and Measles Elimination 2020 resolutions. In 2002, it introduced the first supplementary immunization activities (SIAs) using A-D syringes and Gavi-funded injection safety support 2003–2005. In 2016, it added the MR vaccine. Kenya's measles control involves a first dose of vaccine at 9 months and a second dose at 18 months, with periodic SIAs for accelerated control, aiming to close immunity gaps and prevent large outbreaks (Mburu et al. 2021).

In 2021, Kenya reported 896 measles cases. This outbreak has been associated with a low uptake of the second dose of the measles-containing vaccine (MCV2), which stood at 56 percent in 2021 (WHO 2023b). Achieving at least 95 percent coverage for both doses is essential to establish effective population immunity against measles and rubella. The suboptimal MCV2 coverage in Kenya underscores the need for enhanced immunization efforts to prevent future outbreaks. Today, many cases and deaths from measles still occur worldwide—9.8 million cases and 207,500 deaths in 2019—along with cases of congenital rubella syndrome in LMICs (Levin et al. 2023).

Vaccines for Parasitic Diseases

Malaria Vaccine

In Kenya, 70 percent of the population is at risk of malaria, making it a significant public health concern. Malaria was the second leading cause of disease, with an 11.7 percent caseload in 2022, as per the Kenya Economic Survey 2023 (Ochieng and Jattani 2023). The RTS,S/AS01 vaccine pilot program has been in operation for over three years and successfully integrated into the RI schedule (Moturi et al. 2023), targeting children at 6 months for the first dose, 7 months for the second, 9 months for the third, and 24 months for the fourth. This is distinct from Kenya's standard immunization timeline and implemented only in selected subnational regions.

The analysis reveals the positive impact of introducing RTS,S/AS01 as part of Kenya's integrated malaria control strategy (WHO 2023c). It complements existing malaria interventions, such as insecticide-treated bed nets, indoor residual spraying, preventive treatment for pregnant women, and effective medications. Together, these measures create a multipronged approach. Following the vaccine, hospitalizations for severe malaria declined markedly among children under five, and child deaths reduced notably where it was implemented, highlighting its life-saving potential.
In Kenya, malaria parasite prevalence has decreased from 8 percent in 2015 to 5.6 percent in 2020, attributed partly to the introduction of RTS,S in 2019 (WHO 2023a). This reduction demonstrates the vaccine's contribution to lowering malaria cases, alongside other interventions. However, the slowing reduction rate since 2017 signals challenges in sustaining progress. Factors such as regional disparities, resistance to existing interventions, and environmental changes could be influencing this slowdown. The Kenya Malaria Strategy (2019–2023) boosts gross domestic product (GDP) due to increased labor availability (Elnour et al. 2023). However, it also increases government health expenditure, raises production costs, and decreases household welfare. Consequently, household labor endowment increases due to reduced malaria incidence and deaths. Although service use estimates suggest high uptake of RTS,S/AS01 of those who enter KEPI, with inevitable dropout beyond 9 months, population-based denominators suggest that a significant proportion of children (22 percent) are not receiving any dose of it (Moturi et al. 2023).

Malaria imposes substantial economic costs on Kenya, both directly through treatment and hospitalization and indirectly through productivity losses and deaths (Elnour et al. 2023). The costs significantly affect households (especially those that rely on out-of-pocket expenditure for healthcare), health systems, and the economy at large. These issues and the rising antimalarial resistance are making the WHO's 2016–2030 malaria strategy targets—which aim for at least a 90 percent reduction in cases and deaths by 2030—increasingly difficult to achieve. In 2009, the total economic cost of malaria for children under five in Kenya was estimated at US$251 million. Adding a malaria vaccine to the interventions in

sub-Saharan Africa would be both highly cost-effective and impactful (Sauboin et al. 2019). Child vaccination would prevent 16.8 million malaria cases and 113,000 deaths over 15 years, and infant vaccination would prevent 16 million cases and 107,000 deaths. These reductions, combined with a cost-effectiveness ratio well within acceptable thresholds, indicates that vaccination could be a valuable addition to malaria control programs.

ANIMAL VACCINES

a) East Coast Fever (ECF) Vaccine

ECF is a serious tick-borne disease that affects cattle in East Africa, including Kenya (Ikaal et al. 2020). Before the availability of the vaccine, outbreaks often required antibiotics (Peters et al. 2020). Vaccination has significantly reduced the incidence of the disease, thereby lowering the need for antibiotics (Nanteza et al. 2023); a single dose provides lifelong immunity. Two large batches of the vaccine were manufactured by International Livestock Research Institute and partners in 1996 and 2008, comprising 600,000 and 1.2 million doses, respectively (Toye et al. 2020). Through commercial distribution, about 2 million cattle have now been vaccinated, increasing the incomes of 156,000 households by US$74 million. From 1997 to 2014, the vaccine prevented the untimely deaths of some 400,000 animals. This vaccine has also been used in Malawi, Tanzania, and Uganda, where calf mortality due to ECF has been reduced by up to 95 percent. Vaccination has increased incomes for livestock-keeping households in various ways. Aside from avoided herd losses, milk sales have increased due to more productive cows, vaccinated bull calves have fetched higher market prices than nonvaccinated calves, and, in the pastoral sector, the vaccine has meant a higher number of yearling animals.

b) Rabies Vaccine

Rabies is endemic across Kenya and estimated to cause 523 (95 percent CI: 134–1,100) deaths annually (Bitek et al. 2019). Vaccination plays a crucial role in reducing the need for antibiotics. When individuals are vaccinated, they are less likely to contract the disease from infected animals, thereby reducing the instances where antibiotics might be prescribed as a precautionary measure or for secondary infections (Rupprecht et al. 2006). This directly contributes to lowering the selective pressure for antibiotic-resistant bacteria. Vaccination also prevents rabies itself, a disease that can lead to severe neurological symptoms and eventual death if not treated promptly.. By reducing the incidence of rabies, vaccination programs decrease the need for antibiotics, saving costs for both individuals and healthcare systems. The cost of human treatment for rabies is US$85, but the cost of dog vaccination is US$2 in Kenya (Borse et al. 2018).

*Photo source: Kubik 2024

THE ECONOMIC IMPACT OF VACCINES ADDRESSING AMR

An analysis evaluating the projected impact and cost-effectiveness of continuing PCV use in Kenya beyond 2022 found that, if it were discontinued in 2022, the incidence of invasive pneumococcal disease (IPD) would be predicted to nearly double, from 8.5 per 100,000 in 2022 to 16.2 per 100,000 by 2032 (Ojal et al. 2019). This highlights the critical role of PCV in maintaining low IPD rates. Continuing PCV vaccination is projected to prevent 14,329 deaths (95 percent predictive interval [PI]: 6,130–25,256) and 101,513 cases of disease (95 percent PI: 4,386–196,674) for 2022–2032. These substantial reductions in morbidity and mortality underscore the vaccine's life-saving potential. The incremental cost per DALY averted is estimated at US$153 (95 percent PI: US$70–US$411) by 2032. This ratio is well within the acceptable thresholds for LMICs, making continued vaccination a cost-effective investment.

Sustaining and enhancing pneumococcal vaccination programs is a sound investment in child health and economic savings. Transitioning to PCV13 could further optimize outcomes, benefiting both individuals and the broader healthcare system (Ayieko et al. 2013). Introducing PCV13 improves cost-effectiveness ratios by approximately 20 percent, making it a more efficient option compared to PCV10. This includes indirect effects (e.g., herd immunity) and further enhances cost-effectiveness by 43–56 percent, showcasing the broader community benefits of vaccination.

Another analysis underscores the significant burden of rotavirus infection in Kenya and highlights the potential health and economic benefits of routine vaccination (Tate et al. 2009). Rotavirus infection accounts for 19 percent of hospitalizations and 16 percent of clinic visits for diarrhea among children under five annually. It causes approximately 4,471 deaths, 8,781 hospitalizations, and 1,443,883 clinic visits annually, resulting in a US$10.8 million cost to the healthcare system. A 2-dose vaccination series could significantly reduce the disease burden: prevent 2,467 deaths (55 percent), 5,724 hospitalizations (65 percent), and 852,589 clinic visits (59 percent). Vaccination would save 58 DALYs per 1,000 children annually, demonstrating a substantial health impact.

Between 2014 and 2033, rotavirus vaccination can avert approximately 60,935 and 216,454 undiscounted deaths and hospital admissions, respectively, in children under 5 in Kenya. Over the 20-year period, Kenya would invest US$80 million in vaccination; however, the program is expected to save the government US$30 million in healthcare costs by reducing the disease burden and saving US$38 per DALY averted. This highlights the program's cost-effectiveness.

A study in Kenya estimated that the direct economic cost of malaria to the government and households in children as young as five was approximately US$251 million in 2009 (Ochieng 2023). Investing in vaccination for children and infants is a highly cost-effective strategy with substantial health and economic benefits (Sauboin et al. 2019). Both child and infant vaccination strategies are highly cost-effective relative to GDP per capita thresholds, making them viable options for investment in malaria-endemic regions. The incremental cost-effectiveness ratio is US$200 and US$225 per DALY averted for child and infant vaccination, respectively, which represent 14 and 17 percent of the GDP per capita threshold, indicating that both strategies are highly cost-effective.

The M72 vaccine showed a 50 percent efficacy in preventing pulmonary TB in a Phase 2b trial. The Gates Foundation noted that over 25 years, a vaccine with at least 50 percent efficacy could prevent up to 76 million new cases and 8.5 million deaths. According to WHO, it will also prevent 42 million courses of antibiotics and US$41.5 billion in catastrophic household costs, especially for the world's poorest and most vulnerable people (Bill & Melinda Gates Foundation 2023).

The Hib vaccine significantly reduced the incidence of Hib meningitis, nonmeningitis invasive disease, and nonbacteremia Hib pneumonia in Kenyan children aged

<5. The vaccine's cost per discounted DALY and death averted was US$38 and US$1,197, respectively, making it a cost-effective intervention (Akumu et al. 2007). From 2016 to 2020, 1427 measles cases occurred in hard-to-reach children, causing US$9.5 million in medical costs and productivity losses. An effective outreach vaccination strategy averted these cases, costing US$76 per DALY when 25 percent received MCV and US$122 per DALY when 50 percent received MCV (Lee et al. 2019).

IMMUNIZATION PROGRAM IN KENYA

KEPI, first developed in 1980, recommends immunization against six infectious diseases: TB, polio, diphtheria, whooping cough, tetanus, and measles (Kenya MoH 2023). Since 1980, immunizations have been provided to all children under one; the tetanus toxoid vaccination is also available to pregnant women. By 1990, an 80 percent vaccination coverage rate for all six vaccines was achieved. In 2001, vaccines targeting yellow fever, hepatitis B, and Hib were added to KEPI, followed by PCV in 2011, a second dose of measles-containing vaccine (MCV2) in 2013, and RV in 2014. In addition, the national government coordinates emergency response vaccination campaigns for polio, measles, meningitis, and influenza outbreaks.

Kenya has made immunization a health priority, introducing new vaccines ahead of many other LMICs in sub-Saharan Africa, such as PCV in 2011 and RV in 2014 (Sambala et al. 2019). As of 2020, Kenya's routine childhood immunization schedule included one dose each of BCG and oral polio vaccine (OPV) at birth; three doses each of diphtheria–tetanus–whole cell pertussis–*Hemophilus influenzae* type b–hepatitis B (pentavalent), OPV, and PCV at 6, 10, and 14 weeks; two doses of RV at 6 and 10 weeks; one dose of inactivated polio vaccine (IPV) at 14 weeks; and two doses of measles and rubella at 9 and 18 months (Janusz et al. 2021).

Although vaccine coverage in Kenya is heterogenous, 2024 WHO data indicate that coverage for certain vaccines reached 90 percent or higher in 2023 (Figure 1): Hib third dose (93 percent), PCV third dose (91 percent), MCV first dose (91 percent), and BCG (90 percent). However, 2024 saw a slight decline in coverage such that only Hib third dose (91 percent) achieved the international target of 90 percent. Although coverage for the second dose of MCV has been steadily increasing since 2015, it remained constant at 76 percent across 2023 and 2024. Similarly, RV coverage stood at 82 percent in 2024, highlighting the need for further efforts to improve uptake.

*Photo source: Mayer 2021

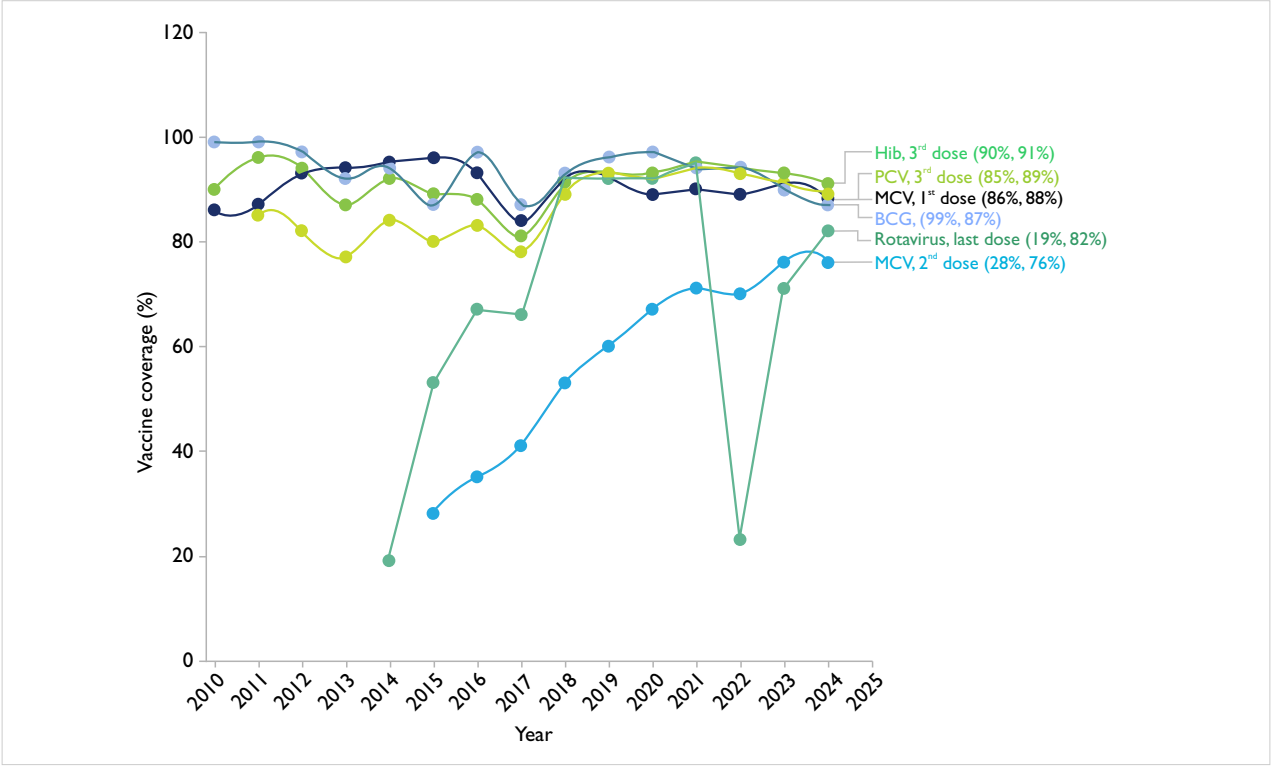

Figure 1. Vaccination Coverage for Selected Vaccine-Preventable Diseases in Kenya (2010–2024)

Values in brackets indicate coverage at the initial year of reporting and most recently (2024). The graph was generated based on WHO's WUENIC (2025) immunization coverage data.

Although the causes of low vaccination coverage are multifaceted, certain factors have been linked to lower full uptake. Children born to mothers with low education levels, delivered at home, from areas with inadequate healthcare facilities, in lower-income households, and of higher birth order are at higher risk of being underimmunized (Allan et al. 2021). The disparities in coverage will be reduced by interventions targeted at underimmunized children in these subpopulations.

The national vaccination plan is financially supported by Gavi. Due to its economic growth, Kenya is expected to graduate out of Gavi eligibility and therefore transition away from foreign donor support for KEPI; the country will fully fund it by 2027. In 2020, 23 percent of the nearly US$34 million annual expenditure on RI was covered by domestic financial support (Simoneau and Bliss 2020). Kenya's 2023–2027 AMR National Action Plans (NAP) emphasizes investment in research for new medicines and vaccines but does not address the role of vaccines in mitigating AMR. Doing so will help ensure that the additional benefits of vaccines in the context of AMR are realized at the policy and implementation level.

In addition, recognizing the links between AMR and vaccines will ensure that human and financial investments for AMR mitigation and vaccine improvement and expansion efforts will be sustainable.

Combination with Other Public Health Interventions

Vaccination is a critical tool for preventing infections; however, as a standalone strategy, it cannot meaningfully reduce infectious disease burden (Li et al. 2025). Improvements in water, sanitation, and hygiene infrastructure, such as increasing access to clean water, sanitation facilities, and hygiene education, prevent environmental transmission, thereby breaking the cycle of contamination in communities where diseases such as cholera or typhoid are endemic (Tadesse et al. 2022). Robust IPC measures in healthcare settings, including hand hygiene, sterilization, and isolation procedures, can help reduce the incidence of hospital-acquired infections. Investing in these public health interventions extends beyond addressing immediate dangers to develop resilient systems that lower overall disease rates, save lives, and support sustainable access to healthcare for all (Lewnard et al. 2024).

KEY RECOMMENDATIONS

The TWG outlined key recommendations to enhance the role of vaccines in combating AMR, as detailed in Table 3. These recommendations focus on strengthening immunization programs, addressing vaccine hesitancy, improving diagnostic and treatment capacity in county hospitals, and reinforcing the NAP and emphasized the importance of a One Health approach and sustained stakeholder engagement to ensure a comprehensive and coordinated response to AMR.

Table 3. Insights and Recommendations From GARP-KENYA Technical Working Group Members to Leverage Vaccines in Addressing AMR

Factors	Potential Issues	Proposed Interventions
Antibiotic Use and Resistance	Challenges in regulating antibiotic use, high costs, and lack of effective national policy guidelines	Develop and adopt updated antimicrobial guidelines, and establish national policy frameworks for antimicrobial use similar to those for TB and HIV.
Threat of AMR	Lack of awareness and insufficient policymaker engagement	Conduct public awareness campaigns, and engage policymakers with data-driven advocacy to emphasize AMR as a serious health threat.
Capacity in County Hospitals	Limited access to necessary tests and antibiotics and overreliance on first-line treatments	Improve diagnostic capabilities and access to antibiotics at county hospitals while enhancing healthcare system efficiencies.
Antimicrobial Effectiveness	Inconsistent therapies and inadequate handling of nonhospitalized patients	Strengthen healthcare system functionality, and improve management of outpatient and emergency care.
One Health Approach	Lack of coordinated response across sectors (health, agriculture, environment)	Foster multisectoral collaboration, integrating veterinary and environmental health into AMR strategies.
Education and Awareness	Misinformation among health workers and the public, including misconceptions about vaccines and antibiotics	Educate health workers and the public on AMR, importance of completing prescriptions, and vaccine benefits, via targeted advocacy and communication strategies.
Policy and Strategic Goals	Weak implementation of AMR and vaccine-related policies	Develop actionable, measurable policies with clearly defined goals, and implement advocacy networks to connect with policymakers effectively.
Diagnostics and Vaccination	Limited rapid diagnostic tools and reliance on clinical diagnoses	Invest in rapid diagnostic technologies, and prioritize preventive measures, like vaccination programs.
Hospital Regulations	Over-prescription, misuse of antibiotics, and insufficient hospital policies	Enforce strict hospital policies on antibiotic stewardship, train healthcare workers on judicious antibiotic use, and strengthen pharmacy boards for compliance.
Local Vaccine Production	Over-dependence on external sources and insufficient vaccine production capacity	Build local manufacturing capabilities, prioritize production for high-burden diseases, and facilitate technology transfer.

Table 3 (continued). Insights and Recommendations From GARP-KENYA Technical Working Group Members to Leverage Vaccines in Addressing AMR

Factors	Potential Issues	Proposed Interventions
Funding and Resource Allocation	High costs of diagnostics, tests, and vaccines hindering accessibility	Advocate for sustainable investment in AMR and vaccination efforts, and include vaccines in insurance coverage to improve affordability.
Vaccine Hesitancy	Cultural, religious, and societal resistance to vaccines	Engage religious leaders and community stakeholders, contextualize vaccine messaging, and fund targeted advocacy to address vaccine hesitancy.
Stakeholder Engagement	Limited stakeholder involvement in immunization strategies	Collaborate with insurance companies, health providers, community health promoters, and youth organizations to enhance coverage and support national immunization programs.
Targeted Vaccination Programs	Insufficient coverage for adults, mobile populations, and specific diseases, such as typhoid and cholera	Develop structured adult vaccination programs, prioritize hard-to-reach and underserved areas, and integrate vaccines such as typhoid and malaria into routine immunization schedules.

CONCLUSION

Vaccines play a pivotal role in mitigating AMR by reducing the burden of infectious diseases and minimizing the unnecessary use of antibiotics. Despite their immense potential, several challenges must be addressed to fully leverage their value. Reaching underserved and hard-to-reach populations, enhancing community awareness, maintaining robust cold chain systems, and countering misinformation are crucial steps to improving vaccine coverage and acceptance. Additionally, addressing systemic barriers, such as gaps in national antimicrobial policies, limited data on vaccine efficacy, and insufficient engagement with policymakers and stakeholders, is critical to building a resilient immunization framework. By integrating innovative solutions, such as drone delivery, empowering community health promoters, and expanding insurance coverage for vaccines, Kenya can strengthen its efforts against AMR. Collaborative strategies that engage all stakeholders—health professionals, policymakers, religious institutions, and communities—will ensure vaccines fulfill their dual purpose of protecting public health and curbing the growing threat of AMR.

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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 Kenya and recommends policy measures to use vaccines as tools to control AMR in the country.

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