TIPC RESEARCH BRIEF

A TRANSFORMATIVE INNOVATION POLICY CONSORTIUM RESEARCH BRIEFING
MAY 2025

TRANSFORMATIVE POLICY ACTIONS TO ANTIMICROBIAL RESISTANCE IN AFRICA: INSIGHTS FROM KENYA

The World Health Organisation (WHO) classifies Antimicrobial resistance (AMR) as one of the top ten global public health threats. In Africa, its impact is particularly acute, affecting human, animal, and environmental health systems. This policy brief draws insights from Kenya's experience and highlights the urgent need for transformative policy actions to effectively implement National Action Plans (NAPs) and strengthen Antimicrobial Stewardship (AMS).

SUMMARY

Antimicrobial resistance (AMR) poses a growing threat to public health and development in Africa. Drug-resistant pathogens already claim 700,000 lives globally each year,[1] and this number could rise to 10 million by 2050, including 4.15 million Africans. The economic cost is projected to reach USD 300 million to 1 trillion in the coming decades.

A 2019 University of Washington study revealed that over 1.3 million people died globally from AMR infections, with Africa facing a significant burden. This study also found that Africa has the highest AMR mortality rate, with 24 deaths per 100,000 people.[2] AMR is especially prevalent in food-borne pathogens found in animals and animal products posing additional risks through the food chain.

The burden of AMR already surpasses that of HIV/AIDS and significantly exceeds the impact of COVID-19 in many African contexts. These figures underscore the urgent need for transformative policy action to mitigate the growing threat.

Growing concerns over resistant pathogens led the 68th World Health Assembly to adopt the Global Action Plan in 2015 and establish the Global Antimicrobial Resistance Surveillance System.[3] In line with the Global Plan, all countries had to create National Action Plans (NAPs) within two years. However, for nations with limited resources or planning capacity, this was a tough challenge.

Since 2017, Africa has faced international pressure to develop or update its NAPs. In response, the African Union (AU) Heads of State and Government committed in February 2020 to tackle AMR threats using the One Health approach, integrating human,

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animal, and agricultural health. This approach requires coordination across human, animal, and environmental health sectors to fight AMR, and many African countries have embraced it. The lack of effective surveillance systems in Africa has made it difficult for countries like Kenya to fully implement their NPs.[4] For countries in this category, the inability to develop NAPs stems from a lack of locally generated data. This issue is further complicated by limited financial resources, poor coordination, and regulatory barriers. This research brief highlights Kenya's progress in addressing antimicrobial resistance (AMR), identifies key policy gaps, and proposes priority interventions to strengthen AMR strategies at both county and national levels. As many African countries face similar challenges, these recommendations may offer valuable insights for the broader region.

KEY MESSAGES

- Antimicrobial resistance (AMR) is a growing threat in Africa affecting animal, human, and the environmental health. With more access to antimicrobial drugs, the devolution of health services, and a shortage of local data, it is challenging to assess how well interventions work.
- Progress on National Action Plans (NAPs) has been slow, especially in animal and environmental health. This is due to several challenges, including insufficient funding, weak coordination across sectors, lack of policy enforcement, and gaps in surveillance systems.
- Political commitments to addressing AMR in Africa are weak and often hindered by unrealistic policy targets. Poor communication and coordination of One Health, both across government levels and with the public, are the main obstacles to effective AMS.
- One Health guidelines fail to meet expectations. For example, there are no ways to resolve conflicts or build consensus to help share information and take joint action across human, animal, and environmental health sectors.
- Prioritizing key NAP targets, such as mobilizing human and financial resources, developing sub-national surveillance systems, and using citizen-generated data to inform policies, remains a challenge.

POLICY RECOMMENDATIONS

- African countries should implement transformative policy actions that drive systems change, strengthen AMR data management, and target key priorities in National Action Plans, such as mobilizing human and financial resources, building surveillance infrastructures, and enforcing robust policies.
- Embrace One Health principles which combine efforts in human, animal, and environmental health. They can transform their response to AMR by boosting and maintaining financial support, improving coordination across sectors, enforcing policies and regulations, and addressing obstacles.
- Advocate for political commitment to shift AMS implementation from being donor-driven to being led by national and regional actors. In addition, unify AMS implementation across counties, countries, and regions, considering their varying capacities.
- Strengthen and adapt One Health guidelines for Africa. These efforts should promote inclusivity and conflict resolution, fostering sustainable agreements that reflect successful approaches and incorporate lessons into future actions.
- Ensure sustainable domestic funding for AMR interventions at national and regional levels. In addition, strengthen human resources and surveillance systems with effective coordination, regulatory, and policy frameworks.

KEY MESSAGES

- The lack of public awareness and engagement on AMR hinders effective NAP implementation. Promoting public education, behaviour change, and citizen involvement in surveillance can strengthen AMS across all sectors.
- Weak surveillance systems and limited use of citizen-generated data undermine efforts to track AMR trends and assess intervention effectiveness. Enhancing national and regional surveillance, improving data-sharing, and integrating real-time monitoring are critical for driving evidence-based policymaking and targeted intervention.

POLICY RECOMMENDATIONS

- Prioritize public awareness by embedding AMR education in schools, health campaigns and community programs to encourage responsible antimicrobial use.
- Invest in national and regional surveillance systems, improve laboratory capacity and data infrastructure, promote data-sharing frameworks, leverage citizen-generated data, and strengthen regulatory and policy frameworks for comprehensive AMR reporting and transparent decision-making.

INTRODUCTION

Antimicrobial resistance (AMR) is a natural phenomenon where microorganisms like bacteria develop resistance to antimicrobial drugs. This can happen naturally or through selective pressure, where the use of medicines kills susceptible bacteria, but resistant bacteria survive. These resistant pathogens can spread across humans, animals, and the environment, leading to significant societal consequences.

Antibiotic-resistant pathogens are rapidly emerging and spreading in humans, animals, and the environment. This poses a significant health threat to people and animals worldwide. Despite the lack of new antimicrobial agents, these resistant organisms are outpacing the current essential medications for both humans and animals.

The World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), and World Organization for Animal Health (OIE) united in 2015 to launch the Global Action Plan on Antimicrobial Resistance, urging all countries to develop National Action Plans by 2017.[3] In Kenya and Sub-Saharan Africa, the development of NAPs has been progressing slowly and inconsistently.

Kenya's implementation of the National Action Plan on Antimicrobial Resistance (NAP-AMR) since 2017 has highlighted key lessons for effective action against AMR. These include strong governance and coordination at national and county levels, a multi-sectoral One Health approach integrating across sectors monitoring and evaluation frameworks, sustained advocacy for political support, accurate costing, and resource mobilization. Regular plan reviews, addressing resource gaps, strengthening surveillance, and enhancing public awareness are essential for long-term impact.

AIM AND SCOPE

This policy brief shares insights, challenges, and recommendations regarding Kenya's implementation of its National Action Plan on AMR. It also presents key policy options to combat AMR in Kenya and across Africa. In addition, it provides an overview of the policy options needed to build a national AMR strategy. It also provides estimates of AMR's health and economic impacts. The paper discusses the challenges, essential AMR policy areas, and priority interventions for the successful implementation of NAPs.

METHODS

This policy brief is based on empirical data gathered during AMR/ASM research between 2021 and 2022, published in the East African Medical Journal.[6,7,8] The policy responses align with the broad objectives and recommendations of the WHO Global Action Plan on AMR from 2015, the 2016 OIE Strategy on AMR and the Prudent Use of Antimicrobials, the 2016 FAO Action Plan on AMR, and Kenya's National Action Plan on AMR from 2017.[9] The international and national plans work together to support a comprehensive, multi-sectoral approach (One Health) to prevent and control AMR **(Table 1)**.

OBJECTIVE	PLANNED ACTIONS	IMPLEMENTATION OUTCOMES
1. Improve awareness and understanding of AMR through effective communication, education, and training.	• Conduct public awareness campaigns. • Train healthcare workers, students, and civil society members on AMR, infection prevention, and hygiene practices. • Collaborate with the media to share accurate information about AMR.	• The World Antimicrobial Awareness Week (WAAW) campaigns have been held annually since 2017. • These campaigns educate healthcare workers, students, and journalists on antimicrobial resistance (AMR) and infection prevention and control (IPC). • Challenges include limited lasting impact and insufficient funding.
2. Strengthen the knowledge and evidence base through surveillance and research.	• Set up a national system to track AMR. • Include labs in the WHO Global Antimicrobial Resistance Surveillance System (GLASS). • Create a national database for AMR data.	• AMR surveillance began in 2017 with pilot sites and expanded to 17 laboratories by 2022. • A National Central Data Warehouse was created to manage AMR data. • Key challenges include limited diagnostic capacity, inconsistent data submissions, and reliance on academic research for AMR data.
3. Reduce infection incidence through effective sanitation, hygiene, and infection prevention measures.	• Implement infection prevention and control (IPC) programs in healthcare facilities. • Create and share IPC guidelines. • Encourage water, sanitation, and hygiene (WASH) practices in communities.	• Some facilities have established IPC and Medicines and Therapeutics Committees (MTCs), but many remain inactive. • Hand hygiene and waste management practices are insufficient. • The COVID-19 pandemic disrupted IPC efforts and exposed existing weaknesses.
4. Optimize the use of antimicrobial medicines for human and animal health.	• Antimicrobial Stewardship (AMS): Establish programs to promote responsible use. • Guidelines: Create standards for rational antimicrobial use. • Monitoring: Track antimicrobial consumption to ensure compliance and effectiveness.	• NASIC: The National Antimicrobial Stewardship Interagency Committee is operational. • Progress: AMS programs are underway in some counties, with 16 out of 47 having established County AMS Committees. • Challenges: Limited funding, a weak laboratory-clinical interface, and inconsistent supply of reagents hinder progress.
5. Develop an economic case for sustainable investment that considers the needs of the country.	• Conduct economic evaluations to support interventions addressing antimicrobial resistance (AMR). • Advocate for increased funding to enhance AMR-related activities. • Incorporate AMR priorities into national health budgets to ensure sustained focus and resource allocation.	• Insufficient funding is a significant obstacle. • Economic evaluations specific to AMR investments are lacking. • Ongoing advocacy aims to secure political backing and include AMR in health budgets.

Table 1: Overview of the objectives of Kenya's /WHO/FAO/OIE action plans and strategies [9]

HEALTH AND ECONOMIC IMPACTS OF AMR

As the burden of antimicrobial resistance increases, it reveals shortcomings in public policy, global governance, research prioritization, and market dynamics. These issues reflect failures in research and development, innovation systems, entrepreneurship, and health, climate, and environmental policies.[10] Factors contributing to AMR include climate change, international travel, and cross-border migration, which spread resistant bacteria. Additionally, the increasing prevalence of AMR in food, livestock, and marine products, along with rising human susceptibility to resistance, are significant factors. In Africa, regulations on antibiotic access and use are weak in both the health and agricultural sectors. While AMR impacts human health, addressing this challenge requires a cross-sectoral response like the "One Health Approach," which incorporates animal health and environmental considerations.

Reports from the UN, WHO, and other global health agencies warn that drug-resistant infections could cause 10 million deaths annually by 2050. This could lead to economic damage similar to the 2008-2009 global financial crisis. Antimicrobial resistance (AMR) impacts both the economy and healthcare, leading to increased illness, treatment failures, and deaths. The cost of AMR varies by country and is rapidly rising. In the United States, AMR costs an estimated $55 billion annually, with $20 billion for healthcare and $35 billion in lost productivity. Global GDP is expected to decrease by about 1% annually, with developing countries facing a 5-7% GDP loss by 2050 due to AMR, amounting to $100-210 trillion. Multidrug-resistant TB alone could cost the world $16.7 trillion by 2050.[11]

In 2019, 1.3 million people worldwide lost their lives to antimicrobial resistance (AMR), with Africa facing the highest mortality rate. In Africa, 24 out of every 100,000 people succumbed to AMR pathogens. The regional breakdown shows that West Africans were the most affected, with 27.3 deaths per 100,000 people, followed by Eastern Africans with 21.4, Central Africans with 20.7, and Southern Africans with 19.4 deaths per 100,000 people.(12) The high mortality rates were due to insufficient water, sanitation, and hygiene infrastructure, poor infection prevention and control, inadequate regulation of antimicrobial use, and overburdened healthcare systems.[12]

GLOBAL RESPONSE TO AMR AND TRANSFORMATIVE POLICY ACTION

The growing threat of AMR could significantly hinder the achievement of Universal Health Coverage and the United Nations' Sustainable Development Goals if we don't take united action. This section highlights selected transformative policy actions and collaborative approaches, both global and national, that offer valuable lesson for a more effective AMR response.

One Health, first championed in 2004 by the Wildlife Conservation Society and later endorsed by organizations like WHO, the EU, and US-CDC, highlights the deep links between human and animal health, as well as the environment. It supports a unified approach to addressing AMR, including the careful use of antibiotics in both humans and animals.[13] The EU banned the use of antibiotics for promoting growth in animal feed starting in January 2006.[14] There is a global need to ensure that antibiotics are not used for animal growth promotion and that key antibiotics are reserved exclusively for human use. This may require new incentives and alternative animal nutrition schemes, in addition to legislation.

WHO took several steps to address the issue, including setting up a Technical and Strategic Advisory Group in 2013, working closely with the FAO and OIE, and coordinating internal departments to create a Global Action Plan in 2015. Recognizing the seriousness of the rise in resistant organisms, the World Health Assembly made this a priority during its 68th assembly in May 2015.[15] The Global Action Plan on antimicrobial resistance was adopted, and the Global Antimicrobial Resistance Surveillance System was established. In February 2020, African Union Heads of State and Government pledged to tackle the threat of AMR across multiple sectors, particularly human health, animal health, and agriculture, which is crucial for the environment.

KENYA'S EMERGING SHIFT TOWARD ANTIMICROBIAL STEWARDSHIP (AMS)

Transforming health systems requires policies that address economic, social and environmental challenges in an integrated way. One such approach, Transformative Innovation Policy (TIP), is currently being tested globally as means to drive systemic change.[16] In Kenya, TIP holds promise for advancing the fight against antimicrobial resistance (AMR) and strengthening antimicrobial stewardship (AMS) across human, animal, and environmental health.

The Government of Kenya released its National Action Plan on AMR in 2017. This plan was created after analysing the country's AMR burden and response. It aligns with WHO's Global Action Plan and includes multisectoral and One Health policies.[17] In 2011, the Global Antibiotic Resistance Partnership (GARP) – Kenya Working Group Report highlighted antibiotic resistance as a significant issue in Kenya and provided recommendations to address it. The report suggested that Kenya should develop policies on antimicrobial resistance (AMR), create antibiotic guidelines, and gather local resistance surveillance data to enhance antimicrobial stewardship (AMS).[18]

Current AMR governance involves both national and county levels; the National Antimicrobial Stewardship Interagency Committee (NASIC). The National Action Plan on Prevention and Containment of AMR provides a One Health approach to AMS. The Ministries of health, agriculture, livestock, and fisheries jointly coordinate national AMR efforts through the National Antimicrobial Stewardship Interagency Committee (NASIC).[19] NASIC brings together research institutions, academia, and civil society. At the county level, County Antimicrobial Stewardship Interagency Committees (CASICs) and hospital antimicrobial stewardship committees (HASC) are being established. Currently, eight out of 47 counties have formed CASICs, which coordinate AMR efforts at both the county and health facility levels.[20]

The National IPC Advisory Committee was formed before NASIC. By 2021, Kenya had a national IPC strategic plan and advisory committees in all 47 counties. Members of these IPC committees also serve on AMR committees, linking the two. The Medicine, Technologies, and Pharmaceuticals Services (MTaPS) program helped develop and implement AMS guidelines at Kenyatta National Teaching and Referral Hospital and Gertrude's Children's Hospital.[21] The Kenyan government created a communication strategy for AMR in 2018 and introduced National Antimicrobial Stewardship Guidelines for Health Care Settings in 2019.[22] The 2020/2021 Tripartite AMR Country Self-Assessment Survey (TrACCS) indicates Kenya is actively monitoring its implementation of the Nation Action Plan (Table 2). Since 2021, 12 facilities have served as AMR surveillance sites; six facilities actively submit data to the national AMR database. The animal health sector began monitoring AMR in May 2021 with six laboratories reporting data. Surveillance data on human antimicrobial consumption which has been ongoing for 3 years is collected through point prevalence surveys.[23]

A clinician's handbook and national integrated AMS plan were developed in 2021. In addition, the key priorities identified for R&D for AMR include point-of-care diagnostics, molecular mechanisms to inform the development of novel anti-infective treatments, and social science research to increase AMS programs' sustainability. Kenyan medical and academic institutions conduct AMR research.[24] Kenya has made significant strides in its fight against AMR, with 93% of human health sector activities completed or ongoing as of April 2025. However, progress in the animal and crop sectors is slower, at 64% completion. The second National Action Plan on AMR (2023-2027), launched in November 2023, focuses on governance, comprehensive costing, and advocacy.

2020/2021 TRIPARTITE AMR COUNTRY SELF-ASSESSMENT SURVEY (TRACCS) STATUS	
Country Response • The national AMR action plan is implemented and actively monitored through an M&E framework, ensuring its effectiveness and adaptability. • The human, animal, and plant health sectors are actively involved in developing and implementing the NAP on AMR. However, the environment, food safety, and food production sectors are not. • The NAP on AMR is linked to the NAP on Health Security. • The NAP on AMR development and implementation process has been impacted by the COVID-19 pandemic.	**Recommendations** There is a need to: • ensure sufficient and sustained domestic funding for an action plan on AMR implementation at the national and county level; • address AMR as a cross-sectoral public health challenge and link AMR to other health plans, policies and budgets, such as those for UHC, HIV/AIDS, TB and malaria, pandemic preparedness and response plans; • through a participatory approach, develop and endorse the next iteration of the NAP on AMR based on a review of the current NAP's progress and challenges; and • ensure inclusion of AMR-relevant interventions in the national health strategy.
CURRENT STATUS • Kenya's NAP on AMR is based on previous policies and evidence-based recommendations drawn from situational analyses conducted in 2011 and 2016. • There is a significant knowledge gap regarding the financial implications of NAP implementation. NAP implementation costs are unknown. It is unclear what budget the national government has reserved and allocated for NAP and AMR implementation. • The NAP expires in 2022; the Ministry of Health and the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives have commenced work to develop the next iteration through a multi-sectoral participatory approach.	

Table 2: Kenya's status of the National Action Plan on Antimicrobial Resistance in 2022

CHALLENGES TO AMR IMPLEMENTATION IN KENYA

While the One Health approach to AMR is supported by policies, current legislative and policy frameworks lack multi-sectoral coordination. Health, agriculture, and the environment ministries have siloed implementing agencies including hospitals, research institutes and national laboratories. The current situation makes it difficult to explicitly support information sharing and joint actions. A summary of the key challenges facing the AMS implementing agencies in Kenya include:

- Insufficient allocation of resources, both financial and human.
- AMS has limited coordination between departments and across sectors.
- Deep learning and reflexivity are limited to policymakers, implementers, and health professionals.
- AMR data generated locally are not sufficient to support the development and implementation of antibiograms.
- Inadequate surveillance systems across the country.
- AMR issues are poorly known in the community.
- Inadequate adherence to AMR clinical guidelines
- Cheap counterfeit medicines are widely available.
- Standard enforcement of agricultural and food practices is lacking.
- Disposing of expired medicines is time-consuming

The persistence of silos in sectors and institutions hinders information sharing and access, thereby limiting the benefits from AMR interventions to society. Documentation systems are typically segmented by discipline, and quality improvement projects are typically stored on SharePoint. Access may be limited to specific work groups rather than integrated into nationwide systems and workflow tools like the national immunization programme. Due to these silos, evidence-based practice and quality improvement projects are frequently duplicated across departments, which is wasteful and inefficient. Furthermore, project teams are unable to learn from previous efforts due to limited access to relevant knowledge repositories. Consequently, avoidable mistakes continue to permeate the system.

CONCLUSION AND RECOMMENDATIONS

Transformative policy actions (TPAs) are needed to address the antimicrobial resistance (AMR) challenge in Africa, as evidence from Kenya shows. Evidence shows that the National Action Plan on AMR (2017–2022) brought improvements in surveillance, raised public awareness, and strengthened antimicrobial stewardship across the health sectors. These coordinated, multi-sectoral efforts highlight how targeted policies can curb antibiotic misuse and reduce AMR threats. Kenya's regulatory reforms and the inclusion of some AMR topics in health curricula further emphasize the impact of focused policies on tackling this pressing public health challenge. New laws, policies, and programs have transformative elements that can inform TPAs. These transformative elements should be considered ingredients for innovation and transformative change. They should respond to the three dimensions of human health, animal health, and the environment, as articulated in the One Health Approach.

Transformative Innovation Policies (TIPs) specifically designed to support AMS such as policy-driven technological innovation to support digital prescription can foster the needed change and development impacts desired and support the One Health Approach to AMR in Kenya and Africa.

To achieve the desired change, all stakeholders, including dominant and marginalised populations as well as civil society groups, must be involved in a participatory way in the development of AMS policies and programs. Inclusivity is vital to ensure that innovations and selected technological solutions lead to system-level impact. Key sectors, including health, agriculture, and the environment, contribute to a system-level impact in the fight against AMR.

Landscaping Kenya's AMS through a One Health approach provides insights into the evolution of the policy environment supporting human health, animal health, agriculture, and the environment. Over the years, Kenya's health sector has tactically maintained many characteristics of the linear model of R&D, innovation, and the triple helix systems.[32] Therefore, as Kenya progresses towards effective AMS, stakeholders must unlearn and reflect on previous policy interventions' successes and shortcomings. In addition, stakeholders need to acknowledge the conflicts arising from the ongoing implementation of highly restrictive policies and guidelines on AMR. In the backdrop of these concluding statements, key recommendations have been provided above to promote AMS and TIP in Africa and Kenya.

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Suggested reference: Ndakala, F. and Daniels C. (2025). Transformative Policy Actions to Antimicrobial Resistance in Africa: Insights from Kenya, TIPC Research Brief No 1

REFERENCES

1. Mancuso G, Midiri A, Gerace E, Biondo C. Bacterial antibiotic resistance: the most critical pathogens. Pathogens [Internet]. 2021 Oct 1 [cited 2023 Jun 9];10(10). Available from: /pmc/articles/PMC8541462/

2. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. Lancet (London, England). 2022 Feb;399(10325):629–55.

3. WHO. WHO Global Action Plan on Antimicrobial Resistance [Internet]. World Health Organization, Geneva, Switzerland. 2015 [cited 2021 Dec 29]. Available from: http://www.emro.who.int/health-topics/drug-resistance/global-action-plan.html

4. Gulumbe BH, Haruna UA, Almazan J, Ibrahim IH, Faggo AA, Bazata AY. Combating the menace of antimicrobial resistance in Africa: a review on stewardship, surveillance and diagnostic strategies. Biol Proced Online. 2022;24(1): 1–13.

5. Prestinaci F, Pezzotti P, Pantosti A. Antimicrobial resistance: A global multifaceted phenomenon. Pathog Glob Health. 2015;109(7):309–18.

6. F Ndakala, B Kisuya, E Wesangula, M Oluka JA and CD. Antimicrobial stewardship practices in Kenyan government and faith-based referral hospitals before and after COVID-19. East Afr Med J. 2024;Vol. 100 N.

7. Ndakala F, Kisuya B, Wesangula E, Oluka M, Ayisi J, Daniels C. A comprehensive assessment of antimicrobial stewardship; adoption and effectiveness in Kenya. East Afr Med J [Internet]. 2023 Sep 28 [cited 2024 Apr 24];100(7):6038–50. Available from: https://www.ajol.info/index.php/eamj/article/view/256050

8. Ndakala F, Kisuya B, Wesangula E, Oluka M, Ayisi J, Daniels C. Tackling antimicrobial resistance in Kenya: Policy and innovation for transformative change. East Afr Med J [Internet]. 2023 Dec 22 [cited 2025 Mar 28];100(11):6456–67. Available from: https://www.ajol.info/index.php/eamj/article/view/261400

9. Inoue H. Strategic approach for combating antimicrobial resistance (AMR). Glob Heal Med. 2019;1(2):61–4.

10. Schot J, Steinmueller WE. Three frames for innovation policy: R&D, systems of innovation and transformative change. Res Policy. 2018 Nov 1;47(9):1554–67.

11. Dadgostar P. Antimicrobial Resistance: Implications and Costs. Infect Drug Resist [Internet]. 2019 [cited 2021 Dec 28];12:3903. Available from: /pmc/articles/PMC6929930/

12. Kariuki S, Kering K, Wairimu C, Onsare R, Mbae C. Antimicrobial Resistance Rates and Surveillance in Sub-Saharan Africa: Where Are We Now? Infect Drug Resist. 2022;15(June):3589–609.

13. Mackenzie JS, Jeggo M. The one health approach-why is it so important? Trop Med Infect Dis. 2019;4(2):5–8.

14. European Union. Ban on antibiotics as growth promoters in animal feed enters into effect. Regulation. 2006; (December 2005):1.

15. World Health Organisation. Draft Global action plan on antimicrobial resistance WHA68.7. World Heal Organ [Internet]. 2015;(May):1–4. Available from: http://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_20-en.pdf?ua=1

16. Johan Schot, Chux Daniels, Jonas Torrens GB. Developing a Shared Understanding of Transformative Innovation Policy. Res Policy Br [Internet]. 2017 Jul [cited 2019 Mar 18];41(6):1037–47. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0048733312000613

17. Gitaka J, Kamita M, Mureithi D, Ndegwa D, Masika M, Omuse G, et al. Combating antibiotic resistance using guidelines and enhanced stewardship in Kenya: A protocol for an implementation science approach. BMJ Open. 2020;10(3):1–7.

18. The GARP-Kenya Working Group. Situational Analysis and Recommendation- Antibiotic Use and Resistance in Kenya. Washington, DC and New Delhi: Center for Disease Dynamics, Economics & Policy. 2011.

19. Government of Kenya b. National Action Plan on Prevention and Containment of Antimicrobial Resistance [Internet]. 2017. Available from: www.health.go.ke

20. World Health Organization. Turning Plans into Action for Antimicrobial Resistance (AMR) Working Paper 2.0: Implementation and coordination [Internet]. Geneva: World Health Orgaization; (WHO/WSI/AMR/2019). 2019 [cited 2021 Apr 6]. Available from: http://apps.who.int/bookorders.

21. United States Agency for International Development. Medicines, Technologies, and Pharmaceutical Services (MTaPS) Program DQA: Kenya. Submitted to the US Agency for International Development by the USAID Medicines, Technologies, and Pharmaceutical Services (MTaPS) Program. Arlington, VA: Management Sciences for Health, Inc.; 2019.

22. Government of Kenya. National Antimicrobial Stewardship: Guidelines for Healthcare Settings in Kenya. Minist Heal [Internet]. 2020 [cited 2022 Jan 2];1–125. Available from: https://www.health.go.ke/wp-content/uploads/2021/09/National-Antimicrobial-Stewardship-Guidelines-for-health-care-settings-In-Kenya-2020.pdf

23. Geneva: World Health Organization. Kenya national action plan on antimicrobial resistance Review of progress in the human health sector Antimicrobial resistance policy information and action brief series. 2022.

25. Majumder MAA, Rahman S, Cohall D, Bharatha A, Singh K, Haque M, et al. Antimicrobial Stewardship: Fighting Antimicrobial Resistance and Protecting Global Public Health. Infect Drug Resist. 2020;13:4713–38.

25. John Ayisi, Frank Ndakala, Rose Nyanga, Chux Daniels and MBT. Transformative Innovation Policy – Kenya's experience [Internet]. Vol. 41, Research Policy. 2019 [cited 2019 Jul 31]. p. 1037–47. Available from: http://www.tipconsortium.net/transformative-innovation-policy-kenyas-experience/