Healthcare provider-focused antimicrobial stewardship in sub-Saharan Africa: opportunities and challenges

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To address the antimicrobial resistance (AMR) crisis, governments around the world have created action plans to optimize antimicrobial use (AMU). These plans include anti- microbial stewardship (AMS) that encompasses educational programs for healthcare workers. We discuss these programs in sub-Saharan Africa, including the opportunities and challenges arising from a highly constrained healthcare environment.

AMR, which refers to mechanisms allowing microbes to survive exposure to antimicrobial treatment, is one of the top global threats being faced in human and animal medicine [1]. To tackle this health crisis, the World Health Organization launched a Global Action Plan on AMR (GAP-AMR) encouraging all countries to develop and implement their own National Action Plans (NAPs) [2]. A central strategic objective of GAP-AMR and other policy guidance is effective AMS through robust training programs on AMR and AMU tailored to healthcare workers [3]. Broadly speaking, these programs aim to optimize antimicrobial prescribing practices and expand the advice offered to end users to improve health outcomes while minimizing AMR risks. The specific circumstances of individual countries, however, may limit the applicability of generic international recommendations. Country-specific NAPs on AMR recognize these limitations, although efforts are still required to identify areas that AMS training programs should target in given contexts.

In this article we explore these issues in a sub-Saharan African context, where AMR- related morbidity and mortality rates, particularly those caused by bacterial resistance to antibiotics, are the highest worldwide [1]. While identifying gaps in knowledge that healthcare provider-focused AMS training programs should target, we argue that, in this context, practices of both antimicrobial prescribers and users are largely driven by the highly constrained environment within which they are forced to operate. These constraints are likely to challenge the sustainability of AMS educational programs. We conclude that these programs are unlikely to succeed if these barriers are not understood and tackled first.

Formal training and remaining knowledge gaps

The need to include AMR- and AMS-related subjects in the curricula for medical doctors, nurses, pharmacologists, pharmacists, veterinarians, drugstore clerks, and community health workers [here referred to as health workers (HWs)] is widely recognized [4]. For example, HWs across Nigeria, South Africa, and Rwanda acknowledged that having a good understanding of AMR is important when prescribing antimicrobials [4., 5., 6.]. Literature from Rwanda suggests that an average of 80% of medical, dental, and pharmacy students (first to final year of study) included in this research had received some type of AMS training from their university [4]. Survey responses from these students indicated a good understanding of antibiotic use and health threats posed by AMR [4]. Similarly, HWs in South Africa identified AMR as an imminent global issue that, if left unchecked, will lead to a decrease in antimicrobial efficacy [5]. In addition, they reported familiarity with the concept of resistant infections, and

appreciated the relationship between these and antimicrobial overuse/misuse [5]. HWs in Nigeria acknowledged that the latter are issues within their own healthcare practice and lamented a lack of AMS or antimicrobial restrictions in their clinics that could address these practices [6].

Despite this appreciation of issues surrounding AMR, several knowledge gaps exist that AMS training programs should address. For example, a study in Rwanda identified a general belief that antimicrobials are necessary for 'all pain and inflammation' [4]. In other circumstances, inconsistencies have been reported when healthcare workers are asked specific information about antibiotic classes and properties, to define correct antibiotic pairing protocols, and whether antimicrobials are necessary for viral infections [4,6].

Constraints to 'good' practice

Despite the knowledge gaps discussed above, favorable levels of AMR and AMU knowledge exist amongst HWs as highlighted in studies from Nigeria, South Africa, and Rwanda [4., 5., 6.]. This raises optimism regarding implementing appropriate AMS. However, in poorly resourced communities, prescribing habits are often influenced by a wide range of factors beyond knowledge of 'good' practice. For example, a lack of diagnostic or antibiotic susceptibility testing capacity in Tanzania [7] limits HW ability to inform their treatment choices. As a result, antibiotics may be prescribed unnecessarily to patients presenting with a viral or parasitic infection [6]. Other factors influencing HW prescribing practices include pressure from patients, large patient loads, and the fear of patient mortality if antimicrobials are not prescribed [5., 6., 7.]. Furthermore, HWs are mindful of the costs involved in medical care and treatment plans are primarily based on the patients' ability to pay [7,8].While HWs generally take into account patients' needs when making decisions on AMU, many HWs consider them responsible for AMR spread through self-medication [5]. However, this is often the first port of call due to poor access to healthcare infrastructure [7]. In addition, unsanitary conditions, in both communities and healthcare settings [8], create a high infectious disease burden, particularly in the most remote communities. AMU in these circumstances often becomes a 'band-aid' or a 'quick fix' for inadequate hygiene on the part of both the providers and users [8,9]. Indeed, HWs recognize that a lack of sanitation – as well as inadequate preventative measures such as vaccination and biosecurity – are important factors contributing to the over-reliance on antimicrobials [5].

Antimicrobial stewardship training: opportunities and barriers to sustainability

Research teams have begun implementing and evaluating AMS training programs in medical clinics in Ghana, South Africa, Kenya, and Tanzania, including small-scale pilot studies, multi-year studies, and programs initiated by national and global agencies [10., 11., 12.]. While research is limited, positive impacts on AMR knowledge and reported AMU practices after training programs have been highlighted. Benefits include improvements in AMR knowledge and awareness, compliance to prescribing guidelines, sanitation habits, and antimicrobial treatment choice and usage amongst respondents [12]. For instance, one study measured a 30% increase in correctly managed respiratory infections [10]. In addition to specific research projects, multiple AMR- and AMS-related training initiatives have been implemented across sub-Saharan Africa tailored to HWs to improve AMR knowledge and AMS, infection, prevention and control in healthcare facilities, and surveillance mechanisms to monitor AMU and AMR [11]. These programs provide tangible opportunities to support HWs in their daily practices [7., 8., 9.] (Table 1).

Although the research studies discussed above demonstrate that such programs have the potential to improve AMS education and awareness, the technical capacity to implement larger-scale training across Africa has been questioned [13,14]. These concerns apply also to the wide range of initiatives implemented by various agencies (Table 1). Doctors and pharmacists in Ethiopia highlighted the fact that no AMR training initiatives are regulated by any government agency, making it impossible to create uniform AMU guidelines [14]. Additionally, several challenges compromise the ability of HWs to act upon the newly acquired knowledge. Many HWs have pointed out that, along with the shortage of HWs, there are only a few qualified individuals who are able to conduct these programs [13]. Furthermore, the high cost of antimicrobials, limited storage space, and a lack of infrastructure to transport pharmaceuticals have made it difficult to access new and high-quality antimicrobials across Africa [7,11]. This lack of access makes following guidelines challenging as HWs might not have the ability to supply patients with the correct type or dosage of treatment as outlined in AMS training programs [11,13].

Concluding remarks

Broader awareness surrounding the repercussions of AMR and AMU should be encouraged when discussing AMR at global levels, but there are challenges individual countries face when implementing sustainable educational programs. Current AMS programs do not fully account for the specific needs of poorly resourced communities and their HWs. To grasp prescriber and community needs, we must change our perceptions of antimicrobial 'misuse' or 'prudent use' [7,8]. While certain treatment practices are considered irrational within the medical science realm, these same practices could be considered rational, or even necessary, in communities struggling with economic hardships and limited biomedical and staffing resources [7,8]. Because of these constraints, HWs serving these communities are often more concerned with fast and robust treatment to avoid severe infections than a possible reduction in antimicrobial efficacy [7,8]. A deeper understanding of perceptions, experiences, and practices of HWs in these environments would support the design of more locally relevant training programs and guidance.

In response to the AMR crisis, a wide range of training initiatives have been launched across sub-Saharan Africa (Table 1). However, initiatives that focus solely on enhancing knowledge would not be sufficient in addressing AMR in this context [7., 8., 9.,13,14]. Ultimately, an environment must be created that is conducive to supporting improved treatment habits. For change to occur, AMS programs must be tailored to specific countries, cities, or facilities. Not only must programs be unique, but national government agencies must be proactive in creating guidelines and initiatives to ensure the sustainability of such programs. Most importantly, these programs must be paired with enhancements in community-level biosecurity capabilities (access to clean water, latrines, vaccine campaigns) to prevent infection, hence the need for treatment; healthcare infrastructure and infection, prevention, and control; access to antimicrobials (expanding provider treatment options and reducing overall cost to patients); and national AMR surveillance standards at all levels (including remote communities). Without these essential steps, HWs cannot be fully supported in their daily practices.

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Table 1. Examples of recent and current initiatives aimed at improving surveillance and management of AMR, monitoring of AMU, and AMS tailored to healthcare workers implemented across sub-Saharan African countries

Focus of the program	Implementers	Location(s) of implementation	Focus of the initiative	Challenges/limitations
One Health	• WHO[i] • Food and Agriculture Organization[ii] • World Organization of Animal Health[iii] • African Union/Africa CDC (Centres for Disease Control and Prevention) Framework for Antimicrobial Resistance[iv] • ReAct Africa[v]	Uganda, Malawi, Zambia, Ghana, Sierra Leone, Tanzania, Kenya, Rwanda, Zimbabwe, Nigeria, Burkina Faso, Burundi, Democratic Republic of Congo, Ethiopia, Mozambique, Senegal, South Africa, Comoros, Djibouti, Madagascar, Mauritius, Seychelles, Somalia, Cameroon, Chad, Equatorial Guinea, Gabonese Republic, São Tomé and Principe, Lesotho, Namibia, Niger, Senegal, South Sudan, Togo, Mali, Liberia, Gabon, Eswatini, Algeria, Angola, Benin, Botswana, Cote d'Ivoire (Ivory Coast), Eritrae	Emphasis on multi- and inter-sectoral collaboration to ensure a One Health approach to tackling AMR, encompassing human, animal, and environmental health dimensions. Efforts to expand laboratory capabilities and access to susceptibility testing have also been integrated within these programs. Benefits could include faster response time to notifiable medical events, better infectious disease outbreak management, and broader AMR awareness.	Highly dependent on stakeholders' ability to communicate. To better enable collaboration, a uniform surveillance system must be used by all parties involved. Otherwise, data reporting might vary between groups.
AMS programs	• WHO, including a toolkit for AMS in healthcare facilities in low-and-middle income countries, a competency-based approach for AMS and policy guidance on integrated AMS activities[vi] • Fleming Fund[vii] • Commonwealth Partnerships on Antimicrobial Stewardship (CwPAMS)[viii] • The Scottish Antimicrobial Prescribing Group[ix] • Tropical Health and Education Trust (THET)[x] • Commonwealth Pharmacists Association (CPA)[xi] • ReAct Africa[xii] • University of Pretoria [10] • University of South Carolina [15]	Kenya, Tanzania, Ghana, South Africa, Eswatini, Malawi, Uganda, Zambia, Zimbabwe, Senegal, Sierra Leone, Nigeria	Activities include AMU analysis within public and private hospitals, as well as the development of AMS programs in these same facilities. The main goal of these initiatives is to provide tools to enable the development of AMS programs that specially target the unique needs of healthcare facilities, in place of broad or all-purpose AMS programs.	The sustainability of AMS programs depends on strong ownership by national governments and on addressing infrastructural challenges the healthcare workforce face in poorly resourced environments, particularly in the more remote areas. National guidelines need to be created to guarantee program funding and incentives for implementing improved AMU habits.
Infection prevention	WHO Water and Sanitation for Health Facility Improvement Tool (WASH FIT)[xii]	Kenya, Malawi, Nigeria, Uganda, Zambia, Burundi, Chad, Comoros, Democratic Republic of the Congo, Ethiopia, Ghana, Liberia, Mali, Mozambique, Niger, Sierra Leone, Tanzania, Togo, Madagascar	Toolkit to enable improvements in hygiene, sanitation, and healthcare waste management infrastructure. This initiative aims to improve infection, prevention and control in healthcare facilities in order to reduce the need for antibiotics.	The focus is on healthcare facilities, although high disease burden and biosecurity concerns exist also in rural communities struggling with sanitation and healthcare access.
AMR surveillance	• Global Antimicrobial Resistance and Use Surveillance System (GLASS-AMR)[xiii] • African Union/Africa CDC Framework for Antimicrobial Resistance[iv]	Ghana, Kenya, Malawi, Nigeria, Tanzania, Uganda, Zambia, Ethiopia, Egypt, Madagascar, Mali, Mozambique, South Africa, Sudan, Angola, Benin, Burkina Faso, Burundi, Chad, Cote d'Ivoire (Ivory Coast), Democratic Republic of the Congo, Eswatini, Liberia, Lesotho, Zimbabwe, Togo, Sierra Leone	Standardized guidance for the collection, analysis, and global/regional sharing of AMR data to enhance and monitor national AMR surveillance systems. Mapping of available microbial testing sites, advocating for policy changes that broaden testing capabilities, and supporting laboratories in creating surveillance programs.	An important aspect of surveillance is ensuring that all agencies involved have the technical capacity to contribute to such systems. More remote locations may be limited in what they are able to report as access to laboratories, antimicrobials, or well-resourced healthcare facilities could be restricted.

Resources

[i]www.afro.who.int/health-topics/antimicrobial-resistance [ii]www.fao.org/antimicrobial-resistance/en/
[iii]www.woah.org/en/what-we-do/global-initiatives/antimicrobial-resistance/
[iv]https://africacdc.org/download/africa-cdc-framework-for-antimicrobial-resistance/
[v]www.reactgroup.org/about-us/a-global-network/react-africa/
[vi]https://apps.who.int/iris/handle/10665/329404 [vii]www.flemingfund.org
[viii]www.flemingfund.org/grants/commonwealth-partnerships-for-antimicrobial-stewardship-2/
[ix]www.sapg.scot [x]www.thet.org
[xi]https://commonwealthpharmacy.org/amr/ [xii]www.reactgroup.org/toolbox/rational-use/health-care/
[xiii]www.who.int/initiatives/glass

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