The Value of Vaccines to Mitigate Antimicrobial Resistance in South Africa

GARP - South Africa Policy Brief

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ABBREVIATIONS AND ACRONYMS

AMR	antimicrobial resistance
AMU	antimicrobial use
BLICs	beta-lactamase inhibitor combinations
BSI	bloodstream infection
CA	ceftazidime-avibactam
CT	ceftolozane-tazobactam
HIV	human immunodeficiency virus
IPD	Invasive pneumococcal disease
LMIC	low- and middle-income country
MDR-TB	multidrug-resistant tuberculosis
NDoH	National Department of Health
PCV	pneumococcal conjugate vaccine
RR-TB	rifampicin-resistant tuberculosis
RSV	respiratory syncytial virus
TCV	typhoid conjugate vaccine
UTI	urinary tract infection
WHO	World Health Organization

EXECUTIVE SUMMARY

Antimicrobial resistance (AMR) is an urgent global health crisis associated with millions of deaths each year. In South Africa, AMR was linked to 35,054 deaths in 2021, underscoring the need for effective interventions to combat AMR and mitigate its health and economic burden.

Key Drivers of AMR in South Africa

1. High infectious disease incidence: South Africa faces a significant burden of infectious diseases, many of which could be mitigated through vaccination. The rise of drug-resistant pathogens further complicates treatment and increases the health and economic burden of infections.

2. Antimicrobial overuse and misuse: Excessive and inappropriate use of antimicrobials in health care and agriculture has accelerated the development of resistant pathogens. Socioeconomic factors, such as poverty and limited health literacy, exacerbate this issue.

Role of Vaccination in Mitigating AMR

Vaccines are a crucial yet underused resource in the fight against antimicrobial resistance in South Africa. By preventing infections and reducing antimicrobial use, immunization programs could provide a sustainable and cost-effective solution to curb the rise of drug-resistant pathogens. The strategic integration of vaccines into national health policies, along with targeted education and awareness initiatives, is essential for maximizing the potential of vaccines in mitigating antimicrobial resistance.

Key Recommendations for the Use of Vaccines to Mitigate AMR

1. Strengthen health care infrastructure to ensure universal vaccine coverage through widespread distribution and equitable access.

2. Incorporate vaccines with significant potential to reduce AMR into the national immunization schedule.

3. Quantify the economic benefits of addressing AMR through vaccination to demonstrate its cost-effectiveness and advantages.

4. Implement strategies that build confidence in vaccines and restore trust in the health care system and immunization programs. Use educational and awareness campaigns to enhance the public's understanding of AMR and the importance of vaccines in preventing infections and reducing the impact of AMR.

BACKGROUND

Antimicrobial resistance (AMR) is a pressing global health challenge, causing more deaths than human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome or malaria (Murray et al. 2022). The World Health Organization (WHO) refers to AMR as the "silent pandemic," impacting populations worldwide, with low- and middle-income countries (LMICs) carrying the highest burden. In South Africa, 35,054 deaths were associated with AMR in 2021, with 8,485 of those directly attributable to it (IHME 2024). This represents nearly half of all deaths caused by bacterial infections in the country, underscoring the severity of the situation. To develop effective policy solutions for AMR mitigation, it is essential to understand the drivers of AMR in South Africa. In this policy brief, we highlight the impact of immunization as an effective, evidence-based tool to prevent infectious diseases and mitigate AMR and propose actionable solutions for implementation.

*Photo courtesy of Eh!woza

DRIVERS OF AMR IN SOUTH AFRICA

Infectious Diseases

South Africa has a population of over 63 million people, with an average life expectancy of 61.5 years as of 2021 and a crude death rate of 12.03 per 1,000 inhabitants in 2022 (Statistics South Africa 2024; Food and Agriculture Organization of the United Nations et al. 2022; Cowling 2024). Infectious diseases contribute a significant proportion to mortality, yet many of them can be averted through vaccines that are available or under development (WHO 2019). Common pathogens contributing to the infectious disease burden include HIV, respiratory infections, such as those caused by *Mycobacterium tuberculosis, Staphylococcus aureus,* and *Streptococcus pneumoniae,* and diarrheal diseases caused by *Salmonella* spp. and rotaviruses (Achoki et al. 2022; IHME 2020; Vos et al. 2020).

Table 1. The burden of infectious disease in South Africa in 2020

Category	Deaths
Human Immunodeficiency Virus (HIV)	94,056
Lower Respiratory Infections	28,316
Tuberculosis	22,957
Diarrhea	15,510

Source: Global Burden of Disease (IHME 2020; Vos et al. 2020)

Although the high infectious disease burden in South Africa is a driver of AMR, the opposite is also true; rising levels of AMR make infections increasingly challenging to treat and exacerbate the disease burden. The African region is estimated to have the highest level of AMR-related burden among all the "super-regions" used by the Global Burden of Disease project, with 23.7 deaths and 1,436.7 disability-adjusted life years per 100,000 individuals attributable to AMR in 2019 (Murray et al. 2022). For South Africa, the burden of rifampicin-resistant tuberculosis (RR-TB) and multidrug-resistant tuberculosis (MDR-TB) cases is ranked among the top globally (WHO 2022a), with 6,381 cases in 2021 alone (WHO 2022b). Drug-resistant infections impose a significant health and economic burden on LMICs, especially among vulnerable populations lacking information and access to treatment or follow-up (Daftary et al. 2021). The cost of treating MDR-TB in South Africa is estimated at USD 6,772 per patient, over 26 times higher than that of drug-sensitive TB, emphasizing the additional burden posed by difficult-to-treat infections (Pooran et al. 2013).

AMR surveillance in South Africa indicates a high frequency of resistant pathogens. A study in Limpopo Province found that 92 percent of *S. aureus* strains were resistant to ampicillin and highly associated with infections among patients with HIV (Samie and Shivambu 2011). Fourie et al. (2021) showed that of 712 urine samples collected for community-acquired urinary tract infections (UTIs), *E. coli* was the most prevalent uropathogen (57.6 percent), followed by *Klebsiella* spp. (13.6 percent) and *Enterococcus* spp. (10.0 percent). *E. coli* exhibited resistance rates of 77.1 percent to amoxicillin, 15.6 percent to amoxicillin-clavulanate, 18.5 percent to ciprofloxacin, 4 percent to nitrofurantoin, and 11 percent to trimethoprim-sulfamethoxazole (Fourie et al. 2021). Another study reported that a sulfonamide-resistant gene (*sul1*) was detected in 100 percent of urine samples collected in a cohort in South Africa (Bischel et al. 2015). Although known to be widespread in the environment, the frequency and concentration at which *sul1* was detected in this study suggest high resistance levels.

A systematic review found that the most frequently cultured bacteria in AMR studies in South Africa from 2011 to 2016 were *S. aureus* and *M. tuberculosis* (Ekwanzala et al. 2018). AMR surveillance 2018–2022 showed high resistance levels of ESKAPE pathogens in blood cultures (South Africa NDoH 2024). For instance, *K. pneumoniae* was the most common pathogen isolated and showed 70 and 40 percent nonsusceptibility to third-generation cephalosporins and first-generation carbapenems, respectively. *A. baumannii* showed 80 percent resistance to carbapenems. These reviews did not consider environmental isolates, which comprise a significant proportion of multidrug-resistant isolates in South Africa (Samie and Shivambu 2011; Ekwanzala et al. 2018; Kimera et al. 2020).

Antimicrobial Misuse and Overuse

Microorganisms develop resistance to various antimicrobials through natural processes. However, AMR is accelerated by exposure to antimicrobials. Consequently, misuse and overuse of antimicrobials in humans, animals, and agriculture are major drivers of AMR. South African regulations prohibit dispensing antibiotics in pharmacies without a prescription; however, concerns about inappropriate dispensing persist (Mokwele et al. 2022). A recent pilot study in South Africa reported high rates of antibiotic sales without a prescription, exacerbated by patient pressure and limited patient knowledge of antibiotics and AMR (Sono et al. 2024). WHO recently released the AWaRe (Access, Watch, Reserve) antibiotic book, which provides specific guidance on the empirical use of antibiotics by considering the risk of AMR development associated with different antibiotics (Zanichelli et al. 2023). It highlights the use of first-line Access antibiotics and the last-resort Reserve antibiotics, restricted to when an infection is confirmed to be caused by multidrug-resistant pathogens. High rates of unnecessary antibiotic prescriptions in both public (78 percent) and private (67 percent) sectors have been reported in South Africa. However, the private sector generates more prescriptions and may have a more significant contribution to the development of resistance (Lagarde and Blaauw 2023).

The most recent surveillance report on AMR and antimicrobial use (AMU) in humans in South Africa showed that in 2018, antibiotic consumption was similar to other BRICS countries (Brazil, Russia, India, China, Egypt, Ethiopia, Iran, and the United Arab Emirates) but lower than other African countries, such as Algeria, Tunisia, Egypt, and Tanzania, and most of the high-income countries (South Africa NDoH 2024). Procurement data from the South Africa National Department of Health (NDoH) showed an increase in imported antibiotics for human use of 26.3 percent 2018–2020. NDoH also reported concerns over the use levels of "Watch" (43 percent) and "Reserve" (6 percent) antibiotics, which are supposed to be preserved because they are at risk of AMR (South Africa NDoH 2024).

Avibactam is a novel β-lactamase inhibitor combined with ceftazidime, and ceftolozane is a novel cephalosporin developed in combination with tazobactam, a recognized β-lactamase inhibitor (Zhanel et al. 2014). Both of these agents have been shown to retain *in vitro* activity against selected resistant Gram-negative pathogens, including *Enterobacteriaceae* and *Pseudomonas aeruginosa* (Mirza et al. 2020). A combination of ceftazidime and avibactam (CA) has consistently proven effective against bacteria that produce *K. pneumoniae* carbapenemase (Niu et al. 2020) These treatments have received approval for complicated intra-abdominal infections, alongside metronidazole, and complicated UTIs. Ceftolozane-tazobactam (CT) has been approved for hospital-acquired and ventilator-associated pneumonia (Mazuski et al. 2016). The emergence of resistance after short courses of therapy with CA and CT in some patients highlights the importance of establishing strict use criteria. They have seen a massive increase in use, with CA increasing by 383 percent in the last three years (Brink et al. 2022). This emphasizes the ongoing challenges of treating infections caused by MDR GNB species and the substantial threat that mechanisms of resistance pose to other second-generation beta-lactamase inhibitor combinations (BLICs) and drug development.

Issues surrounding antimicrobial misuse and overuse in South Africa are exacerbated by socioeconomic factors,

such as poverty, poor levels of education, and low health literacy. The World Bank (2024) reports that 55.5 percent of the population is living in poverty with low levels of education. Recent work has revealed antibiotic misconceptions among the public (Boyles et al. 2019; Mokoena et al. 2021). Common misconceptions were the belief that AMR occurred in the human body rather than the organism itself and that sharing antibiotics was acceptable (Boyles et al. 2019; Mokoena et al. 2021). In addition, understanding was inadequate of the patient's role in controlling AMR, with 87 percent of patients blaming resistance on doctors for overprescribing antibiotics (Boyles et al. 2019). However, 66 percent of in primary care felt pressured to prescribe antibiotics because of patient expectations. Furthermore, antibiotics were also thought to treat colds, flu, and fevers (Mokoena et al. 2021).

THE ROLE OF VACCINES

Given the complexity of AMR, strategies to address it must focus on reducing the incidence of infectious diseases and misuse and/or overuse of antibiotics. Vaccination emerges as an effective solution to both problems, as successful immunization campaigns prevent infections, reduce morbidity and mortality, and reduce the need for antimicrobials, thus lessening the selection pressure for development and escalation of resistance (Figure 1) (Vekemans et al. 2021). Two significant examples of this are the introduction of the pneumococcal conjugate vaccine (PCV) and influenza vaccine, which halved the rates of drug-resistant and MDR pneumococcal strains in the United States (Kyaw et al. 2006) and reduced antibiotic prescribing in the United States (Klein et al. 2020) and United Kingdom (Muller-Pebody et al. 2021).

A recent study reported that in 2019, the vaccine-avertable AMR burden was highest for lower respiratory infections, TB, bloodstream infections (BSIs), and pathogens such as *M. tuberculosis* and *S. pneumoniae*; 0.51 million deaths could be prevented by primary vaccination of specific age groups against 15 pathogens (Kim et al. 2023). Another study of 18 LMICs estimated that PCV and rotavirus vaccines prevented 20 percent

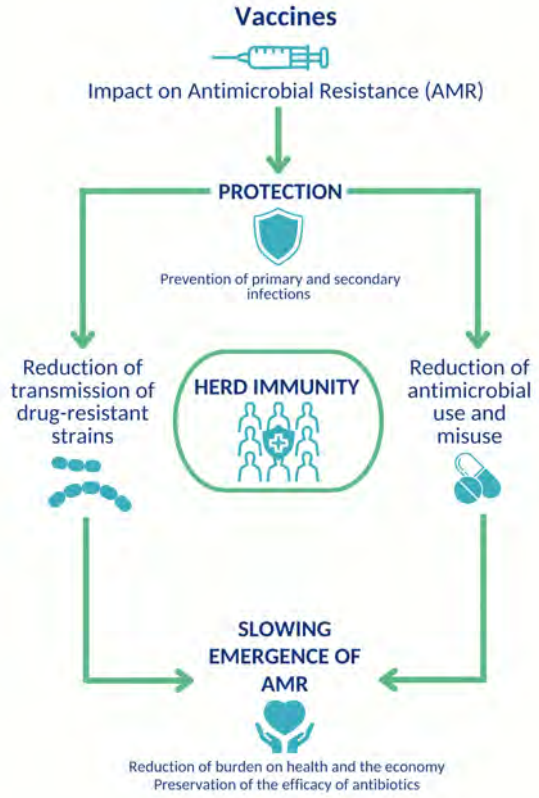

Figure 1. How vaccination reduces AMR burden
Vaccines prevent infections and reduce AMR burden by two mechanisms: reducing the transmission of drug-resistant strains and lowering antimicrobial prescriptions.
Source: Kalanxhi et al. 2023

*Photo courtesy of Eh!woza

of antimicrobial-treated infections in children 24–59 months old and 11 percent of antibiotic-treated diarrhea cases in children under two, respectively (Lewnard et al. 2020). Under 2018 vaccine coverage levels, pneumococcal and rotavirus vaccines avert 23.8 million and 13.6 million episodes of antimicrobial-treated acute respiratory infection and diarrhea, respectively, for children under five in LMICs each year. Universal coverage for both vaccines could prevent an additional 40 million episodes of antibiotic-treated cases. Another recent modeling study has predicted that a TCV vaccine for infants in 73 lower-income countries could prevent up to 53.5 million cases of drug-resistant typhoid fever over 10 years (Birger et al. 2022).

The need to prioritize vaccination to mitigate AMR is clear; however, despite its significant contribution to health, immunization coverage has stagnated or declined in recent years, and the COVID-19 pandemic has exacerbated this decline. Urgent action is needed to increase national coverage and strengthen immunization programs to protect children from vaccine-preventable diseases. This is true for the available vaccines, such as PCV, *Haemophilus influenzae* type B, influenza vaccines, and TCV (only at traveling clinics), and those under development, such as malaria, HIV, RSV, and group A *Streptococcus* vaccines (Birger et al. 2022). Estimates suggest that in 2022, only about 84 percent of the world's children under one received the first dose of the measles vaccine, representing the lowest coverage rate since 2008 (WHO 2024). More recently, in 2023, UNICEF reported that 1 in 5 children in South Africa were unvaccinated or underimmunized, and 67 million children globally missed out on one or more vaccinations during the COVID-19 pandemic (WHO 2024; Kaur 2023; Frost et al. 2023).

IMPACT OF VACCINES ON AMR IN SOUTH AFRICA

Vaccines in the South African Expanded Program on Immunization

PCV

A 2019 study found that invasive pneumococcal disease (IPD) incidence rates in children under two declined 93.2 percent post-PCV13 vaccination in South Africa, making the PCV vaccine an effective tool to mitigate infectious disease burden (Von Gottberg et al. 2024). In another study, the PCV vaccine was also shown to avert 6.9 cases of *S. pneumoniae*-attributable, antibiotic-treated IPD and 12.4 cases of antibiotic-treated acute otitis media per 100 children ages 2–5, respectively, annually (Lewnard et al. 2020).

Rotavirus Vaccine

Rotavirus-attributable diarrhea does not respond to antibiotics. However, it is a common cause of antibiotic misuse. A vaccine administered to children under two can avert 5.4 cases (66.7 percent) of rotavirus-attributable, antibiotic-treated diarrhea per 100 children annually (Lewnard et al. 2020).

Influenza Vaccine

As influenza is a common condition for which antibiotics are inappropriately prescribed, reducing influenza infections through immunization can potentially reduce unnecessary antibiotic use. The influenza vaccine is on the standard treatment guidelines for certain vulnerable populations, such as infants over 6 months old and patients over 65 (South Africa NDoH 2019). A recent study has shown that if 30 percent coverage was achieved for adults over 65 (assuming 50 percent vaccine efficacy), 11,153 antibiotic prescriptions could be averted annually (Knight et al. 2018). If 30 percent vaccination coverage was achieved for the population under six months of age (assuming 50 percent vaccine efficacy), an additional 1,094 antibiotic prescriptions could be averted each year.

Available Vaccines Not Included in the South African EPI

Respiratory Syncytial Virus (RSV) Vaccine

In a Phase 3, double-blind trial in 18 countries, pregnant women at 24–36 weeks of gestation received a single RSV vaccine. This was shown to be highly effective against medically attended severe RSV-associated lower-respiratory-tract illness in infants, and no safety concerns were identified (Kampmann et al. 2023). Results from another double-blind, randomized, placebo-controlled study showed that the RSV F vaccine could avert 7.3 cases of antibiotic prescription due to RSV per 100 children (Lewnard et al. 2022). Also, the RSV maternal vaccine administered to expectant mothers reduced the incidence of antibiotic prescriptions within the first 3 months of life in newborns. In South Africa, antibiotic prescriptions for this age group were 43.1 per 100 in the control group and 37.3 in the experimental group in that study, suggesting that 5.8 percent of antibiotic prescriptions were averted through vaccination.

Typhoid Conjugate Vaccine (TCV)

Modeling suggests vaccine use proportionally reduces the incidence of resistant and nonresistant typhoid and the number of chronic carriers (Bilcke et al. 2019). Typhoid remains a critical health concern, with high MDR *S. typhi* predominant in endemic areas, especially among children younger than 15 (Park et al. 2018). LMICs have an estimated 21.7 million cases annually, 217,000 of which are fatal (Yamba et al. 2022; Keddy et al. 2016). *S. typhi* resistance is well documented, with reports from the 1980s and 1990s showing resistance to traditional first-line antimicrobials, such as ampicillin, chloramphenicol, and trimethoprim-sulfamethoxazole. More recently, increased resistance to fluoroquinolones has been reported (Park et al. 2018). Fluoroquinolone-resistant *S. typhi* has been listed as a WHO high-priority pathogen. Additionally, co-infection with HIV, which was found at an incidence of 19.3 percent among typhoid patients with known HIV status, was correlated with higher mortality rates in South Africa (Keddy et al.

2016). A typhoid vaccination trial combined with a safe water program in South Africa's Limpopo province in the 1980s, with 0.6 percent of children aged 5–16 vaccinated, led to a gradual decrease in infectious disease burden from 17 out of 100,000 in the 1980s to 0.1 of 100,000 culture-confirmed in 2018 (Keddy et al. 2018). Although the TCV received WHO prequalification in 2018, it is not included in South Africa's vaccination schedule (Burki 2018).

Vaccines in Development

Tuberculosis (TB) Vaccine

A routine postexposure TB vaccine program for adolescents and adults with 50 percent efficacy against symptomatic TB is projected to avert 8.9 percent of cases and 6.7 percent of deaths from RR-TB in South Africa from 2020 to 2035 (Fu et al. 2021). RR-TB is of particular concern, as the second-line treatment success rate is only 56 percent. Anticipated benefits are even greater if the program is implemented alongside improvements in the diagnosis and treatment of TB.

K. pneumoniae Maternal Vaccine

A 2022 birth-cohort study of 885 subjects in the peri-urban part of South Africa established *K. pneumoniae* as a cause of lower-respiratory-tract infections; out of 439 episodes, 15.5 percent of infants were found to have *K. pneumoniae* (Zar et al. 2022). A South African study 2014–2019 also found that out of 43,438 positive blood and cerebrospinal fluid cultures collected nationally, it was the most common cause of BSI and meningitis in South Africa (Mashau et al. 2022). Additionally, a drug-resistant strain of ST307 *K. pneumoniae* Lineage A emerged in a Johannesburg hospital in 2013 and demonstrated intrahospital spread to 350 patients across Gauteng, Free State, Mpumalanga, Eastern Cape, and Limpopo provinces throughout 2014, indicating the imminent risk of AMR (Lowe et al. 2019). A maternal vaccine was projected to avert almost 4 percent of all neonatal deaths yearly worldwide, indicating a potential solution for the pervasive health concerns associated with the pathogen (Kumar et al. 2023). The model also predicts 1,717 neonatal sepsis cases and 344 sepsis deaths averted annually, assuming 70 percent vaccine efficacy and coverage equivalent to the maternal tetanus vaccine.

Acinetobacter baumannii Vaccine

A. baumannii is a critical priority pathogen with great AMR risk in South Africa. In 2015, all 94 isolates collected from a tertiary hospital in the Tshwane region were resistant to ampicillin, amoxicillin, cefuroxime, cefoxitin, cefotaxime, and nitrofurantoin (Lowings et al. 2015).

Additionally, a study in a Cape Town pediatric intensive care unit found 323 (26 percent) positive *A. baumannii* cultures among 1,265 elective and emergency admissions in 2010, with 88.7 percent of those resistant to aminoglycosides and 80.9 percent resistant to penicillins with a β-lactamase inhibitor (Reddy et al. 2015). Two potential vaccine constructs have been developed to counter *A. baumannii* using seven different joined virulent epitopes, which are predicted to elicit immune responses (Shahid et al. 2021).

Preliminary research from One Health Trust (OHT) has suggested that a potential vaccine (70 percent coverage and 70 percent efficacy) targeting vulnerable populations—patients requiring mechanical ventilation, with urinary catheters, with immunocompromise, and in long-term care facilities—could halve drug-resistant *A. baumannii* infections by averting 47,271 such cases each year.

Pseudomonas aeruginosa Vaccine

Another contributor to South Africa's AMR burden is *P. aeruginosa,* a high-priority pathogen globally, as described by the 2024 WHO bacterial pathogen priority list. A 2010–2011 multidrug-resistant outbreak in a South African tertiary academic hospital resulted in a case fatality rate of 80 percent (Mudau et al. 2013). Also, the molecular characterization of resistant *P. aeruginosa* in a private Durban hospital found that 94 percent of isolates were resistant to aztreonam and piperacillin, 88 percent to imipenem and ticarcillin, and 76 percent to ceftazidime and tazobactam (Adjei et al. 2018). Reverse vaccinology (where vaccines are developed based on protein and antigen structure from bioinformatic screening of whole genome sequencing), shows promise in identifying 52 candidate antigens that

may have to be combined to develop a candidate vaccine (Killough et al. 2022).

Preliminary estimates from OHT projected that a hypothetical vaccine (70 percent coverage and 70 percent efficacy) targeting vulnerable populations—patients requiring mechanical ventilation or undergoing invasive procedures, with immunocompromise, and with neurological and chronic pulmonary conditions—could halve drug-resistant *P. aeruginosa* cases in this target group (n = 32,535) each year.

S. aureus Vaccine

S. aureus is one of the six leading pathogens responsible for AMR-associated deaths (Murray et al. 2022; IHME 2020). Globally, it ranks second as the pathogen causing the most AMR-associated and AMR-attributable deaths, with methicillin-resistant *S. aureus* causing more than 100,000 deaths attributable to AMR in 2019 (Murray et al. 2022). *S. aureus* was responsible for 6,000 AMR-associated deaths in South Africa in 2019 (IHME 2024). Potential chimeric *S. aureus* vaccines have been constructed using highly antigenic proteins. However, additional studies are needed to comprehensively study the impact of AMR in South Africa within all of its relevant contexts (Chatterjee et al. 2021).

HARNESSING THE POWER OF AMR AND IMMUNIZATION GROUPS

Despite growing evidence of immunization having a positive impact on AMR and AMU, AMR and immunization strategies remain siloed in South Africa. Reductions in AMR and AMU are not yet recognized as benefits of immunization programs. On the other hand, immunization is often mentioned as a tool for reducing infectious disease burden in national AMR strategies but with a lack of specific objectives or direction. This disconnect stems in part from institutional fragmentation, where AMR efforts are typically driven by laboratory surveillance units or pharmaceutical stewardship programmes, while immunization initiatives are anchored in maternal and child health departments. As a result, joint planning, budget allocation, and shared outcome measurement across these spheres remain minimal. It is imperative that the evidence of vaccination's importance and specific effects on AMR and AMU, from trials (Von Gottberg et al. 2024), epidemiological case studies (Klein et al. 2020), and mathematical modelling studies (Fu et al. 2021), are brought to the attention of AMR and immunization groups to inform practical policy. Highlighting these findings in routine health program reviews, joint technical groups set up by the government, and policy dialogues can facilitate cross-sector learning and lead to pilot projects that specifically track AMR outcomes of vaccination programmes, particularly for pneumococcal and influenza vaccines. AMR mitigation will decrease health care costs over the long term by reducing infections, hospital admissions, length of hospital stay, and resource use, thereby justifying AMR reduction as a major goal of any immunization policy. Several issues need to be addressed through the collaborative work of AMR and immunization groups, including inadequate health literacy, inequities in access to health care, infrastructure, and data gaps, and a lack of coordination between health programs. Establishing shared indicators, leveraging digital health tools for integrated data reporting, and fostering joint community engagement strategies could play a critical role in building public trust and improving vaccine uptake. Additionally, linking AMR-sensitive vaccination goals to broader universal health coverage commitments may help galvanise political attention and financing.

*Photo courtesy of Eh!woza

RECOMMENDATIONS

The high-priority action point for realizing the full benefits of vaccines is to scale up all existing vaccines on the national immunization schedule to reach universal coverage (GARP—South Africa Group collaborators et al. 2024).

For the NDoH

- Encourage policymakers responsible for vaccine approvals and implementation mechanisms to prioritize vaccines that can mitigate the health and economic impact of AMR. These include for malaria, RSV, active TB disease in adolescents and adults, and alternative pneumococcal strains.

- Incorporate available infant TCVs to reduce cases of typhoid fever in children and antibiotic use.

- Introduce a life course vaccination program to improve quality of life and reduce the additional health and economic burden from drug-resistant infections in vulnerable groups.

- Prioritize the equitable provision of and access to vaccines.

For AMR and Immunization Groups

- Quantify the economic benefits of mitigating AMR through vaccination by using existing data and encouraging collaboration and integration of research interests between AMR and immunization groups. This could lead to including measurable immunization targets in the National Action Plan on AMR 2.0 and aligning One Health and immunization policies.

- Lean on lessons learned during the COVID-19 pandemic, such as the need for multidisciplinary scientific research. Integrate AMR and vaccine research to increase the body of national-level data and inform strategies for AMR control.

- Prioritize education and awareness campaigns on the full benefit of vaccination. Leverage the pharmacy workforce in strategies to facilitate immunization and antimicrobial stewardship.

CONCLUSION

Vaccines are an important tool to decrease the incidence of disease and, therefore, antibiotic prescriptions and associated AMU. Using existing and modeled data will create an irrefutable health and economic case—an excellent metric when considering the value of vaccines and their added benefits. Costs associated with AMR are very high, and treatment is not always available, so prevention through vaccination represents an effective solution to mitigate the health and economic burden on communities and the health care system.

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

 This report is based on research supported by Gates Foundation.

The findings and conclusions contained within are those of the authors and do not necessarily reflect the positions or policies of OHT, Gates Foundation, or partnering institutions. Related research and additional information on vaccines and antimicrobial resistance are available at onehealthtrust.org.

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