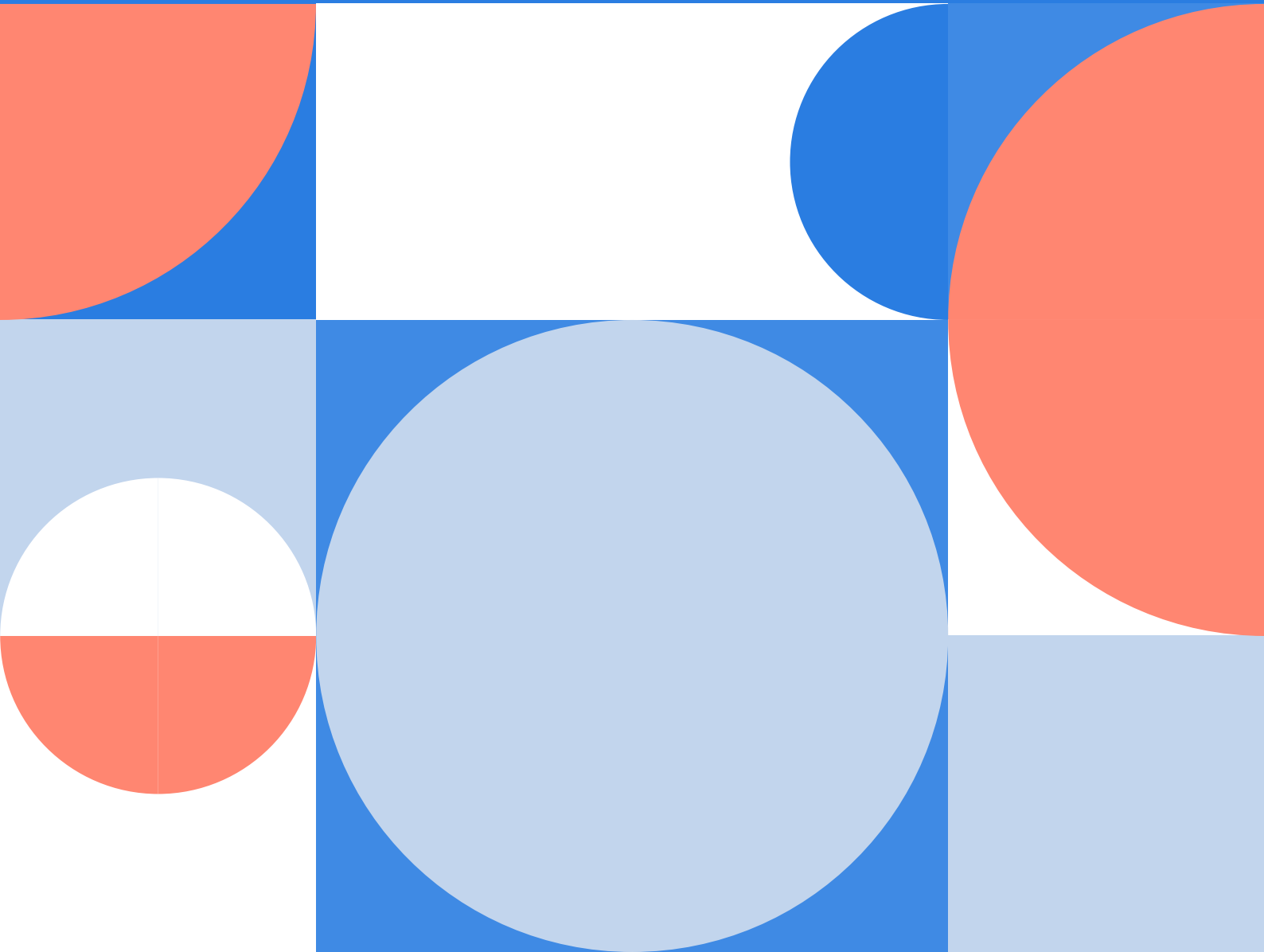


Malawi national action plan on antimicrobial resistance

Review of progress in the
human health sector

Antimicrobial resistance policy information
and action brief series



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(Antimicrobial resistance policy information and action brief series)

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Acronyms and abbreviations

AFIDEP	African Institute for Development Policy
AMC	antimicrobial consumption
AMR	antimicrobial resistance
AMRCC	antimicrobial resistance coordinating committee
AMS	antimicrobial stewardship
AMU	antimicrobial use
AST	antimicrobial susceptibility testing
AWaRe	Access, Watch and Reserve
CHAM	Christian Health Association of Malawi
CLSI	Clinical and Laboratory Standards Institute
CMST	Central Medical Stores Trust
COVID-19	coronavirus disease
DRUM	Drivers of Resistance in Uganda and Malawi
EML	essential medicines list
EQA	external quality assurance
ESBL	extended-spectrum-lactamase
EUCAST	European Committee on Antimicrobial Susceptibility Testing
GLASS	Global AMR and Use Surveillance System
HAI	health-care-associated infection
IDSR	integrated disease surveillance and response

IHR	International Health Regulations
IPC	infection prevention and control
JEE	joint external evaluation
KAP	knowledge, attitudes and practices
KI	key informant
KII	key informant interview
M&E	monitoring and evaluation
MK	Malawian kwachas
NAP	national action plan
NGO	nongovernmental organization
NMRL	national microbiology reference laboratory
PPS	point prevalence survey
R&D	research and development
SARS-CoV-2	severe acute respiratory syndrome coronavirus type 2
STGs	standard treatment guidelines
STI	sexually transmitted infection
TB	tuberculosis
TrACSS	Tripartite AMR Country Self-Assessment Survey
UNICEF	United Nations Children's Fund
WAAW	World Antimicrobial Awareness Week
WASH	water, sanitation and hygiene
WASH FIT	Water and Sanitation for Health Facility Improvement Tool
WHO	World Health Organization

Executive summary

Antimicrobial resistance (AMR) is a recognized threat to public health and modern medicine. In 2019, an estimated 1.27 million deaths were directly attributable to bacterial AMR, and sub-Saharan Africa carried the highest burden (1). Focusing on Malawi, our analysis of available AMR data suggests that resistance of common pathogens to various antimicrobials has increased since the early 2000s. The Government of Malawi has recognized this threat and has mobilized resources for its mitigation. Malawi endorsed the Global Action Plan on AMR and is a signatory to the 2016 *Political declaration of the high-level meeting of the United Nations General Assembly on antimicrobial resistance*. In addition, in 2017 Malawi published a national action plan (NAP) on AMR (*Antimicrobial resistance strategy 2017–2022*) (2). The NAP incorporates a One Health approach for addressing AMR, defines specific roles for relevant government ministries and implementation partners, and includes a detailed operational plan, cost analysis, and monitoring and evaluation (M&E) framework.

Commendably, Malawi is one of only a few countries in the African region with a dedicated, albeit small, national budget to address AMR. However, while Malawi has made great progress in implementing various aspects of the NAP, a lack of consistent and sufficient financial and human resources for AMR activities is a major barrier to sustainable implementation. This policy brief reviews the status of Malawi's national AMR mitigation and control policies and strategies, and highlights findings to accelerate further progress in the human health sector.

Malawi has a functioning governance and coordination mechanism for AMR with designated full-time staff. This mechanism comprises a multisectoral national coordinating committee (AMRCC), subcommittees that function as technical working groups and a core group of interdisciplinary stakeholders that oversee and coordinate national and subnational AMR strategy and activities. Currently, the AMRCC and subcommittees are financially supported by a grant from the Government of the United Kingdom (Fleming Fund).

Although few studies have assessed knowledge, attitudes and practices (KAP) regarding antimicrobial use (AMU) and AMR among key stakeholder groups, several AMR awareness and educational campaigns have been organized by both government and nongovernment stakeholders. AMR was recently incorporated into in-service training at the hospital level as part of broader infection prevention and control (IPC) training. Additionally, there are plans to develop and include AMR topics in future curricula at the primary, secondary and higher education level.

An estimated 40% of hospital laboratories in Malawi have the capacity to isolate and identify bacterial infections as well as to perform antimicrobial susceptibility testing (AST). However, despite these capacities being available,

health care workers do not always use laboratory services to inform diagnosis or treatment. Malawi has implemented AMR surveillance in 15 human health laboratories and three animal health laboratories. Since April 2020, AMR surveillance data have been stored at a national data warehouse and are regularly analysed. However, there is no national surveillance or reporting mechanism for health-care-associated infections (HAIs).

Malawi has implemented a national immunization campaign that covers all internationally recommended vaccines. In addition, national IPC guidelines and capacity-building activities have recently been implemented in the human health sector, and there is a clear model for improving IPC measures at all levels of health care. However, no mechanism exists for tracking IPC progress at the national or community level.

Surveillance data on antimicrobial consumption (AMC), AMU and sales in the human health sector are just beginning to emerge through various projects. The Ministry of Health has developed national standard treatment guidelines (STGs) and an essential medicines list (EML). Work is under way to update these documents to directly acknowledge AMR and incorporate key antimicrobial stewardship (AMS) principles, including the WHO Access, Watch and Reserve (AWaRe) classification of antimicrobials (3). Budgetary gaps at the facility and national level result in frequent stock-outs of critical medicines, including antimicrobials, which may contribute to inappropriate AMU. Although national laws mandate prescription-only use of antimicrobials, weak enforcement of these regulations and lack of access to and affordability of essential antimicrobials may also drive inappropriate AMU.

This policy brief concludes by highlighting 10 findings and suggested actions to advance the NAP on AMR.

Key findings to accelerate AMR mitigation efforts in Malawi

Need to:

1. Increase domestic financing and donor resource mobilization for sustainable coordination and implementation of the NAP on AMR priority activities.
2. Further develop or revise the NAP on AMR and accompanying operational plan
3. Increase awareness-raising activities among health care workers, financial decision makers and the public to promote appropriate AMU (in both English and Chichewa).
4. Incorporate AMR and AMS into pre- and in-service education and training of health care workers, including the use of laboratory data to inform appropriate prescription.
5. Expand the proportion of health care facilities with the capacity to detect and diagnose infections and conduct AST, including ensuring a quality assurance programme and continued supply of equipment, supplies and reagents, appropriate staffing and training of laboratory personnel.
6. Prioritize investments and capacity building in IPC and water, sanitation and hygiene (WASH) to achieve the objectives of the NAP on AMR and broader health systems strengthening. Take the opportunity to leverage existing coronavirus (COVID-19) initiatives to monitor IPC activities and WASH status at the national level. The current high nationwide immunization coverage for all recommended vaccines is commendable, but the critical role that vaccines play in mitigating AMR could be more explicitly communicated.
7. Support the roll-out of AMS programmes and activities in health care facilities by developing a national practical guide for establishing, implementing and monitoring AMS programmes at the facility level.
8. Establish a functioning national surveillance system for AMC to routinely collect and analyse AMC data and ensure the data inform policy and practice (using internationally recognized tools and guidance). Strengthen the national AMU surveillance system to periodically collect and analyse AMU data and ensure that they are used to inform and evaluate AMS interventions at all levels of care.
9. Strengthen the supply chain of medical products to ensure that adequate quantity and quality of all essential antimicrobials and laboratory diagnostic supplies reach the national and facility level in a timely manner and are well managed.
10. Assign responsibility for regularly assessing the quality of imported medicines, including antimicrobials, to the relevant national authority or establish a regulatory authority with this mandate.

AMC: antimicrobial consumption; AMU: antimicrobial use; AST: antimicrobial susceptibility testing; IPC: infection prevention and control; M&E: monitoring and evaluation; NAP: national action plan.

1. Introduction

The following policy brief describes the status of Malawi's national AMR mitigation and control policies and strategies, and highlights findings to accelerate implementation of priority activities outlined in the NAP on AMR.

The findings in this brief are informed by a review and analysis of numerous sources, including government reports, peer-reviewed literature, press releases, funding proposals and periodicals. Semi-structured key informant interviews (KIIs) with select AMR focal points and stakeholders in Malawi were also conducted between October and November 2021. The policy brief

is structured to align with the strategic objectives described in the Global Action Plan on AMR (4) and encompasses public awareness and understanding of AMR, surveillance (including laboratory and research), infection prevention, optimal use of antimicrobials, and research and development (R&D) in the human health sector.

2. Context of health and AMR in Malawi

The population of Malawi, estimated at 18.6 million, is expected to double by 2038 (5). As of 2019, 83% of the population lived in rural areas, 43% were aged 0 to 14 years, and overall life expectancy at birth was 64 years. That is lower than the global average of 73 years but higher than the average 62-year life expectancy for sub-Saharan Africa (6–8). Leading causes of morbidity and mortality in Malawi include HIV/AIDS, lower respiratory tract infection, malaria and diarrheal diseases, according to a 2006 report (9). Other major public health challenges include chronic malnutrition, cholera, tuberculosis (TB) and an increasing prevalence of noncommunicable diseases. According to 2016 data, an estimated 69.2% of Malawians lived under the international poverty line of US\$ 1.90 per day (10).

Malawi has a three-tiered health care system consisting of primary (including dispensaries, health centres and community hospitals), district or secondary, and central or tertiary health care facilities (11). There are 26 secondary-level facilities and four tertiary-level facilities in each of the country's major cities (Mzuzu, Lilongwe, Zomba and Blantyre) (12). A health-facility mapping analysis conducted in 2016 by the United Nations Children's Fund (UNICEF) recorded 9498 health

facilities in the country, of which 86.2% are public or government-run facilities (11). An additional 11.9% of facilities are run by the country's largest religious health care provider, the Christian Health Association of Malawi (CHAM), which has facilities in rural and hard-to-reach locations and aims to make health care accessible to the poorest and most vulnerable citizens of the country (13). Even though CHAM operates only 12% of the health care facilities, they provide more than 30% of all health care services. Health facilities operated by the private sector and nongovernmental organizations (NGOs) comprised 1.3% and 0.6% of the country's health care system, respectively (11).

An estimated 90% of Malawians lived within an 8-kilometre radius of a health facility in 2016, according to the Ministry of Health (14). However, the lack of access to and affordability of health services, especially advanced medical procedures, and medications remains a major barrier to comprehensive, quality care. Select health services and medicines, including many antimicrobials, are provided to patients free of charge at government-owned facilities, whereas these must be paid out of pocket at CHAM, NGO and private sector facilities (15, 16).

The human health care sector lacks adequate funding and is understaffed. The WHO benchmark for annual per capita health allocation is US\$ 86. In Malawi, per capita health spending was US\$ 10.40 (17). The out-of-pocket expenditure for patients seeking health care, measured as a proportion of the total health expenditure, was approximately 11% for the past 5 years, which is lower than the 33.3% average for sub-Saharan Africa (18). Previous studies reported that 27% of total health care expenditures came from the private sector and that more than half (53.4%) was from out-of-pocket spending (19). WHO estimates that per 1000 Malawians, there are only 0.018 doctors (2009 estimate), 0.6 community health care workers (2018), and 0.3 nurses and midwives (2009), which is far below the WHO standard of 4.45 health care workers (including doctors, nurses and midwives) per 1000 people (20–23). An estimated 5000 physicians are registered in Malawi; however, the number of infectious disease specialists is not known, according to a key informant (KI). Up to 81% of public health positions, particularly clinical positions, are vacant across health care tiers (17). The pharmaceutical sector is similarly understaffed. As of 2019, only 66 pharmacists were working in Malawi along with an additional 240 support staff, including pharmacy technicians and assistants, fulfilling only 17% of the country's needs (17).

Multilateral organizations, foreign donors and NGOs contribute significantly to health-related development and capacity building, including AMR-related activities such as strengthening laboratory and clinical diagnostic capacities and improving disease surveillance and control infrastructure. For example, Malawi receives financial and technical assistance from donors and implementing partners for AMR surveillance activities. In 2020, the Fleming Fund provided a country grant in the amount of a £3.4 million (approximately US\$ 4.5 million) to strengthen Malawi's One Health AMR programme (24).

The national AMR burden in Malawi is not known; however, analysis of available data suggests that resistance of common pathogens to various antimicrobials has increased since the early 2000s (Figs. 1 and 2) (25). A hospital surveillance study conducted at Queen Elizabeth Central Hospital, a large, government-run tertiary health care facility in Blantyre, analysed blood cultures obtained from adult and paediatric patients admitted between 1998 and 2016 with fever or suspicion of sepsis (26). A total of 29 183 pathogens were isolated from 194 539 blood cultures. Despite an overall decrease in the incidence of bloodstream infections between 1998 and 2016, the study showed an increase in AMR, especially among Gram-negative organisms. There were indications of emerging methicillin resistance in *Staphylococcus aureus* and an increasing trend in multidrug resistance in three out of six commonly identified pathogens (*Klebsiella* spp., *Enterococcus* spp. and *Streptococcus* spp.) (26).

Data from the Queen Elizabeth Central Hospital survey and surveillance data reported to WHO's Global AMR and Use Surveillance System (GLASS) in 2017 indicated an increase in rates of resistance. However, the findings should be interpreted with caution, because they are derived from one or two hospitals and therefore do not represent national estimates. Additionally, AMR surveillance data from larger facilities in low-resource settings may not represent routine AMR surveillance data, as many patients included in the surveys may be suspected of having severe infections (27).



Figure 1. Resistance rates of *E. coli* to various antimicrobials in Malawi, 1998–2017

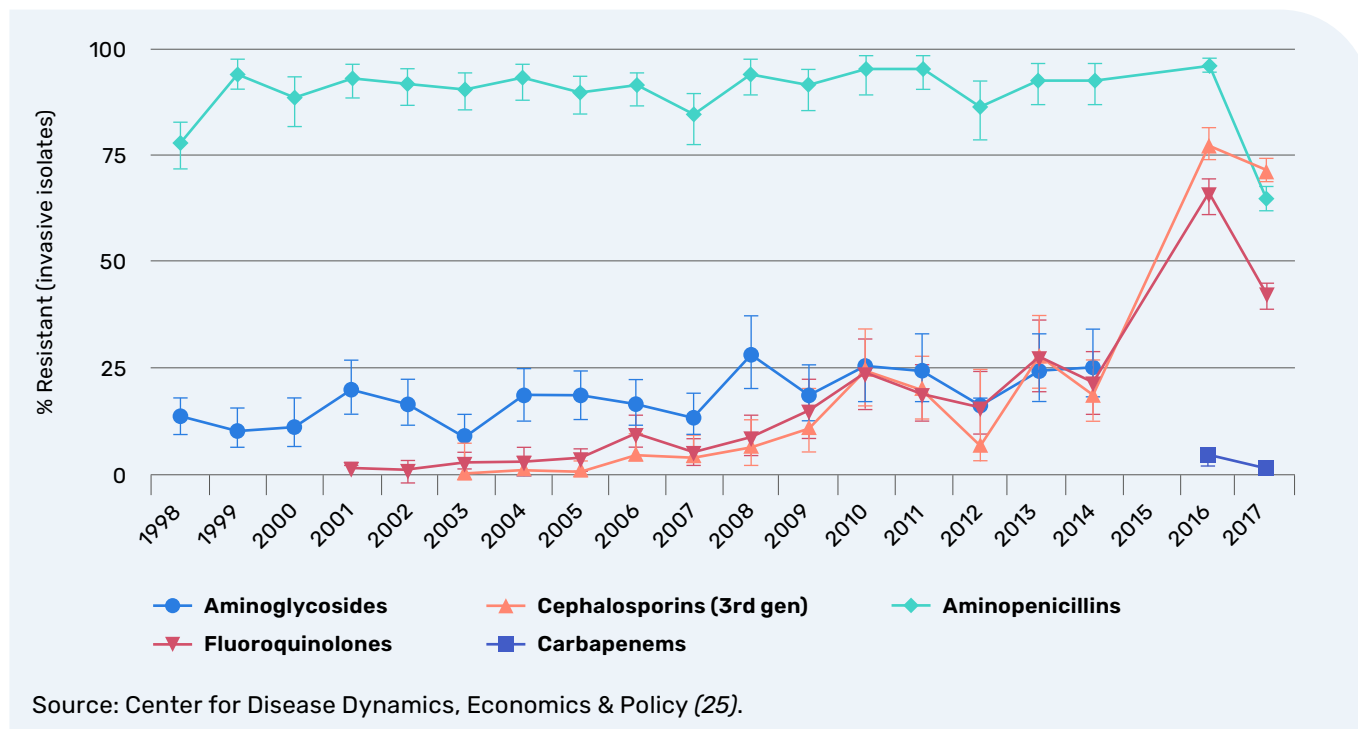
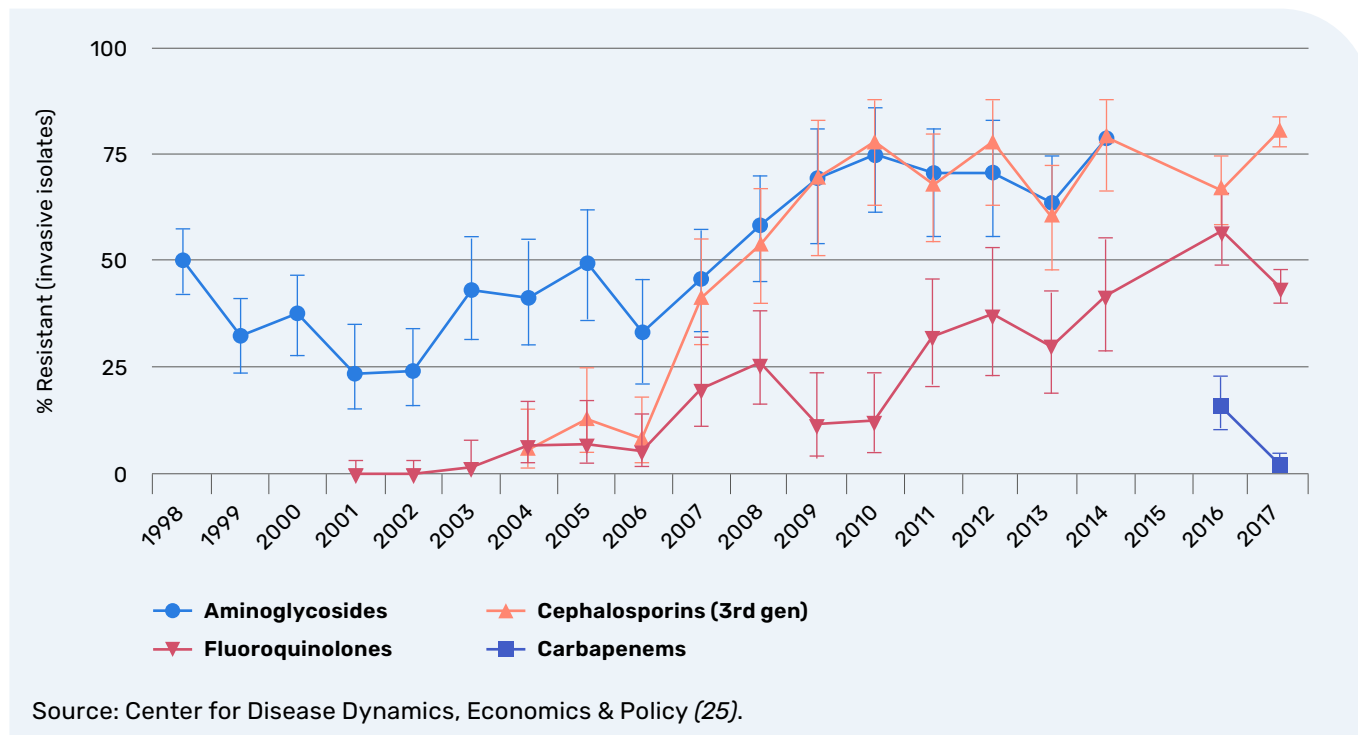


Figure 2. Resistance rates of *K. pneumoniae* to various antimicrobials in Malawi, 1998–2017



3. Status of the NAP on AMR

Malawi identified AMR as a critical area for action in its *Health sector strategic plan II* published in 2017. The NAP on AMR further outlines health policy and implementation objectives, yearly operational plans and budgetary requirements (2, 14). The NAP is based on a comprehensive situational analysis conducted as part of the Antibiotic Stewardship and Conservancy in Africa project funded by the Norwegian Programme for Capacity Development in Higher Education and Research for Development (2). The NAP on AMR outlines five core outcomes with baseline and target values (Table 1). How the baseline and target estimates were set is unspecified. Nonetheless, there is a clear indication that the objectives of the NAP intend to significantly increase AMR mitigating activities by 2022.

Malawi's NAP explicitly outlines roles and responsibilities for various stakeholders involved in implementing AMR-related activities and control measures, including the Ministries of Health; Agriculture; Education, Science and Technology; National Resources, Energy and Mining; and Finance, Economic Planning, and Development; as well as health development partners and civil society organizations. A 5-year operational plan describes annual output targets, including the number and type of activity (e.g. development of materials, workshops, meetings and training) for each strategic objective. Notably, the strategy also includes detailed annual cost estimates for each strategic objective along with funding source, risk and assumptions; however, the operational plan is not complete for all outputs and sub-activities.

Table 1. Core outcomes and baseline and target values of Malawi's NAP on AMR

Outcome	2016 Baseline (%)	2022 Target (%)
Improve awareness and understanding of AMR through effective communication, education and training	0	90
Improve knowledge and evidence of AMR through surveillance and research	5	70
Reduce incidence of infection through effective IPC and WASH measures	5	90
Ensure sustainable investment through government ownership, partnership and R&D	5	60
Optimize use of antimicrobial medicines in the human, agriculture and animal health sectors	5	100

AMR: antimicrobial resistance; IPC: infection prevention and control; R&D: research and development; WASH: water, sanitation and hygiene.

Source: Ministry of Health of Malawi (2).

The estimated annual budget required to implement all the strategic objectives described in the plan is approximately 1 billion Malawian kwachas (MK), or about US\$ 1 million. In the 2017/2018 fiscal year, the Ministry of Health received US\$ 24 000 from the national government for AMR-related activities (28). Malawi is one of very few African countries with an itemized budget line for AMR as part of the *Health sector strategic plan II*. Although the budget is small, it represents a critical step in getting AMR into national health budgets and plans and consequently towards long-term sustainability of actions to address AMR. In addition, efforts are ongoing to increase awareness of AMR among financial decision makers and ensure AMR activities receive consistent and sufficient budgetary allocation. External partners, including WHO and the Fleming Fund, have supported implementation of the NAP on AMR; however, inadequate funding overall has delayed or hampered implementation efforts, according to several key informants (KIs).

According to a KI, the NAP on AMR is linked to HIV, STI and TB action plans. Surveillance of *Neisseria gonorrhoea* is being conducted by the department of HIV/AIDS with resources from the Global Fund. The national TB control programme is supporting the development of stewardship guidelines.

Since 2016, countries have been working to develop NAPs for health security (NAPHS) to guide the identification of evidence-based priority actions to improve health security in the short and long term. Malawi completed drafting an NAPHS in February 2020; however, as of May 2022, the plan had not yet been published (29).

Results of the 2020/21 Tripartite AMR Country Self-Assessment Survey (TrACSS) (30)

- The NAP on AMR is currently being implemented.
- The NAP on AMR's coverage period is almost over, and work is ongoing to develop a new set of goals covering the next 5 years.
- Stakeholders from the human health, terrestrial and aquatic, food production, food safety and environment sectors are actively involved in implementing the NAP on AMR.
- The development and implementation process of the NAP on AMR has been affected by the COVID-19 pandemic and the national response.

Current status

- Malawi's NAP on AMR is well aligned with the Global Action Plan on AMR.
- The NAP on AMR incorporates a One Health approach to addressing AMR, defines specific roles for relevant government ministries and implementation partners, and includes an operational plan, cost analysis and M&E framework.
- The national government provides a financial allocation for AMR. In the 2017/2018 fiscal year, the Ministry of Health received US\$ 24 000 for AMR-related activities. However, the lack of sufficient financial resources for AMR activities remains a significant barrier for NAP on AMR implementation.
- The NAP on AMR is linked to other national health plans, e.g. HIV, STIs and TB action plans.
- National policies and guidelines for vertical disease control programmes such as TB are crafted in a manner that informs case management of drug-resistant TB, while periodic drug resistance surveys inform policy change and practice.

Findings

- Domestic financing and donor resource mobilization must be increased for sustainable implementation of the NAP on AMR priority activities.

4. AMR governance and coordination

In the 2019 joint external evaluation (JEE) of International Health Regulations (IHR) core capacities mission report, WHO stated that the AMRCC was functioning (Table 2) (31). In its 2018/19 TrACSS, Malawi reported that the subcommittees were functional, with funding, clear terms of reference and regular meetings to review AMR and AMU data. In 2021 Malawi reported via TrACSS that integrated approaches were being used to implement the NAP on AMR, drawing on relevant data and lessons learned from all sectors. The country was also employing relevant AMC/AMU and AMR data to amend national strategy and inform decision-making, at least annually, for the human health sector. However, this information should be interpreted with caution given that findings suggest robust AMC/AMU and AMR surveillance data are not readily available.

As of January 2022, the AMRCC is run by five full-time staff in addition to 22 part-time (20% capacity) core team members from the human health, agriculture,

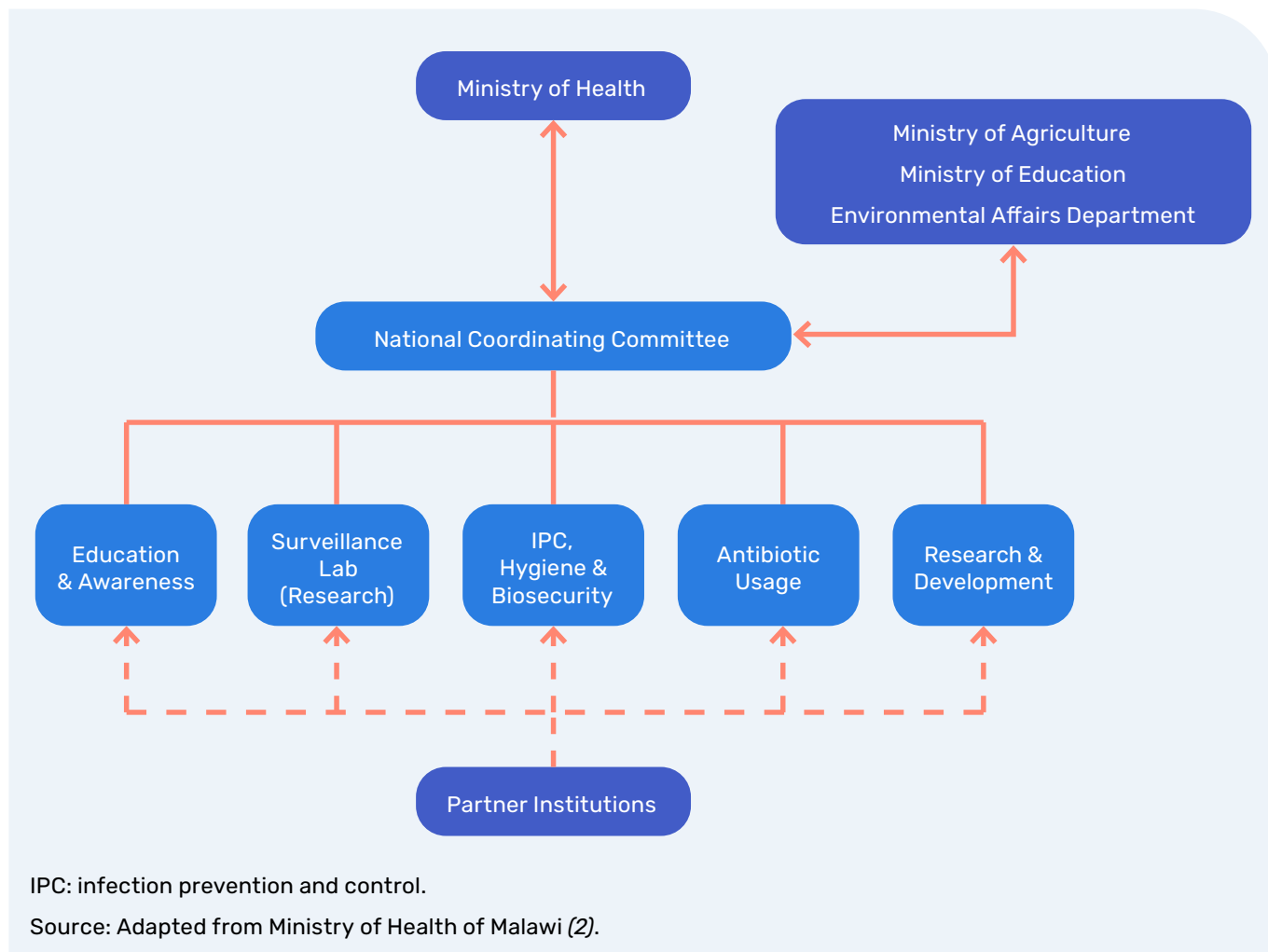
environment and education sectors. Together these staff drive NAP on AMR implementation in the context of the One Health approach, according to a KI. The AMRCC has terms of reference to drive their agenda, according to a KI. Five subcommittees take responsibility for implementing and monitoring different aspects of the action plan: 1) education and awareness; 2) surveillance, including laboratory strengthening; 3) IPC hygiene and biosecurity; 4) rational use of antibiotics; and 5) research and development (Fig. 3). Subcommittees propose activities in their specific technical areas; however, all AMR-related activities are approved by the AMRCC secretariat. Subcommittees function to varying degrees. For example, the IPC and surveillance subcommittees are active and meet quarterly. The rational antibiotic use and awareness subcommittees have become more active in the past 6 months. In total, between 80 and 100 part-time staff are engaged with the AMRCC and the various subcommittees, according to a KI.

Table 2. AMR indicators and priority actions in the 2019 JEE of IHR core capacities mission report

Indicator	Score	Priority actions
P.3.1. Effective multisectoral coordination on AMR	3	<ul style="list-style-type: none"> Incorporate aspects of pharmaceutical production into the AMR strategy and institutionalize a monitoring and evaluation system to track progress of AMR strategy implementation in both human and animal health.
P.3.2. Surveillance of AMR	2	<ul style="list-style-type: none"> Establish AMR surveillance in the animal sector.
P.3.3. IPC	1	<ul style="list-style-type: none"> Develop and implement an antimicrobial policy to guide the appropriate prescription and use of antimicrobials in both human and animal health.
P.3.4. Optimize use of antimicrobial medicines in human and animal health and agriculture	1	<ul style="list-style-type: none"> Develop standard operating procedures and tools for effective coordination and communication, including AMR data sharing and reporting for both human and animal health. Finalize, disseminate and implement IPC policy and guidelines for human health, animal health and food production, as well as mechanisms to offer supportive supervision, monitoring and evaluation.

AMR: antimicrobial resistance; IHR: International Health Regulations; IPC: infection prevention and control; JEE: joint external evaluation.

Figure 3. Governance structure for AMR strategies in Malawi



Monthly and quarterly reports from AMRCC meetings are made available to national and international stakeholders, including the director of the Public Health Institute of Malawi; the director of the Animal Health and Livestock Department; the chair of the AMR subcommittees; WHO; the Fleming Fund and the Africa Centres for Disease Control and Prevention, according to a KI.

The AMRCC and subcommittees are financially supported by a 2-year grant (currently in a no-cost extension of the grant's first year) from the Fleming Fund, according to a KI. This grant covers expenses for office space and the five full-time staff on the AMRCC. According to a KI, following completion of this grant, the Ministry of Health will be able to support one full-time staff to run the AMRCC, which is vital to ensure continued progress in implementing the NAP on AMR from an operational perspective.

National target

- Malawi's NAP on AMR calls for developing a multisectoral AMRCC and explicitly defines roles and responsibilities for various government ministries and other stakeholders.

2020/21 TrACSS results

- Integrated approaches were used to implement the NAP on AMR, drawing on relevant data and lessons learned from all sectors.
- The country used relevant AMC/AMU and/or AMR data to amend national strategy and/or inform decision-making, at least annually, for the human health sector.

Current status

- The AMRCC is functional, meets regularly and consists of representatives from the human, animal and environmental health sectors (22 core members with part-time engagements), whereas the subcommittees (technical working groups) are functional to varying degrees.
- Monthly and quarterly reports from the meetings of the AMRCC and subcommittees are made available to national and international stakeholders.
- The AMRCC and subcommittees are financially supported by a 2-year grant from the Fleming Fund. Following completion of the grant, the Ministry of Health will support one full-time staff member to oversee the AMRCC and subcommittees.

Findings

- Human resource options (e.g. secondments) need to be considered to ensure at least one full-time staff member to support overall functioning of the AMRCC office in coordinating and implementing the NAP on AMR. This support could be provided on a rotational basis from the different ministries or departments involved.

5. AMR awareness and knowledge

The Government of Malawi has set a national target to increase awareness and understanding of AMR among public and professional stakeholders in the human health, animal health and agricultural sectors from 0% in 2016 to 90% by 2022. The NAP on AMR calls for a variety of awareness-raising activities, including engaging with media, social networks, pharmaceutical companies and community leaders; disseminating bimonthly media and public communications on AMR topics; including AMR in human and animal health education curricula; holding in-service training for professionals in relevant sectors and conducting assessments on socio-behavioural drivers and determinants of AMR.

A nationally representative assessment of AMR knowledge and awareness among the public or professional stakeholders has not yet been done, according to KIIs. However smaller-scale KAP studies were conducted in 2016 and 2019. In 2016, a KAP study on AMU and AMR was conducted among 74 final-year medical students in the University of Malawi's College of Medicine. The study revealed that overall technical knowledge of AMU was high but that there were gaps that could be addressed by integrating AMU, AMS and AMR topics into the pre-service education curriculum of health care workers (32). Most respondents agreed that AMR is a significant national challenge, that antimicrobials are overused at both the facility and national level and that better use of antimicrobials would reduce the AMR burden. A 2019 cross-sectional KAP study involving Lilongwe residents found that 92.4% of respondents reported that antibiotics could be used to stop a fever (33).

While no regular AMR awareness or education campaigns target the general public, the Ministry of Health and other government and nongovernment stakeholders have held several events over the years. Between 2019 and 2020, the Drivers of Resistance in Uganda and Malawi (DRUM) consortium designed and distributed several AMR informational materials during World Antimicrobial Awareness Week (WAAW) (34-36). This event emphasized the role of the media and social networks in promoting AMR awareness and behaviour change regarding prudent AMU. During WAAW, members of the press actively participated in a discussion on debunking myths and misconceptions regarding AMR. Interactions on AMR throughout this event shed light on the challenge of scientific communication to the public due to the lack of a vernacular term for "antibiotic" in Chichewa, a language spoken by 70% of the population (37).

Public outreach on AMR has also taken place via official Ministry of Health social media platforms. In 2019, the African Institute for Development Policy (AFIDEP), a regional non-profit research policy organization, collaborated with the Malawi Ministry of Health in organizing "the big walk" in Lilongwe to promote public awareness of the prudent use of antibiotics. Since then, AMR content and awareness materials have been developed and disseminated through various platforms, including comic strips, fact sheets and other informational materials (34-36). The Ministry of Health and other government and nongovernment stakeholders were actively involved in disseminating AMR information and engaging the public and the media during the 2021 WAAW. AMR is also periodically addressed during health promotional activities for other vertical disease control programmes, such as for HIV/AIDS, TB, malaria and WASH, according to KIIs. These efforts should be further enhanced, however. In February 2022, the Ministry of Health hosted an AMR conference that targeted the general public and was broadcast on local TV, Facebook and Twitter, according to a KI.

Only one university in Malawi, (University of Malawi, College of Medicine) awards a medical degree (i.e. bachelor of medicine and bachelor of surgery), and AMR has now been incorporated as a module in the curriculum. There are plans to develop and include AMR topics in future curricula at the primary, secondary and higher education level. Development and implementation of such curricula will be accomplished through collaborations with the Ministry of Education, Science and Technology; the Malawi Institute of Education and other regulatory bodies. AMR has been incorporated into in-service training at the hospital level as part of broader IPC training. In May 2021, the Medical Council of Malawi launched a course on AMR with support from the African Society for Laboratory Medicine; 24 participants, including epidemiologists, microbiologists, pharmacists, data managers and AMR subcommittee members, are currently enrolled in the course and finishing the last modules, according to a KI.

National target

- Improve awareness and understanding of AMR through effective communication, education and training from 0% in 2016 to 90% in 2022.

2020/21 TrACSS status

- Activities are under way in parts of the country to raise awareness about the risks of AMR and specific actions that can be taken to address it. The focus of these activities includes the human and animal health sectors.

Current status

- Few studies have assessed KAP regarding AMU and AMR among key stakeholder groups.
- AMR awareness and educational campaigns organized by NGOs have been implemented primarily in urban settings since 2017.
- AMR has been incorporated into in-service training at the hospital level as part of broader IPC training. There are plans to develop and include AMR topics in future curricula at the primary, secondary and higher education level.

Findings

- To establish a baseline understanding of KAP, at least one KAP assessment needs to be conducted among key stakeholder groups involved in the use or prescription of antimicrobials to target awareness-raising messaging.
- Incorporating AMR and AMS into pre-service educational curricula for health care workers, including doctors, pharmacists, microbiologists and nurses, would strengthen prevention, diagnosis and treatment of infections, including AMR infections.
- Bimonthly media and public communications about AMR topics can be disseminated by leveraging other health promotional activities, such as those for HIV/AIDS, malaria, TB, COVID-19, immunization and WASH.
- It would be helpful to develop targeted messaging on the proper use of antibiotics in both English and Chichewa to raise awareness among the public. These efforts could include campaigns targeting faith-based organizations, which provide about a third of health care services in the country.
- Given that 80% of Malawi's population is below 35 years of age and that the median age is 17, it would be beneficial to consider how best to target this critical age group. Inclusion of educational material in school curricula, adapted to different grade levels, could provide one opportunity.

6. Surveillance, laboratory and diagnostic capacity

The NAP on AMR calls for a 55% increase in AMR knowledge and evidence through research and surveillance between 2016 and 2022 and sets forth the following three specific aims:

1. Strengthen the national AMR surveillance system for human, animal, agriculture and environmental health.
2. Identify key stakeholders and resources in AMR through the creation of a multidisciplinary research platform.
3. Develop and incorporate AMR research priorities into the national research agenda.

Malawi enrolled in WHO GLASS in May 2017, and in 2021 reported data from eight surveillance sites to GLASS for the 2021 GLASS report (38–40). As of January 2022, the national AMR surveillance system covers 15 human health laboratories and three veterinary laboratories, according to KIIs. Since April 2020, AMR data reported from these sites have been stored in a national data warehouse, according to a KI. Retrospective AMR data from 2018 to 2020 collected under a Fleming Fund regional grant have also been added to the data warehouse. The AMR surveillance system data platform is separate from other infectious disease surveillance systems. Duplication in data entry is avoided, as AMR surveillance is pathogen specific and Malawi has integrated AMR surveillance data reporting into its IDSR platform. Since April 2020, the AMRCC data team have been analysing surveillance data quarterly and upload these data to the IDSR platform

There is currently no national surveillance system for HAIs (24).

Malawi has a designated AMR national reference laboratory – the National Microbiology Reference Laboratory (NMRL) – which plays a central role in national AMR surveillance activities by providing training and performing confirmatory testing for other surveillance sites. The NMRL is enrolled in the international external quality assurance (EQA) scheme from the National Institute for Communicable Diseases in South Africa (24). It is mandatory for public laboratories to participate in the EQA programme for quality control and assurance for serology, haematology, biochemistry, bacteriology and parasitology laboratory procedures. More than 90% of public laboratories and over 70% of private laboratories are registered with the EQA programme (31, 39). Malawi has also established a national reference laboratory for the animal health sector (Central Veterinary Laboratory).

While approximately 40% of hospital laboratories in Malawi have the capacity to isolate and identify bacterial resistance, these data are not commonly used by health care workers to inform appropriate treatment, with empiric prescribing predominating over targeted therapy. One KI underscored the need to develop laboratory infrastructure at other health facilities outside of the existing 40% with current AST to enhance capacity for data to inform appropriate prescribing (32).

With the ongoing effort of countries to implement genomic analysis of SARS-CoV-2 (severe acute respiratory syndrome coronavirus type 2) viruses, it is essential to also promote the capacity for identifying AMR genes in Malawi.

National target

- Improve knowledge and evidence of AMR through research and surveillance from 5% in 2016 to 60% to 2022.

2020/21 TrACSS status

- A standardized national AMR surveillance system collects data on common bacterial infections in hospitalized and community patients. An established network of surveillance sites, a designated national reference laboratory for AMR and a national coordinating centre all produce reports on AMR.
- Most bacteriology laboratories in the public health sector belong to a national laboratory network.
- A regulatory authority exists to certify/accredit bacteriology laboratories.
- National AMR surveillance guidelines have been developed, based on international standards for AST (e.g. CLSI or EUCAST), bacterial isolation and identification for use within the bacteriology laboratory network.
- In the animal health sector, there is a national plan for surveillance of AMR, but capacity (including laboratory and for reporting data on AMR) is lacking.
- There is no national plan or system for surveillance of AMR in food.

Current status

- Fifteen human health laboratories and three animal health laboratories report regularly to the national AMR surveillance system.
- The AMR surveillance system data platform is separate from other infectious diseases surveillance systems. Duplication in data entry is avoided, as AMR surveillance is pathogen specific. Malawi has also integrated AMR surveillance data reporting into its integrated disease surveillance and response (IDSR) platform.
- Since April 2020, the AMRCC data team has been analysing surveillance data quarterly and uploads these data to the IDSR platform.
- There is no national surveillance system for HAIs.
- All surveillance sites are connected to WHONET, the laboratory information system for uploading and analysing AST data. Data are uploaded to WHONET on a daily basis.

Findings

- The number of health care facilities (currently 40%) with capacity to detect and diagnose infections and undertake AST needs to be expanded, including ensuring a quality assurance programme, continued supply of equipment and reagents, and appropriate staffing and training of laboratory personnel to support appropriate AMU.
- Health care workers need to be educated and trained to incorporate clinical diagnostic and laboratory testing and results into routine clinical practice and consideration.
- Passive (routine), facility-based surveillance for HAIs needs to be integrated, and active, short-term HAI surveillance should be conducted to support development of baseline data on HAIs to guide AMR interventions.

7. IPC, WASH and immunization

The NAP on AMR aims to strengthen IPC policy and implementation to reduce AMR in the human and animal health sectors by:

1. Establishing infection prevention systems and building appropriate infrastructure for IPC implementation at the national level.
2. Providing WASH facilities and promoting personal hygiene etiquette and safe disposal of antimicrobials to promote IPC at the community level.
3. Strengthening the availability of IPC supplies in human and animal health settings and enforcing safety measures for health workers.
4. Promoting good agricultural practices and safety measures to prevent and control infection in the agricultural sector.
5. Promoting water, waste and sewage management from human and animal health facilities, industry and agriculture to reduce AMR spread in the environment.

Despite progress, IPC measures and WASH infrastructure remain underdeveloped across the human, animal and environmental health sectors. In 2020, 24% of the rural population had access to improved sanitation, a 3% increase from 2010. Among urban populations, 27% of people had access to improved sanitation in 2020, a 0.3% increase from 2010. In 2016, the mortality rate attributed to poor WASH standards was 28.3 per 100 000 people compared to 11.8 and 47.2 per 100 000 globally and in the sub-Saharan African region, respectively (41).

In Malawi, IPC falls under the Ministry of Health's Quality Management Directorate, according to a KI. The national government provides financial support to maintain the Quality Management Directorate offices, staff and operational equipment; however, no national budget allocation is made for specific IPC activities, according to KIs. All previous and ongoing IPC activities are enabled by periodic support from external partners, according to KIs, which is not sustainable in the long term.

Numerous national and facility-specific WASH and IPC programmes and policies have been developed and implemented, including the National Sanitation Policy of 2008; the Water, Sanitation and Irrigation Sector Strategic Plan of 2016–2017; and disease-specific IPC guidelines for TB (including multi- and extensively drug-resistant TB) and HIV/AIDS to minimize disease transmission in health care and other high-risk facilities (42, 43). In November 2020, the Ministry of Health released the *Infection prevention and WASH guidelines for Malawi*, which explicitly address the role of improved IPC and WASH in mitigating AMR (44).

Standard IPC practices and interventions to improve WASH have been implemented to varying degrees in most human health facilities since 2006 (43, 45). However, these previous efforts were conducted in silos, without M&E; consequently, funding and momentum for these activities declined, according to KIs. Efforts are under way across various Ministry of Health departments to reinvigorate IPC and WASH efforts and integrate them with AMR, according to KIs. In October and November 2021, Save the Children supported IPC team training at nearly 65 facilities, including 29 district-level hospitals and select private and non-profit facilities, according to a KI. Monitoring and capacity-building activities around IPC and WASH are meant to cascade from the Ministry of Health to district-level hospitals, which are then expected to ensure and sustain these capacities in the community and at lower-tier health facilities. However, no system is currently in place to monitor whether this cascade model is active or effective.

In addition, the DRUM consortium is implementing an AMR surveillance research project in urban, peri-urban and rural settings with a focus on ESBL (extended-spectrum β -lactamase)-producing *E. coli* and *Klebsiella* bloodstream infections to evaluate the association between AMR prevalence and WASH infrastructure (46).

During the COVID-19 pandemic, WASH and IPC activities were prioritized in the national response. According to a KI, IPC and WASH capacities at facilities with high COVID-19 burden were assessed on a quarterly basis with support from UNICEF. A rapid IPC scorecard/checklist was developed to guide a 1-hour assessment of IPC. The checks included documenting whether the facility had a designated IPC focal person, IPC team, adequate personal protective equipment, standard operating procedures and educational materials to guide IPC practices. Findings from these assessments have not been published; however, they were shared with the Emergency Operations Centre during the pandemic, and several facility-level IPC bulletins were posted on the Ministry of Health and Public Health Institute of Malawi's websites. In addition, there are plans to conduct a national baseline assessment of IPC activities and capacities in the future, though no exact date or timeframe for this assessment has been set, according to KIs. The 2019 JEE of IHR core capacities for Malawi reported an IPC score of 1 (out of 3).

Malawi's current national vaccination programme, published in 2017, includes all WHO-recommended immunizations (47). Vaccines are administered through the national immunization programme at health care facilities, additional outreach clinics and mass vaccination campaigns (for polio and measles). Gavi, the Vaccine Alliance has been providing financial and logistical support for Malawi's immunization programme with secured funding from 2001 to 2023 (48). With support from Gavi, Malawi launched a rotavirus immunization campaign following introduction of the pentavalent vaccine and the pneumococcal conjugate vaccine to reduce preventable diseases for children under 1 year of age in 2012 (49). According to a KI, the typhoid conjugate vaccine, recently shown to protect against typhoid disease in over 80% of vaccinated children under the age of 12 (50), will also be incorporated into the national immunization programme in the near future. The cholera vaccine is not part of the routine vaccination programme; however, mass vaccination campaigns were conducted during previous cholera outbreaks (51).

Vaccines have the potential to reduce infectious disease burden and the need for treatment with antimicrobials, thereby slowing the emergence of AMR. As such, they constitute a critical tool for mitigating AMR. Malawi's NAP on AMR mentions the need for developing new vaccines; however, explicitly addressing the critical role vaccines play in mitigating AMR will help ensure that the additional benefits of vaccines in the context of AMR are realized at the policy and implementation level.

National target

- Implement IPC and WASH policies and activities in 100% of health care facilities and ensure all health care workers have access to personal protective equipment by 2022.

2020/21 TrACSS status

- IPC programmes are in place and functioning at the national and health facility level according to the WHO IPC core component guidelines. Compliance and effectiveness are regularly evaluated and published. Plans and guidance are updated in response to monitoring.
- Some activities are in place to develop and promote good management and hygiene practices to reduce the use of antimicrobials and minimize development and transmission of AMR in animal production (terrestrial and aquatic) and food processing.

Current status

- A national immunization campaign has been established and covers all vaccines recommended by WHO, with coverage ranging between 60% and 90%.
- The 2020 *Infection prevention and WASH guidelines for Malawi* explicitly addresses the role of improved IPC and WASH in mitigating AMR.
- National IPC programmes, policies and plans have been implemented in the human health sector at the facility level, but there is no mechanism for tracking IPC measures at either the community or national level.

Findings

- The current high nationwide immunization coverage for all recommended vaccines is commendable. Continuity should be ensured, particularly for: (i) pneumococcal conjugate vaccine ii) rotavirus vaccine iii) measles-containing vaccine and iv) Haemophilus influenzae type b containing vaccine (Hib).
- National investments in IPC implementation and capacity building should continue to be a priority, focusing on the WHO IPC minimum core components. This will help to mitigate AMR and strengthen broader health systems.
- Investments to ensure all health care facilities in Malawi have minimum WASH infrastructure should be prioritized, including consistent access to clean running water; an initial priority assessment at the facility level can be done using WHO's Water and Sanitation for Health Facility Improvement Tool (WASH FIT).
- The critical role that vaccines play in mitigating AMR should be explicitly addressed in future iterations of the NAP on AMR.
- Existing COVID-19 initiatives could be leveraged to monitor IPC activities and WASH status at the national level.

8. Access and optimal use of antimicrobials

Malawi's NAP on AMR aims to reduce inappropriate AMU by 100% across the human and animal health and agricultural sectors by 2022. The government also aims to ensure uninterrupted access to high-quality antimicrobials by strengthening relevant regulations and legislation.

Currently no national AMC surveillance system is in place for either the human or animal health sector, according to KIIs. In 2020, the Ministry of Health did conduct a PPS on AMU in seven public health facilities with support from WHO, according to a KI. A report on those findings is currently being finalized. Following the PPS, AMS teams with specific terms of reference were established at those seven health facilities with support from the Fleming Fund, according to KIIs. No publicly available data exist on the impact of the COVID-19 pandemic on AMU or AMC in Malawi. A study at the Queen Elizabeth Central Hospital in Blantyre reported high rates of antibiotic prescription and use; between 2017 and 2019, 90% and 82% of patients in the intensive care unit were prescribed and administered antibiotics, respectively (52). The majority received broad-spectrum antibiotics such as ceftriaxone (WHO Watch category) and metronidazole (WHO Access category).

The Ministry of Health has developed national STGs, which provide clinical guidance for the use of antimicrobials in treating common infectious diseases, as well as a national EML. The most recent edition of the EML was published in 2015 and includes over 60 essential antimicrobial agents (53). Revised versions of the STGs and national EML, explicitly acknowledging AMR and reflecting AMR trends and data drawn from Malawi's increasing evidence base, are currently under way, according to KIIs. Notably, the revised national EML will include the WHO AWaRE classification. There is no mechanism for monitoring STG adherence.

Enforcement of antimicrobial dispensing laws and regulations is poor (33). The Pharmacy, Medicines and Poisons Act of 1988 specifies that a medicinal product can only be sold in accordance with a prescription given by an appropriate practitioner, unless the sale or administration is conducted by a medical practitioner or dentist who holds a dispensing licence (54). According to a KII, health care workers and pharmacists both commonly sell and dispense antimicrobials without a prescription; however, the extent to which this occurs is not well quantified. A KII explained that one major driver of non-prescription AMU is the lack of health care workers at many facilities across the country, resulting in patients having to wait all day for a consultation. Many patients seek out antimicrobials without consultation or prescription from a health care worker to bypass these barriers. Moreover, to accommodate the high volume of

patients and to prevent further long waits at the facility's drug dispensary, health care workers may dispense antimicrobials directly to patients without a prescription, according to KIIs. In addition, anecdotal evidence suggests that TB medications are being used to treat STIs and that antiretroviral agents are being used in both the human and animal health sectors to treat infectious diseases other than HIV/AIDS, according to a KI. An education campaign targeted these practices with the aim of ending them, according to a KI; however, no M&E or assessments of campaign outcomes were conducted.

Access to and affordability of essential antimicrobials remain a challenge. A 2019 study that assessed the availability of 32 antimicrobials listed in the national EML found that only 48.5% of the drugs were available in public facilities. The number of essential antimicrobials available was higher in CHAM facilities (62.9%), private clinics (57.5%) and private pharmacies (71.1%) (16). The study also reported that more than half of the essential antimicrobials included were unaffordable for the average Malawian, in line with findings from a previous study in 2017 (16, 19). The national government covers the cost of antimicrobials when a patient has a prescription from a medical specialist, provided that the prescribed pharmaceuticals are collected at a public hospital or public pharmacy. However, if a prescribed drug is unavailable at a designated public facility, patients must cover the cost out of pocket at a private or NGO-affiliated facility, where they are more expensive. The median ratio of sale prices to wholesale procurement prices was estimated to be 2.8 in CHAM facilities and 2.3 in private facilities (15). Unlike in some other African countries, the Malawian government does not regulate the price of pharmaceuticals (55). The government purchases between 70% and 90% of all medicines consumed in the country through the national Central Medical Stores Trust (CMST), a state-owned distributor and the largest purchaser of medicines. Foreign donors mainly supply medicines through the CMST or directly to hospitals, health centres and NGO-run facilities. To date, no local commercial business has been able to compete with foreign suppliers of the current supply chain. In other countries, such as Ghana and Mali, the private sector is one of the key suppliers of pharmaceuticals for the public sector (55).

Antimicrobial stock-outs leave no option for health care workers but to treat patients with suboptimal or more expensive second- and third-line antimicrobials. The lack of access to clinically appropriate antimicrobials due to stock-outs or unaffordability may accelerate AMR, which is worrisome (16), which is worrisome. According to a KII, the frequent stock-outs result from substantial funding gaps at the national and facility level. The KII estimated that the CMST requires MK 30 million (US\$ 37 000) to prevent drug shortages and stock-outs. At many health care facilities, annual budgets earmarked for purchasing medicines often run out before the year is over. Despite ongoing advocacy and lobbying for the past several years, there has been no change to national financial investments to ensure consistent access to medicines.

The Pharmacy, Medicines and Poisons Board, National Drug Quality Control Laboratory, and Pharmacies and Medicines Regulatory Authority oversee drug quality. However, these regulatory bodies do not conduct quality checks on medicines and other medical supplies imported into Malawi, according to KIIs. While medicines imported to Malawi sourced from WHO undergo quality checks at the source, most other medicines do not undergo quality assessment, according to a KI. As such, substandard and falsified medicines are commonly sold by street vendors.

National target

- Reduce inappropriate AMU by 100% across the agricultural, human and animal health sectors by 2022.

2020/21 TrACSS status

- Laws and regulations on the prescription and sale of antimicrobials for human use are in place. However, overall, there are no or weak national policies for optimizing AMU in the human health sector.
- The country is knowledgeable about the AWaRe classification of antibiotics and intends to adopt it in the next few years into the national EML.
- The system designed for surveillance of AMU includes monitoring national-level sales and consumption of antibiotics in health services.

Current status

- No national AMC surveillance system is in place for the human health sector.
- The first round of a point prevalence survey (PPS) on antibiotic use was conducted by the Ministry of Health in seven hospitals in 2021, supported by the Fleming Fund.
- National AMS activities are minimal. However, facility-level AMS programmes have been implemented with donor support in seven health care facilities.

- The national EML is currently being updated to include the WHO AWaRe classification.
- Legislation and regulation regarding sales of antibiotics only on prescription by qualified health care professionals are in place but are not consistently enforced.
- Access to and affordability of essential antimicrobials are key challenges to appropriate use, with regular stock-outs reported at facility pharmacies and the central medical store.

Findings

- There is a need to raise awareness and education of health care workers on the use of laboratory data to inform appropriate prescription of antimicrobials and adherence to national treatment guidelines, which should be monitored on a regular basis.
- Development of a national practical guide for establishing, implementing and monitoring AMS at the facility level is encouraged to support roll-out of AMS programmes and activities in health care facilities.
- AMS programmes and teams should be rolled out in additional facilities beyond the current seven facilities and AMS activities, informed by the PPS data gathered and analysed.
- A national AMC surveillance system should be established.
- Budgetary gaps should be reviewed and filled to strengthen the supply chain of quality assured antimicrobials and to ensure adequate stocks of all essential antimicrobials at the national and facility level.
- The regulation on prescription-only use of antimicrobials should be strengthened by ensuring adequate trained staff and resources for enforcement.
- It would be beneficial to assign responsibility for regularly assessing the quality of imported medicines, including antimicrobials, to the relevant national authority or to establish a regulatory authority with this mandate.

9. Research and development

National R&D for antimicrobials and alternatives is limited. There is no ongoing national-level investment to support R&D on novel antibiotics, alternatives to antimicrobial therapies (herbal products or traditional medicines) or alternate interventions. Most foreign funding for R&D is mainly directed at academic institutions and research facilities in Malawi and originates mainly from the United States of America, the United Kingdom and the European Union (24).

One KI noted that the research agenda outlined in the NAP on AMR has not been operationalized and is now outdated. A clear formulation of research priorities and questions with input from across the sectors would help guide future research initiatives and investments, according to another KI.

Domestic production of generic pharmaceuticals, including antimicrobials, is frequently identified as an opportunity to improve the country's health system and increase access to quality pharmaceuticals. While local antibiotic production is not endorsed as a national priority, in 2020 the government announced a US\$ 55.4 million investment to set up a pharmaceutical manufacturing company with a special focus on producing antiretroviral agents for HIV, antimalarial agents and cancer treatments that would meet WHO standards (56).

Four local drug manufacturing companies (Crown Pharmaceuticals, Pharmanova, Kentam and SADM Pharmaceuticals) currently operate in Malawi and include antibiotics in their list of products. These four domestic producers of pharmaceuticals started the Pharmaceutical Association of Malawi and have been working together with the Government of Malawi to promote domestic production of pharmaceuticals and to seek out additional investment and production opportunities. In line with this vision, a pharmaceutical chapter of the Buy Malawi Strategy was launched in 2013 to promote the purchase and use of locally produced antimicrobials (57, 58). Under this initiative, CMST prioritizes buying 60 antimicrobials from local producers as long as they are not 20% more expensive than foreign equivalents (58).

Major obstacles for the local production of drugs in Malawi include lack of infrastructure and institutional capacity to produce and distribute pharmaceuticals and regulate their quality (59).

Current status

- R&D for antimicrobials and alternatives is mainly sponsored by academic institutions, grants from private organizations, stakeholders and foundations.
- The Malawian government recently invested in the local pharmaceutical manufacturing industry.
- Insufficient financial resources and limited infrastructure pose significant challenges for the government's R&D initiatives.

Findings

- The AMR research agenda outlined in the NAP should be reviewed and revised to include research that generates evidence to monitor targets set by the action plan.
- Evidence needs to be generated on the health and economic burden of AMR.

10. Key findings for policy and action to accelerate implementation of the NAP on AMR

Malawi has made great strides in recognizing and responding to the emerging threat of AMR. Its current NAP on AMR is well aligned with the Global Action Plan on AMR, outlines clear roles and responsibilities for all relevant stakeholders, and describes clear objectives, budgetary requirements and M&E frameworks for implementation. Malawi has a well-functioning AMRCC that meets regularly to discuss ongoing and future AMR activities. Efforts are under way to conduct educational and awareness campaigns, implement IPC and improve surveillance and laboratory capacity. Despite these successes, continued progress is required to adequately address the challenge of AMR.

The following are findings and suggested actions to enable the NAP to mitigate AMR.

- 1 **Domestic financing and donor resource mobilization need to be increased for sustainable implementation of NAP on AMR priority activities.**
 - The AMRCC office and its five full-time staff are currently supported by a 2-year Fleming Fund grant. Once this grant expires, it will be important to ensure that there is at least one full-time staff member to support the AMRCC office in coordinating and implementing the action plan. To this end, alternative human resource options (e.g. secondments) should be considered.
 - Endeavour to reduce reliance on foreign partners and increase domestic investment to support critical health care capacities such as IPC, WASH, vaccination, medicines procurement, and diagnostic and laboratory testing services to strengthen the long-term access and sustainability of implementation and overall progress.
- 2 **Implementation of the NAP on AMR should be reviewed according to the M&E framework and further developed or revised, along with an operational plan.**
- 3 **Awareness-raising activities among health care workers, financial decision makers and the general public need to be increased to promote appropriate AMU.**
 - Disseminate bimonthly media and public communications about AMR topics, leveraging other health promotional activities such as for HIV/AIDS, malaria, TB, immunization and WASH. Ensure that the public and relevant stakeholders have consistent access to AMR information.
 - Develop targeted messaging on the proper use of antibiotics in English and Chichewa in language the general public can understand.
 - At a minimum, conduct at least one KAP assessment among a key stakeholder group to generate baseline evidence.
 - In lieu of consistent AMR awareness and education campaigns, which may not be feasible, ensure that the public and relevant stakeholders have consistent access to AMR information by including AMR in education curricula and integrating it into other health promotional activities.
- 4 **AMR and AMS need to be incorporated into pre- and in-service education and training of health care workers, including use of laboratory data to inform appropriate prescription.**
 - Raise awareness and education of health care workers on the use of laboratory data to inform appropriate prescription of antimicrobials.
 - Monitor adherence to national treatment guidelines on a regular basis.

5 The proportion of health care facilities capable of detecting and diagnosing infections and undertaking antimicrobial sensitivity testing need to be expanded, including ensuring the continued supply of equipment and reagents, and appropriate staffing and training of laboratory personnel.

- Build clinical and laboratory capacity to detect and identify drug-resistant organisms at additional human, animal and environmental health laboratories.
- Ensure that health care workers with access to laboratory AST capacity consistently use these services to ensure a robust surveillance system.
- Leverage the molecular epidemiology infrastructure established for the genomic analysis of SARS-CoV-2 viruses during the COVID-19 pandemic to identify antibiotic resistance genes.
- Integrate passive (routine), facility-based surveillance for HAIs to avoid increasing the data entry burden on health care workers and conduct an active, short-term HAI surveillance activity to develop a baseline evidence base.

6 Investments and capacity building in IPC and WASH need to be prioritized to achieve the objectives of the NAP on AMR and broader health systems strengthening.

- Prioritize national investments in IPC implementation, focusing on WHO IPC minimum core elements.
- Leverage existing COVID-19 initiatives to monitor IPC activities and WASH status at the national level.
- Maintain the current, commendable high nationwide immunization coverage for all recommended vaccines.

7 The roll-out of AMS programmes and activities in health care facilities needs to be supported by developing a national practical guideline for establishing, implementing and monitoring AMS programmes at the facility level.

- Establish AMS programmes and teams in additional facilities.
- Promote the use of laboratory data on the detection of pathogens and AST by health care workers for patient management to inform appropriate prescription of antimicrobials following national treatment guidelines and monitor this use regularly.

8 Establish a functioning surveillance system to routinely collect, analyse and use AMC data for policy and practice (employing internationally recognized tools and guidance).

- Strengthen the AMU surveillance system to periodically collect, analyse and use AMU data to inform and evaluate AMS interventions in hospitals.

9 The supply chain of quality assured antimicrobials needs to be strengthened to ensure adequate stocks of all essential antimicrobials at the national and facility level.

- Review and fill budgetary gaps in the supply of essential antimicrobials.
- Ensure that the national medicines regulatory authority regularly assesses the quality of all imported antimicrobials or, if necessary, establish a regulatory authority with this mandate.

10 A relevant national authority responsibility for regularly assessing the quality of imported medicines, including antimicrobials, or establishing a regulatory authority with this mandate, is needed.

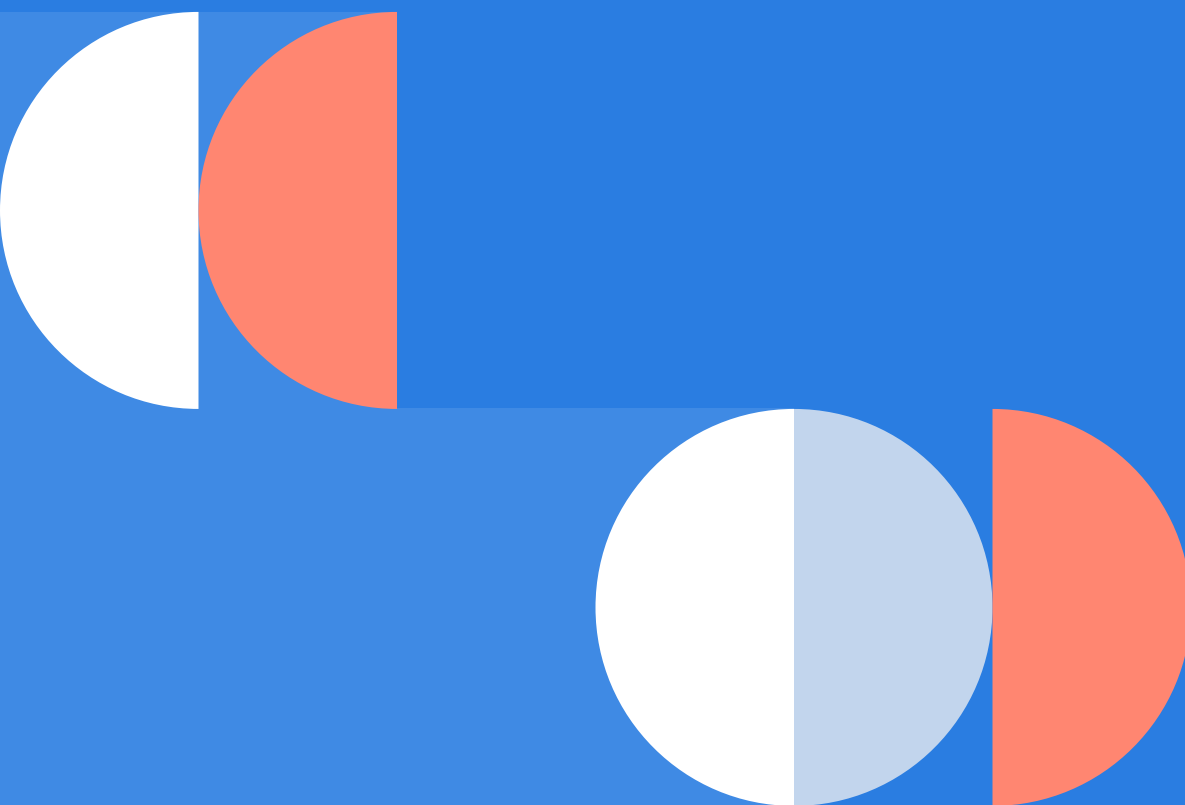
Sustainably implementing the NAP on AMR will not simply mean increasing the financial pool for implementation – although that is of obvious importance, especially in low-resource settings – but just as importantly creating integrated cross-talk between interdependent AMR activities. Given the great strides that Malawi has already made, it will be important to build this integration where possible and profit from synergies.

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