

## Interprofessional education in antimicrobial stewardship, a collaborative effort

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**Introduction:** Antimicrobial stewardship (AMS) education and interprofessional collaboration are integral to the success of a stewardship programme. An interactive interprofessional AMS workshop, designed to encourage workplace interprofessional collaboration was piloted in a tertiary hospital.

**Objectives:** To obtain feedback to determine the suitability and sustainability of the AMS workshop.

**Methods:** Feedback was elicited through a predesigned questionnaire containing both open-ended and closed questions on the content and structure of the workshop.

**Results:** The survey had a 70% ( $n=16$ ) overall response rate. All participants agreed that the goals of the workshop were met and that the knowledge and skills gained from the workshop would help them in their AMS roles. All participants indicated that the workshop content, and the level at which it was pitched, met their expectations and that it had improved their knowledge and skills. All agreed that they found it advantageous and enjoyed learning as an interprofessional group. Open feedback showed that the workshop was found to be useful and would potentially result in improved patient care, dissemination of knowledge, improved teamwork and organizational culture.

**Conclusions:** The positive feedback and changes made following the workshop demonstrated that a targeted AMS educational workshop adds value to an antimicrobial stewardship programme.

### Introduction

As the world collectively recovers from the COVID-19 pandemic, an old but still unresolved public health issue once again comes under the spotlight. Often described as the ‘silent pandemic’, antimicrobial resistance (AMR) remains one of the top 10 global public health priorities.<sup>1,2</sup> Murray *et al.*<sup>3</sup> estimated that in 2019, 1.27 million [95% uncertainty interval (UI) 0.911–1.71] deaths were a direct result of bacterial AMR, with the highest all-age death rates found in western sub-Saharan Africa, i.e. 27.3 deaths per 100 000 (95% UI 20.9–35.3). The true figure for numbers due

to drug resistance is, however, most likely higher due to a deficit in reporting in low-and-middle-income-countries (LMICs).<sup>2</sup>

A 2018 report by the Organisation for Economic Co-operation and Development (OECD) states that in conjunction with other policies and infection prevention and control (IPC), antimicrobial stewardship (AMS) programmes could prevent up to 1.6 million deaths as a consequence of AMR by 2050, and have a cost saving of US \$4.8 billion per year in the 33 OECD countries.<sup>4</sup> The ethos of AMS is to optimize antimicrobial use, promote rational prescribing, and elicit positive behavioural change whilst improving patient care and outcomes, and reducing resistance. AMS education and training targeted at developing and improving

competencies is regarded as an important persuasive intervention, key to the sustainability of AMS programmes.<sup>5</sup> In a recent scoping review on AMS interventions in South Africa (SA), we found that education was integral to the success of an accompanying AMS intervention.<sup>6</sup> A number of policy documents and guidelines recognize the skills that each healthcare professional brings to a successful AMS programme advocating interprofessional collaboration.<sup>5,7-9</sup> Interprofessional education and collaborative practice (IPECP) is widely regarded as a means of promoting teamwork for the benefit of improving health outcomes and patient care.<sup>10,11</sup>

With an aim of encouraging a workplace interprofessional AMS curriculum, we (i) designed and piloted an interactive interprofessional AMS workshop and (ii) elicited feedback through a predesigned questionnaire to determine suitability and sustainability.

## Methodology

### Setting and study design

The study was carried out at an 846-bed specialized central referral hospital located in KwaZulu Natal (KZN), SA. The AMS workshop was targeted and open to all healthcare professionals (doctors, pharmacists and nurses) based at this hospital. Support for the initiative was enlisted from senior management at the hospital and the AMS committee. Information about the workshop was relayed by e-mails to all staff via the staff intranet.

The learning objectives and content for the workshop were designed by two pharmacists (S.C., S.Y.E.), two clinical microbiologists (K.S.S.H., Y.M.) and one paediatric infectious diseases specialist (A.P.). Learning needs were identified from two previous studies, i.e. a knowledge, attitudes and perceptions (KAP) analysis and a strengths, weaknesses, opportunities and threats (SWOT) analysis of the facility where an AMS programme is currently being instituted (J. Cassim, S. Essack and S. Chetty, unpublished data). A recent AMS survey of public hospitals in KZN, conducted by Chetty *et al.*,<sup>12</sup> identified the gaps in AMS for the province and analysis of key AMS documents aligned the content with the needs of the country and globally,<sup>5,7-9,13-16</sup>

### Pre-workshop activities

Participants were given a pre-workshop task to reflect on AMS in their hospital, specifically the challenges and how AMS can be improved in the hospital.

### Curriculum/workshop content

To address the educational needs of the facility, a two-part educational programme was designed. This consisted of a theory component followed by a 1 day workshop covering the practical aspects of AMS and how to facilitate stewardship interventions within the facility. To obtain maximum benefit from the practical workshop, attendees were encouraged to complete an online 3–6 h National Department of Health (NDOH) AMS course (theory component) prior to attending the workshop.<sup>17</sup> This course provided a basic overview of AMR. The continuing professional development (CPD)-accredited workshop covering the practical

aspects of AMS was designed to complement the theory from the online course.

The workshop covering the practical aspects of AMS was broadly divided into five sections: (i) an overview of antibiotics and antifungals; (ii) adverse effects and AMR; (iii) AMS concepts; (iv) surveillance; and (v) IPC.

Each section was accompanied by case vignettes including laboratory data and question-and-answer sessions. Participants were allocated to interprofessional groups of five to eight people and were given tasks to complete as collaborative group work.

By removing staff from their workplace, we anticipated this would have the additional benefit of creating an informal comfortable setting, free from distractions.

### Post-workshop feedback

On completion of the workshop, feedback on the content and structure was elicited from participants by requesting that they complete either an onsite paper-based or an electronic online questionnaire via Lime survey, which was open for 2 weeks after the workshop ([Supplementary Material S2](#), available as [Supplementary data](#) at [JAC-AMR Online](#)). The questionnaire containing both open-ended and closed questions was designed by S.C. and checked for comprehensibility and suitability by S.Y.E., K.S.S.H., Y.M. and A.P. Fifteen participants completed the paper-based questionnaire on the workshop day and one completed the online version.

### Data analysis

Answers to closed and open-ended questions were double-checked, captured and coded in Microsoft Excel<sup>®</sup>. Descriptive statistics were used to analyse the data obtained from the closed questions. The results were reported as frequency and percentages.

The responses to open-ended questions were transcribed verbatim. Manifest content analysis using the method described by Erlingsson and Brysiewicz<sup>18</sup> was used to analyse responses. After reading and re-reading the transcripts, meaning units were identified, condensed and labelled with a code. Codes were then grouped to form categories. See [Table S1](#) for examples of content analysis coding and categorization.

### Ethics

Ethical approval was granted from the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal, South Africa (BREC/00001935/2020). Permission was obtained from the hospital prior to carrying out the research. Prior written consent was required and participation was purely voluntary with no linked identifiers. To maintain anonymity and confidentiality, results are reported as a summary aggregate of the findings, and individual comments were given participant numbers.

## Results

### Number and category of attendees

A total of 23 healthcare professionals attended the workshop. Sixteen (consisting of five doctors, eight pharmacists and three

**Table 1.** AMS challenges experienced at the hospital and solutions for improvement as suggested by participants

What are the AMS challenges experienced in your hospital?	Overall issue	How can AMS be improved at the hospital?
Irrational prescribing of antibiotics. Inadequate understanding of the spectrum of antibiotics and choice of empirical antibiotic. Lack of awareness of the implications of a lack of antimicrobial stewardship	Inappropriate prescribing	Improve education of AMS and enforce microbiology-informed treatment.
Antibiotic prescriptions not reviewed on time. Pharmacy issues stock for 7 days. Lack of/suboptimal IV-to-oral switch. Patients are not commenced/stopped on treatment timeously. Minimal antibiotic utilization reviews. Use of more than one antibiotic to treat an infection that could be treated with one. Empirical prescription of an antimicrobial agent while awaiting microbiology results	Inappropriate prescribing	Use of antimicrobial prescription form. Review antibiotic duration time over a shorter period. Audit patient prescription charts and correct errors in antibiotic prescriptions. Follow up on microbiology report and order according to susceptibility.
Adverse effects of antibiotics in patients who are unnecessarily exposed to antibiotics. Misuse leading to antibiotic resistance.	AMR	Reduce the use of broad-spectrum antibiotics. Optimize and improve antibiotic prescribing.
Signs of sepsis are often non-specific in the neonate. Very sick patient profile—differing pathologies but mostly surgical patients with many risk factors (operative intervention/prolonged total parenteral nutrition (TPN) use/ need for central lines).	Complicated patient cases	De-escalation of antibiotics as per microbial culture and susceptibility results. Stopping antibiotics sooner if indicated.
No uniformity between disciplines. Non-adherence to protocols. Prescribing patterns are not consistent due to numerous and new prescribers.	No standard protocol	More formalized antibiotic stewardship meetings and ward rounds on a continuous and regular basis. Orientate new prescribers from the different disciplines to AMS.
Lack of understanding of how to implement AMS	AMS implementation	An active AMS programme through the inclusion of pharmacists, prescribers and nurses who are willing to participate in the AMS. Greater multidisciplinary team involvement. Staff training on AMS.

nurses) completed the questionnaire, yielding a 70% overall response rate.

### Pre-workshop activities

The results of the pre-workshop activity, reflecting on AMS at the hospital, are tabulated in Table 1.

### Post-workshop feedback

Participants perceived an improvement in AMS knowledge when they were asked to rate their level of AMS knowledge before and after the workshop (Figure 1).

All participants agreed that the workshop was pitched at the appropriate level and that they would recommend the workshop to other healthcare professionals.

### Workshop content

All agreed that the goals of the workshop were met and that the knowledge and skills gained from the workshop would help them

in their AMS roles. The feedback regarding the content and format of the workshop is summarized in Table 2.

### Learning as an interprofessional group

The feedback regarding learning as an interprofessional group is summarized in Table 3.

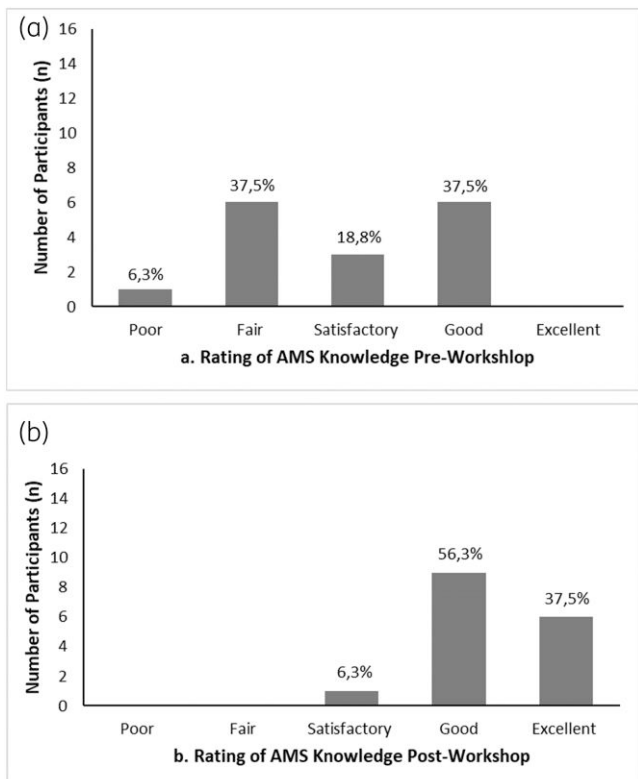
### Open-ended questions

When asked ‘How do you think this workshop will help you in your current role?’, the following categories emerged.

#### Better patient care

Many participants agreed that the knowledge gained from the workshop provided essential skills to provide better patient care delivery and hence do their jobs better.

*To be able to interrogate the patient's file to identify the type of HAIs [healthcare-associated infections] and [I] will disseminate information to subordinates [on] the importance of pre-analytical specimen collection. (P2, Nurse)*



**Figure 1.** Self-rating of participant AMS knowledge pre (a) and post (b) workshop.

*Will improve patient care. (P11, Doctor)*  
*To improve AMS in my unit. (P14, Doctor)*  
*Prevent the misuse of antibiotics. Participate in AMS rounds. (P15, Pharmacist)*

The knowledge gained supplemented their existing knowledge and consequently will impact patient care.

*Helped understand microbiology better. (P3, Nurse)*  
*More information has been achieved. (P8, Pharmacist)*  
*Supplemented my current knowledge. Will improve patient care. (P11, Doctor)*

The workshop allowed participants to reflect on their current practice and facilitate change to ensure better rational prescribing and dispensing of antimicrobials.

*Prescribing personally will change. Will try to get involved in AMS. (P13, Doctor)*  
*Be more vigilant in dispensing antibiotics. (P6, Pharmacist)*

#### Knowledge dissemination

Interestingly, some of the hospital staff who had attended were willing to share this information with other colleagues who had not attended to improve AMS overall within the hospital. This sentiment resonated among all cadres of hospital staff.

*Will educate the staff in my unit. (P4, Nurse)*

*To disseminate the information to my team and appropriately apply the current practice. (P12, Pharmacist)*

*Educate other healthcare professionals on [the] correct use of medication. (P15, Pharmacist)*

There was also a greater willingness to strengthen AMS overall within the institution.

*It will enhance my oversight of AMS and will assist in planning for strengthening of AMS at our institution. (P5, Doctor)*

*Understand and be able to advise other doctors on rational prescribing. (P10, Doctor)*

When asked why they enjoyed learning in a multidisciplinary team, the following categories were observed:

#### Teamwork is important

The participants realized that for AMS to be effective it must be carried out by a multidisciplinary team. By identifying each healthcare professional's role in AMS, the workshop clarified and highlighted the value that each professional brought to AMS.

*AMS is multidisciplinary. (P12, Pharmacist)*

*Need to understand each profession's role for the system to work efficiently. (P4, Nurse)*

*We value the multidisciplinary approach and appreciated that the roles and responsibilities of each cadre of staff were highlighted. The relevance for each group was emphasized to ensure everyone was appropriately engaged and motivated to participate. (P5, Doctor)*

By having input from the different healthcare professionals it enhanced and strengthened the provision of AMS within the hospital.

*Input from a multidisciplinary team is very important. (P8, Pharmacist)*  
*Great to see the role each profession plays and how we all work together for a common goal. (P11, Doctor)*

They also learned from each other and gained a different perspective on the topic that they wouldn't necessarily have received if the topic had been taught separately to the different professional cadres.

*It reinforced the importance of informed decision making especially in antimicrobial utilization. (P2, Nurse)*

*You are able to get different levels of understanding and responses. (P3, Nurse)*

By being interactive it made the learning event more enjoyable.

*It was interactive and enjoyable. (P7, Pharmacist)*

The workshop also improved relationships by providing an opportunity for the staff to get to know one another and thereby enhance communication. Good communication is key to a successful AMS programme.

**Table 2.** Feedback regarding the content and format of the workshop

Likert scale	The content of the workshop was useful, n (%)	The content of the workshop was interesting, n (%)	The format of the lectures was conducive to learning, n (%)	The format of the participatory activities enhanced my learning, n (%)	The workshop was enjoyable, n (%)
Agree	16 (100)	16 (100)	14 (87.5)	16 (100)	15 (93.7)
Neutral	0	0	2	0	1 (6.3)
Disagree	0	0	0	0	0

**Table 3.** Feedback regarding learning as an interprofessional group

Likert scale	Did you enjoy learning as an interprofessional group? n (%)	Did you think that it was an advantage learning as an interprofessional group? n (%)	Did you think that it was a disadvantage learning as an interprofessional group? n (%)
Agree	16 (100)	16 (100)	0
Neutral	0	0	0
Disagree	0	0	15 (93.8)

*Got to see and get to know the staff ‘behind the scenes’. (P6, Pharmacist)  
Enhance interdisciplinary communication. (P15, Pharmacist)*

The responses to the question ‘Did you think that it was an advantage learning as an interprofessional group?’ were as follows:

*Learning together promoted organizational culture and teamwork*

They felt it was advantageous to learn from each other and share information.

*Diverse ideological sharing in healthcare systems for attaining one common goal. Learnt a lot from the contribution of the rest of the team. (P2, Nurse)  
I learnt from the different professions to better my clinical practice (pharmacy practice). (P9, Pharmacist)*

They acknowledged that improving AMS within the hospital required teamwork. There was a sense of identity of belonging to the same hospital.

*It encourages teamwork as we all belong to the same facility. (P3, Nurse)  
Will ensure [the] effectiveness of the program. [We] cannot work in isolation. (P4, Nurse)  
Encourages the multidisciplinary team to function together as the learning occurred together. (P5, Doctor)*

Learning from other healthcare professionals increased collegiality and they gained different perspectives to the problem.

*Can receive input from other professionals. (P10, Doctor)  
Involving and taking the viewpoints of other healthcare professionals can prove to be very beneficial. (P12, Pharmacist)*

It also gave them an insight into the challenges experienced by other healthcare professionals that they perhaps were not aware of before.

*It gave you an idea of the challenges all groups were experiencing. (P7, Pharmacist)*

*It’s important to understand the challenges faced by the other healthcare professionals (P15, Pharmacist)*

The participants gave useful feedback on suggestions of how to improve the workshop. This is captured in Table 4.

**Discussion**

Recognizing that AMS is a team effort, we designed a 1 day inter-professional, CPD-accredited workshop held offsite, inviting doctors, pharmacists and nurses. All indicated that the workshop content, and the level at which it was pitched, met their expectations and that it had improved their knowledge and skills. Therefore, they would recommend the workshop to other healthcare professionals. Open feedback showed that the workshop had assisted them and would potentially result in improved patient care, dissemination of knowledge and teamwork.

AMS is relatively new, consequently, many experienced healthcare professionals have not received this training as part of their undergraduate degree. Worldwide, KAP studies have demonstrated that gaps in AMS knowledge do exist in qualified medical professionals, demonstrating the importance of more specialized CPD training on this topic.<sup>19-25</sup> CPD could help bridge this gap in knowledge. All participants perceived an improvement in AMS knowledge after the workshop as evidenced by their responses. An integrative review of the effectiveness of healthcare professionals’ CPD provides evidence that the mode of educational delivery employed impacts learning outcomes and retention. The use of multiple techniques such as case-based learning, clinical simulations, practice and feedback is more effective than passive didactic lecturing.<sup>26</sup> These were incorporated in the workshop and the feedback demonstrated that this form of learning was well received.

Literature has demonstrated that ‘joint training’ or ‘shared learning’ is a good way of encouraging collaboration to provide comprehensive care for the patient.<sup>27</sup> The AMS workshop had representation from all three healthcare professional groups in patient-facing roles within the hospital. Participants enjoyed learning as an interdisciplinary team during the workshop. They recognized the importance of teamwork and the value that each professional group brought to AMS and a successful AMS



**Table 4.** Feedback on suggestions on how to improve the AMS workshop

Suggestions	Possible solutions
<i>The time was limited, have the workshop in 2 days.</i> (P1, Pharmacist)	Spread the content over 2 days
<i>Duplication of information. Ran over time.</i> (P14, Doctor)	Requires more tailoring of content to prevent information overlap
<i>To focus on prevention first (IPC) then progress to AMS.</i> (P3, Nurse)	Cover IPC earlier in the programme
<i>Perhaps include a session on feedback from each group/cadre on their suggestions to implement.</i> (P5, Doctor)	Obtain suggestions from the staff for AMS implementation
<i>AMS at unit and facility level. So that solutions can be driven via a bottom up approach.</i> (P5, Doctor)	Training at unit and facility level

programme. They also felt that during the workshop they learned from each other and gained a perspective that they would not necessarily have received if they had learned the topic separately in their professional groups.

From the feedback, it was evident that the workshop had the added benefit of improving communication between the different healthcare professionals by providing an opportunity for them to get to know one another. Additionally, the workshop created a sense of identity within the institution and indirectly improved organizational culture. We hope this will lead to a breakdown in silos between different healthcare professionals and departments to create a more cohesive AMS workforce within the hospital. A similar finding was obtained from a study where an HIV interprofessional educational initiative amongst staff at a non-governmental organization improved working relationships.<sup>28</sup>

Learning together also allowed them to gain a different perspective on the problem through different professional views and also gain insight into the challenges that each profession experienced. A systematic review evaluating the effectiveness of interprofessional education (IPE) in comparison with different professionals learning separately on patient outcomes showed that of the 15 studies assessed, 7 IPE studies had either improved healthcare processes or patient outcomes or both, 4 studies had mixed outcomes and 4 reported that IPE did not affect outcomes.<sup>29</sup> Challenges to AMS raised by participants included high AMR, inappropriate prescribing and the complexity of medical cases especially involving critically ill patients, which further complicated prescribing decisions. These challenges have also been found in other studies, which are common in the SA public health system.<sup>6,12</sup> A correlation between these pre-workshop listed challenges and the workshop content indicated that the workshop content aligned well with the needs of the healthcare professionals at the facility. It also highlighted the scope for further educational initiatives such as *ad hoc* bedside AMS educational initiatives or regular AMS meetings/grand rounds to discuss serious cases, which would be beneficial to staff. One of the findings of a systematic review on IPE highlighted the importance of customization of the content to the specific audience

targeted. Authenticity by making concepts relevant to practice is also another way to ensure the success of an IPE initiative.<sup>30</sup>

With the open-ended questions we wanted to delve deeper to gain further insight into participant perceptions. When asked how they felt this workshop would help them with their AMS role in the hospital, two categories emerged. The first was that the workshop helped improve patient care delivery by providing new knowledge, and that essential skills and supplementing their existing knowledge resulting in better patient care decisions regarding AMS. The workshop allowed participants to cognitively reflect on their own practice and fostered a change in prescribing habits thus promoting rational antimicrobial prescribing. Education is therefore a key persuasive intervention. In a randomized controlled multifaceted trial by Weiss et al.,<sup>31</sup> educational interventions including group meetings, workshops, seminars and practice campaigns helped decrease paediatric prescription rates in comparison with the control.

Enhanced IPC, adherence to guidelines and rational prescribing require behavioural modifications. Effecting behavioural changes can be explained via the capability, opportunity, motivation, behaviour (COM)-B model.<sup>32,33</sup> Capability relates to the knowledge and physical capability of the person to make a change. Knowledge in this instance was provided by the workshop. Opportunity includes external factors that make behavioural changes possible, e.g. time, location and resources. The support of senior management provided participants with protected time to attend the workshop. Motivation is an internal process within each individual to influence decision-making. This can be reflective or automatic, such as desires or impulses. Persuasive interventions like education touch on the COM-B model to elicit favourable behavioural changes.<sup>32,33</sup>

The second category of knowledge dissemination revealed that participants were willing to impart the knowledge they obtained to other colleagues so as to improve AMS overall within the hospital. This was an altruistic motive that would benefit both patients and staff. Train-the-trainer models are one way of amplifying training, leading to one educational initiative having a sustainable impact.<sup>34</sup> A USA-SA partnership train-the-trainer programme initiated in 2012, trained 10 mentees from 2013 to 2019. This resulted in a transfer of AMS knowledge to a further 120 pharmacists.<sup>34</sup> From the feedback received we felt confident that this training created awareness amongst attendees and will be imparted in some form to non-attendees.

When we elicited feedback on how to improve the workshop, we received some useful suggestions. This feedback allowed us to reflect on the content and design of the workshop. Although the content of the workshop was meticulously researched and prepared and the different topics were slotted within a designated timetable, some sessions ran overtime. One of the suggestions was that we should extend the workshop to 2 days. This would allow for a better spread of material over the allocated time period thus allowing extra time for discussion and implementing additional active tasks. We acknowledged that there was an overlap of some content. This is inevitable due to the nature of the different sections but will require more tailoring on the part of the coordinators in the future to minimize.

One of the comments was to include a session on suggestions for AMS implementation. We did this by setting the pre-workshop task to all participants. The intention was to discuss the various

comments at the workshop but as the workshop ran overtime we were unable to hold a discussion on challenges and suggestions for AMS at the hospital. The information was, however, relayed via representatives on the AMS committee. For future workshops, a 2 day event would allow enough time to do this. For this initiative to be sustainable it would require ongoing educational initiatives. An integrative review of different continuing medical education (CME) studies showed that repetitive targeted interventions had better retention and learning outcomes than single interventions.<sup>26</sup>

Following the workshop, personal communication with the lead of the hospital AMS committee revealed that staff were encouraged, if they hadn't done so previously, to complete an online Department of Health module covering the basic principles of AMR. The AMS educational workshop reinforced and reiterated the goals of AMS within individual units at the hospital. Subsequent to the workshop training session, the AMS committee went on to implement audits on non-Essential Medicine List antimicrobials using a combination of pre-prescription authorization and post-prescription review for carbapenems, colistin, tigecycline, amphotericin and echinocandins. The multidisciplinary team conducting AMS clinical ward rounds experienced positive and engaging interactions with fellow healthcare professionals who had attended the workshop. This has resulted in improvements in encouraging safe de-escalation of broad-spectrum antimicrobials and shortened duration of antimicrobial courses.

This workshop was, thus, beneficial in sensitizing healthcare professionals at the facility to the enormity of the issue of AMR and the benefits of implementing an AMS programme and provided an impetus for further AMS implementation.

### The next step

This interactive workshop was designed to cover the practical aspects of AMS. This component of AMS is often difficult to cover in online modules. To the best of our knowledge, this was the first time that such a workshop was piloted in the KZN province of SA. Feedback from participants was elicited to determine if such an educational intervention was feasible with regard to content, structure and format. Feedback provided from the participants allowed us to further tailor the workshop content and programme to the needs of a medical interprofessional audience. Through personal communication with the AMS lead at the hospital, as detailed above, the workshop encouraged further AMS interventions at the hospital. Our future intent is to obtain support from the provisional Department of Health and roll out further to other public hospitals in the vicinity. Support would ensure sustainability and continuity of the programme for the province.

### Limitations

The post-workshop feedback provided a surface view of participants' perceptions. To gain a deeper understanding, qualitative studies such as focus group discussions will be beneficial to complement this study. Another limitation of the study was the small sample size. This limits generalizability to all staff at the hospital. The study, however, still provides insight into the perception of the value of this type of educational intervention.

### Conclusions

In LMICs, AMS is still in its infancy but is gradually gaining momentum. For an AMS programme to be effective, successful and sustainable it requires buy-in from all healthcare professionals within the organization. AMS requires multidisciplinary teams with diverse skills for a coordinated approach to tackle AMR.

The beginnings of an AMS programme starts with awareness of the problem of AMR and what can be done to mitigate it. Stewardship principles and training are invaluable to a successful sustainable AMS programme. In this study, we have shown that an educational initiative can improve knowledge and perceptions of AMR and elicit positive behavioural changes. Further to this, learning as an interprofessional team promotes teamwork, provides a sense of identity and is a step towards improving patient outcomes and health systems within hospitals.

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### Author contributions

S.C., S.Y.E., K.S.S.H., Y.M. and A.G. designed the workshop. S.C. collected and analysed the data, and wrote the original draft of the manuscript. S.C., S.Y.E., K.S.S.H., Y.M. and A.G. reviewed and edited the final draft of the manuscript.

### Supplementary data

Supplementary Material S1 and S2 and Table S1 are available as Supplementary data at JAC-AMR Online.

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