Potential Strategies to Limit Inappropriate Purchasing of Antibiotics without a Prescription in a Rural Province in South Africa: Pilot Study and the Implications

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Abstract

Introduction: There is considerable concern with rising rates of antimicrobial resistance (AMR) with its subsequent impact on morbidity, mortality and costs. In low- and middle-income countries, a key driver of AMR is the appreciable misuse of antibiotics in ambulatory care, which can account for up to 95% of human utilisation. A principal area is the selling of antibiotics without a prescription. There is conflicting evidence in South Africa regarding this practice alongside rising AMR rates. Consequently, there is a need to explore this further, especially in more rural areas of South Africa. A pilot study was undertaken to address this. **Materials and Methods:** A two-step descriptive approach involving a self-administered questionnaire amongst pharmacists and their assistants followed by cognitive interviews with some of the participants. **Results:** Twenty-one responses were obtained from nine of the 11 community pharmacies invited to participate. Participating pharmacies were all independently owned. Ten of the 21 participants admitted dispensing antibiotics without a prescription, including both adults and children, representing five of the nine participating pharmacies. A minority dispensed antibiotics before recommending suitable over-the-counter medicines. These high rates were exacerbated by patient pressure. There were issues with the length of the questionnaire and some of the phraseology, which will be addressed in the main study. **Conclusion:** There were concerns with the extent of purchasing antibiotics without a prescription in this pilot in South Africa study. Key issues will be explored further in the main study.

Keywords: Antibiotics, AWaRe classification, education, health policy, pharmacists, purchasing antibiotics without a prescription, South Africa

Introduction

There are considerable concerns globally regarding the rising rates of antimicrobial in resistance (AMR) as this is resulting in morbidity, mortality, and costs, with the greatest AMR burden currently seen in sub-Saharan Africa.[1-4] These concerns regarding increasing AMR have resulted in multiple global and national initiatives. These include the World Health Organization (WHO) developing its Global Action Plan (GAP), with associated National Action Plans (NAPs) to reduce AMR.[5-8] Alongside this, the development and instigation of the WHO AWaRe (Access, Watch, Reserve) list of antibiotics.[9,10]

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These initiatives are important, especially amongst low- and middle-income countries (LMICs), to reduce inappropriate use of antibiotics, especially 'Watch' antibiotics from the AWaRe list, and hence AMR.[11-15] The suggested target for antibiotic utilisation across sectors is that at least 60% of antibiotics prescribed or dispensed must be from the 'Access' list.[12,16]

A key focus area for governments to enhance appropriate antibiotic use is ambulatory care, as this sector can account for up to 90%–95% of total antibiotic consumption in LMICs.[16-19] Within ambulatory care, a principal concern amongst LMICs is the purchasing of antibiotics without a prescription, as this will drive up AMR.[20-24] In these instances, antibiotics are often being dispensed for self-limiting conditions, including acute respiratory infections (ARIs), which incorporate upper respiratory tract infections (URTIs).[21,25-27] Of equal concern can be considerable dispensing of 'Watch' and 'Reserve' antibiotics without a prescription, further driving up AMR.[28] In addition, in some African countries, up to 100% of pharmacies have dispensed antibiotics without a prescription.[21,29] These high rates typically happen despite legislation often in place making such practices illegal.[21,30,31] While pharmacies are a crucial local source of accessible antibiotics with extended operating hours,[21,32-34] this environment also increases the opportunity for dispensing antibiotics without a prescription. This especially where there is considerable pressure from patients alongside lax monitoring of current regulations. In addition, community pharmacists or their assistants may not be fully aware of the optimal management of these patients especially those with self-limiting infections; alternatively, failing to adequately convey this to patients.

In 2017, the South African Minister of Health launched the National AMR Strategy Framework for 2017–2024,[35] which was part of the ongoing initiatives to improve antibiotic use in the country.[36] The purpose of this framework was to provide a structure for managing AMR, to limit further increases in AMR in South Africa, and ultimately improve patient outcomes. As such, it aligned with the goals of the WHO GAP as well as the NAP of South Africa to reduce AMR.[37,38] While implementation and monitoring of the NAP are at a more advanced stage in South Africa than other African countries, there are still concerns with increasing resistance rates that need addressing.[38-41] Rising AMR rates are exacerbated by inappropriate use of antibiotics, especially in ambulatory care.[19,36,42-45] However, this is not always the case, with high adherence rates to current guidelines observed in the study of Skosana *et al*. amongst community health centres in South Africa.[46]

In the context of pharmacy practice in South Africa, it is vital to understand the existing legislation governing the roles and responsibilities of pharmacy personnel, especially concerning the dispensing of prescription-only medications (POMs), including antibiotics. Pharmacists, who are licensed healthcare professionals (HCPs), play a central role in the safe and responsible dispensing of POMs. They are authorised by law in South Africa to dispense medications, including antibiotics, when presented with a valid prescription.[47] This responsibility encompasses assessing the medical necessity for the medicines, for example, antibiotics and ensuring the appropriate medication is provided to patients.

Pharmacists' assistants are also integral members of the pharmacy team in South Africa. However, their roles and responsibilities differ significantly from those of pharmacists, and they provide appreciable support to pharmacists and patients. They are not authorised by law to independently dispense medications; however, they assist pharmacists in their role as well as dispense medication under the supervision of pharmacists.[48]

In South Africa, educational qualifications and responsibilities for pharmacy assistants are outlined in accordance with existing regulations and guidelines, with universities in South Africa providing the necessary educational input. The roles that pharmacy assistants can fulfil may depend on their level of education and training. For instance, those with post-basic qualifications may have broader responsibilities, which include the dispensing of certain medications.[48]

The specific legislation regarding the roles and responsibilities of pharmacy personnel, especially with regard to dispensing POMs and antibiotics, is essential to ensure patient safety and the responsible use of antibiotics are maintained. However, despite the legislation, there is currently purchasing of antibiotics without a prescription in South Africa.[21] This, though, is variable. There was no purchasing of antibiotics in the study of Anstey Watkins *et al*. and amongst franchised pharmacies reported by Mokwele *et al*.[49,50] In addition, very limited purchasing without a prescription amongst South African participants in the study of Do *et al*.[51] Conversely, there was the purchasing of antibiotics without a prescription amongst 80% of privately owned pharmacies in the study of Mokwele *et al*.[50] These differences may be due to differences in the ownership of pharmacies, access to HCPs in ambulatory care clinics, training of pharmacists and their assistants, as well as economic circumstances and local context, similar to other African countries.[21] We have seen in Zimbabwe that changing economic circumstances greatly enhanced self-purchasing, while in Kenya, there was no or very limited purchasing of antibiotics without a prescription amongst trained pharmacists who were linked to the University of Nairobi.[52-56] The situation was very different in other pharmacies in Kenya including during the recent COVID-19 pandemic.[57,58] The provision of training and guidelines, coupled with greater monitoring of community pharmacies, also appeared to appreciably reduce the extent of purchasing of antibiotics without a prescription in the Republic of Srpska.[59] This contrasts with other LMICs, including other African countries, where there have been concerns with the level of knowledge of antibiotics and AMR amongst pharmacists and their assistants, which impacts on the extent of self-purchasing of antibiotics in practice.[21,57,60,61]

We are aware that key drivers of self-purchasing of antibiotics include socio-economic reasons.[20,21] Economic reasons include potentially appreciable travel costs to attend public clinics and insufficient resources for copayments for consultations alongside funding the cost of any medicine prescribed. Combined with this, there can often be long waiting times to see an HCP in public clinics and time of work can lead to loss of income.[21,62,63] This contrasts with the convenience of community pharmacies. Consequently, in view of ongoing concerns in South Africa regarding AMR, as well as variable findings regarding current rates of purchasing of antibiotics without a prescription, there is a need to explore these issues further. This includes ascertaining the current knowledge of antibiotics and AMR amongst pharmacists and their assistants, alongside current rates of purchasing of antibiotics without a prescription, with the findings used to create pertinent quality improvement strategies, building on other countries.[21] In addition, potentially instigate quality indicators aligned to the WHO AWaRe book, which gives guidance for the treatment of a range of common infections typically seen in ambulatory care in LMICs.[16,17] Consequently, address concerns seen in some LMICs with the list of antibiotics that can currently be dispensed under the country's drug laws.[64] We chose a rural province in South Africa for the purpose of this study since extended travelling distances and long waiting times to see a HCP, including for self-limiting conditions such as ARIs, are common. Our approach was firstly to undertake a small-scale preliminary pilot study with a self-administered structured questionnaire amongst community pharmacists and their assistants as proof of concept. The concept is to investigate the feasibility of administering the proposed questionnaire as well as understand the experiences and views of pharmacists and pharmacist assistants of the relevance and understanding of the questions, and the time required to complete the questionnaire, to revise the questionnaire if needed. The findings of the pilot study will enhance the validity of the final questionnaire used across the entire province. In this paper, we report on the findings of the pilot study and implications.

Methods

A two-step descriptive approach was used for the pilot study. This involved a self-administered questionnaire amongst pharmacists and pharmacist assistants followed by cognitive interviews. The objectives of the cognitive interviews were to evaluate the survey questions, to explore their experience with completing the questionnaire and to obtain their suggestions on how the questionnaire could be adapted, if necessary, for the main study.

We realise that there is a bias associated with self-administered questionnaires versus using simulated patients.[65] However, we will seek to limit this bias by conducting exit interviews with patients in a separate study.

Self-administered questionnaire

The self-administered questionnaire was developed based on the published literature.[21,66,67] The initial questionnaire consisted of a number of sections to ascertain current rates of dispensing of antibiotics without a prescription, the rationale for this practice, as well as the current knowledge of pharmacists and their assistants regarding antibiotics and AMR [Supplementary Table 1]. The questionnaire allowed for differences in dispenser types, i.e. pharmacists or their assistants, as well as target patient groups, i.e. children or adults. As far as possible, statements were provided regarding current knowledge, practices and attitudes concerning antibiotics and AMR with suitable response options to assist with timely completion. A limited number of open-ended questions were also included to enable participants to freely respond where necessary.

The initial questionnaire was subsequently reviewed by all co-authors based on their considerable experience in this area across LMICs and subsequently adapted before the pilot study. We have used this approach before when developing questionnaires where no standard questionnaire was available.[43,60,68,69] The questionnaire was available in English only, as it is the official language of communication in the training of pharmacists and pharmacist assistants in South Africa.

Pilot study sites and distribution of questionnaires

Eleven community pharmacies were purposively selected for the pilot study to ensure representation from the different geographical areas in the province. These pharmacies will not be part of the study population included in the main study. Data for the pilot study were collected by the principal researcher (TMS), with the help of a research assistant (MTM), when visiting the selected community pharmacies. They approached the pharmacist in charge with an invitation for all the pharmacists and pharmacist assistants present in the pharmacy on the day of data collection to participate.

Information about the study was provided both verbally and in writing. A study participant instruction sheet was included with the questionnaire to explain the aims and objectives of the study and emphasising the anonymity of participation. Participants were invited to ask questions about the study before completing the questionnaire. Each participant provided written informed consent for participation.

The questionnaires were left at the pharmacy and collected at the end of the day or the next day (depending on the situation). The researchers kept going back to the pharmacies to pick up the completed questionnaires when ready. Each completed questionnaire was placed in a sealed envelope provided with the questionnaire. On collection, a sealed box was provided for participants to place their completed questionnaires in it to maintain confidentiality and anonymity. In addition, a separate sealed box was provided for participants to place consent forms, to ensure that responses remained anonymous and could not be linked to the signed consent forms.

Follow-up cognitive interviews

The final step involved conducting face-to-face cognitive

interviews with a number of participants when collecting the completed questionnaires in order to explore their experiences with the questionnaire in terms of their understanding, relevance, and time taken to complete it. Furthermore, to obtain suggestions on how the questionnaire could be improved. Since anonymity is very important in this type of study, there was no attempt to link interview feedback with responses to the questionnaire since responses were anonymous and provided in a sealed box. In this way, it was anticipated that participants would feel more comfortable in providing candid answers.

Ethical approval

Ethical approval for the study was obtained from the Sefako Makgatho University Research Ethics Committee. Permission to conduct the study from the National Department of Health was not required, as no public sector facilities were included in this study. Data collection only commenced after ethical clearance was received and all participants had provided written informed consent to participate. Participation was completely voluntary, and participants were informed that they could withdraw from the study at any time without providing reasons for their withdrawal. All responses of participants were kept confidential. Data were stored securely in a password-protected computer with access to the principal researcher (TMS) only, and will be destroyed after 5 years.

Results and the Implications

General study characteristics and findings

Twenty-one responses were obtained from 9 of the 11 community pharmacies invited to participate in this pilot study. Participating pharmacies were all independently owned pharmacies, while the two pharmacies who declined participation were chain pharmacies and stated they were too busy to complete the questionnaire. The participants included 14 pharmacist assistants and seven pharmacists, of whom three were responsible pharmacists. This reflects the current situation in the Province. All the pharmacies that took part in the pilot study operated for a minimum of 9 h on weekdays and maintained a minimum of 5 h of operation on Saturdays. Four of the nine pharmacies remained closed on Sundays, while only one pharmacy was not operational on public holidays. All participants were registered with the South African Pharmacy Council as either pharmacists, post-basic pharmacist assistants or learner pharmacist assistants.

Antibiotic and over-the-counter dispensing patterns

Ten of the 21 participants admitted that the dispensing of antibiotics without a prescription did occur in their pharmacies, representing five of the nine participating pharmacies. In two of the remaining four pharmacies, the pharmacist responded that they do not dispense antibiotics without a prescription, while in the remaining two pharmacies, where only a pharmacist assistant completed the questionnaire, they both indicated that they do not know whether this happens. Five out of the ten participants who admitted to dispensing antibiotics without a prescription were unable to estimate the frequency, with the majority unable to provide a figure such as the average number of patients given an antibiotic without a prescription per day. Five admitted that they dispensed antibiotics to both adults and children under the age of 12. Nine participants stated they always first offered over-the-counter (OTC) medication before antibiotics when the patients presented with self-limiting symptoms, while eight stated they mostly did so and three stated that only sometimes. One pharmacist assistant who worked alone without supervision admitted to never offering OTC medication before offering antibiotics where OTC medication was appropriate.

The most common infections for which antibiotics were dispensed without a prescription were sexually transmitted infections and URTIs. Penicillins, typically in the 'Access' group, were the predominant non-prescription antibiotic.

Principal reasons for dispensing without a prescription and alternatives

In most cases, patients requested antibiotics for their symptoms. Six of the participants acknowledged that their patients always and/or mostly demand antibiotics, while another seven said that it would only happen sometimes. Some participants (seven), mostly pharmacist assistants, admitted that they felt pressured by patients to provide them with antibiotics without providing a prescription for dispensing.

Knowledge of antibiotics and antimicrobial resistance

Six of the seven pharmacists answered correctly when asked about the definition of AMR, while 11 out of the 14 pharmacist assistants answered this correctly. Six pharmacists again answered correctly to the statements regarding stopping antibiotics when symptoms improved, antibiotics not to be used as preventative measures, as well as the fact that antibiotics will not make patients with common colds recover more quickly. Five of the pharmacists agreed that antibiotics cannot treat influenza and all seven agreed that antibiotics cannot relieve pain.

Only five of the 14 pharmacist assistants agreed that antibiotics cannot treat influenza and that antibiotics should not be prescribed as preventative measures. Two of the pharmacist assistants stated that patients could stop taking antibiotics when their symptoms resolved and three of them did not know what AMR is.

Participants' experience with completing the questionnaire and implications for the main study

General findings and the complexity of the current questionnaire

Overall, it appeared easier for pharmacists to complete the current pilot questionnaire as they had a better understanding of the subject matter and did not find it difficult to complete the questionnaire. However, some pharmacist assistants (the majority of the responders) found the current questionnaire difficult to complete.

A number of pharmacists' assistants stated that the current questionnaire was too complex for them. Consequently,

any future questionnaire should be designed to be easily comprehensible to all participants with varying educational backgrounds and levels of experience. This will involve simplifying the language, providing clear instructions, and reducing the complexity of questions to enable both pharmacists and their assistants to complete the questionnaire with both involved in questioning patients and offering advice. All the participants stated that the current questionnaire was too long. This suggests potentially dividing the questionnaire into two with different aims and objectives. The objective of the first questionnaire would be to ascertain current rates of purchasing of antibiotics without a prescription and the rationale for this. The objective of the second questionnaire would be to ascertain their current knowledge concerning key issues surrounding antibiotics and AMR.

In this way, help with time constraints, with some participants mentioning they were too busy to complete the full pilot questionnaire. In addition, when the revised questionnaires are distributed, this should ideally be during less busy times to be able to fully discuss the questionnaires and the rationale behind the study.

Some respondents, particularly pharmacy assistants, also had difficulty working out percentages. This suggests a need for clearer instructions and possibly providing respondents with the necessary tools to assist with calculations. In addition, the questionnaire should aim for questions that require minimal or no mathematical calculations where possible.

Recollection challenges regarding past prescriptions

A number of participants mentioned challenges in accurately recalling their past experiences. The questionnaire will be refined to focus on more recent experiences, making them more specific and easier to recall. This approach would likely yield more precise information.

Fear of job losses

Some respondents expressed reluctance to participate due to concerns about risking their jobs. Addressing this issue may require emphasising the confidential and anonymous nature of the study by including a statement explicitly stating that participation will not result in any negative consequences, including job-related repercussions, and encourage respondents to report any such incidents should they occur. Ensuring that participation will not have any negative consequences through confirming again the anonymous nature of the study, and stating again that the collection of the questionnaire will be in sealed boxes, will also be essential to encourage full disclosure and honest and open responses.

No pharmacist on site

In some instances, some community pharmacies did not have pharmacists on site, and instead, relied solely on pharmacy assistants to manage daily operations. However, these assistants were not appropriately qualified or authorised to work in a pharmacy, let alone dispense medications. This is in accordance with South African law.[70] The legislation clearly stipulates that individuals without the necessary qualifications and proper supervision are not permitted to dispense medicines. In this situation, the approached pharmacy assistants declined to participate in the study to avoid any potential legal or regulatory complications, even though the replies were anonymous.

Discussion and Next Steps

The foremost goal in this pilot study was to evaluate the fitness-for-purpose of the initial research instrument, and to suggest changes where pertinent. To achieve this, we assessed the clarity, appropriateness, and effectiveness of the questions and methodologies employed. We wanted to determine if the pilot instrument was capable of eliciting the information necessary to answer the research questions in the main study to achieve the study objectives.

We analysed the feedback and responses gathered during the pilot phase to identify any shortcomings or challenges faced by participants. This information subsequently guided us in making adjustments and improvements to the research instruments, ensuring they are refined and optimised for the main study [Supplementary Tables 1-3].

The pilot study identified that the purchasing of antibiotics without a prescription did occur in an appreciable number of community pharmacies in this rural province in South Africa. As a result, at odds with the findings of Anstey Watkins *et al*. and Do *et al*.,[49,51] as well as some of the pharmacy types reported by Mokwele *et al*.; however, not all.[50] These differences may be due to differences in the patient populations studied and their circumstances, which we will explore further in the main study as well as other research projects. We will also explore further the dispensing of antibiotics without a prescription before OTC medicines are offered, especially for self-limiting conditions as this should not take place. In addition, any differences in the rates of dispensing by dispenser type. Any differences and their rationale will be important to develop future pertinent strategies to reduce unnecessary dispensing of antibiotics without a prescription in this rural province, including refining curricula and continual professional development activities. These suggestions will build on similar initiatives amongst prescribers, given ongoing concerns with current antibiotic prescribing patterns in South Africa across sectors and their rationale, including patient pressure.[36]

Finally, there are concerns with the knowledge of pharmacists and their assistants in key areas surrounding antibiotics and AMR [Figure 1]. This will also be explored further in the main study, along with the implications for refining future curricula for pharmacists and their assistants and the implications. In view of the comments regarding the length of the current questionnaire, the next steps will involve distributing the updated two questionnaires [Supplementary Tables 2 and 3] to community pharmacists and their assistants on different dates in order not to overload them. This will start with an assessment of current rates of dispensing antibiotics without a prescription and the rationale.

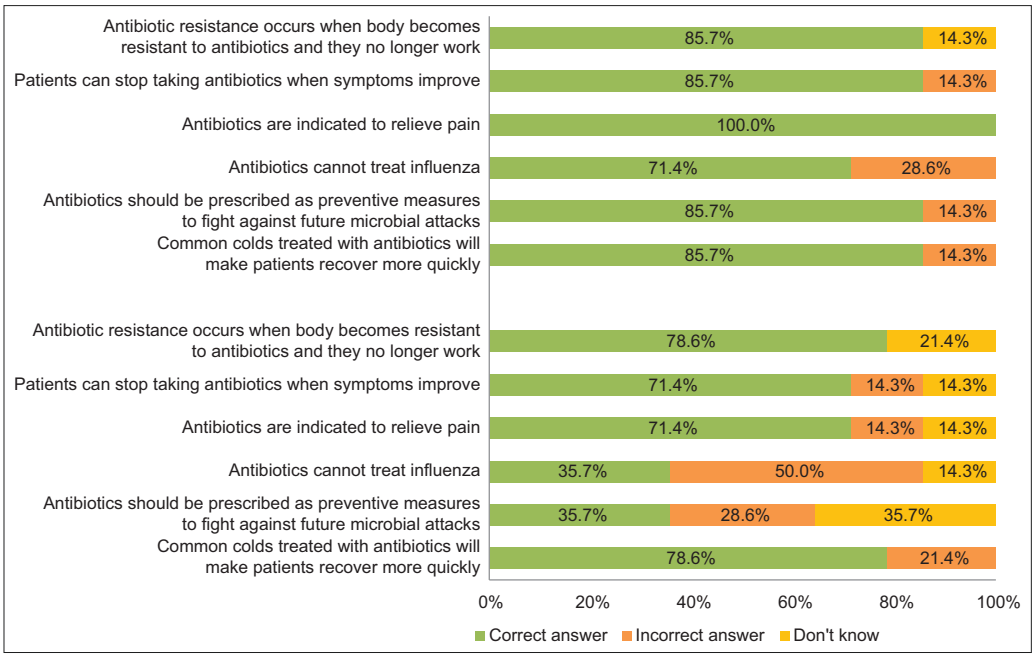

Figure 1: Participants' knowledge of antibiotics.

However, the responses from both will be critical to formulate potential strategies to reduce inappropriate dispensing of antibiotics amongst community pharmacies in South Africa, especially for self-limiting conditions. Alongside this, as mentioned, confirmatory research will be undertaken amongst patients leaving community pharmacies to ascertain from them the exact extent of purchasing antibiotics without a prescription and the rationale given. This is seen as important given, as mentioned, the potential bias associated with self-administered questionnaires versus using simulated patient studies.[65]

Conclusion

The pilot study raised considerable concerns regarding the extent of purchasing antibiotics without a prescription, including before OTC medicines were advised, in this rural province in South Africa. There were also concerns of participants regarding their knowledge of antibiotics and AMR, especially amongst pharmacy assistants. These issues will be explored further in the main study to provide future direction to the authorities, along with feedback from patients.

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Conflicts of interest

There are no conflicts of interest.

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Supplementary Table 1: Pilot questionnaire

Demographics

Type of pharmacy	Independent/franchise		Chain
Age	<21	21–30	31–40
	41–50	51–60	>60
Gender	Male		Female
Job type	Pharmacist		
	Pharmacist assistant		
Educational level	Grade 12		
	Certificate		
	Diploma		
	Bachelor's degree		
	Master's degree		
	Doctorate degree		
Number of dispensary personnel at your pharmacy			
Employment type	Owner		
	Full-time employee		
	Part-time employee		
	Student		
Duration of work in pharmacy (years)	Up to 1		
	2–4		
	>5		

Dispensing of antibiotics

How many items/prescriptions are typically dispensed in a day in your pharmacy (for medicines not including OTC medicines)?		
What percentage of the items dispensed are antibiotics		
Which classes of antibiotics are typically kept in your pharmacy and approximate percentages?	Penicillins	
	Macrolides	
	Fluoroquinolones	
	Cephalosporins	
	Other	
What % of daily dispensed antibiotics were dispensed without a prescription?		
What are the common infectious diseases that patients typically present with when dispensing an antibiotic?	URTI	
	LRTI	
	STI	
	Skin and soft tissue infection	
	Other	
Which classes of antibiotics do you often dispense without a prescription?	Penicillins	
	Macrolides	
	Fluoroquinolones	
	Cephalosporins	
	Other	
When symptoms are presented do you first offer OTC medications before antibiotics?	Yes	No
Have you received any training on the appropriate use of antibiotics?	Yes	No
Source of training	School	
	CPD	
	Other	
Do you counsell patients on the appropriate use of antibiotics when dispensing them? Please provide a reason	Verbally	
	Written	
	Both	
	None	
Reason		
Do you also check for possible allergic reactions when dispensing antibiotics?	Yes	No
Do you ask if patient is taking other medication?	Yes	No

Contd...

Supplementary Table 1: Contd...

Knowledge of antibiotics	True	False
Common colds treated with antibiotics will make patients recover more quickly		
Antibiotics should be prescribed as preventive measures to fight against future microbial attacks		
Antibiotics cannot treat influenza		
Antibiotics are indicated to relieve pain		
Patients can stop taking antibiotics when symptoms improve		
Knowledge of AMR	**True**	**False**
Antibiotic resistance occurs when your body becomes resistant to antibiotics and they no longer work as well		
Many infections are becoming increasingly resistant to treatment by antibiotics		
If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause		
Antibiotic resistance is an issue that could affect me or my family		
Antibiotic resistance is only a problem for people who take antibiotics regularly		
Bacteria which are resistant to antibiotics can be spread from person to person		
Antibiotic-resistant infections could make medical procedures like surgery, organ transplants and cancer treatment much more dangerous		
Antibiotic resistance is one of the biggest problems the world faces		
I am not at risk of getting an antibiotic-resistant infection, as long as I take my antibiotics correctly		
Potential solutions of AMR	**True**	**False**
There is not much people like me can do to stop antibiotic resistance		
People should use antibiotics only when they are prescribed by a doctor or nurse		
People should not keep antibiotics and use them later for other illnesses		
Pharmaceutical companies should develop new antibiotics		
Doctors should only prescribe antibiotics when they are needed		
Everyone needs to take responsibility for using antibiotics responsibly		
Parents should make sure all of their children's vaccinations are up-to-date		
People should wash their hands regularly		
Pharmacists are responsible for		
i) Promoting optimal use of antibiotics		
ii) Educating healthcare professionals, patients and the public		
iii) Prevent antibiotic misuse		
iv) Promote AWaRe guidelines		

Supplementary Table 2: Update questionnaire to pharmacists/assistants ascertain the extent of self-purchasing of antibiotics and the rationale

Type of pharmacy	Independent	Franchise	Chain
Age (years)			
Biological sex assigned at birth	Male	Female	Prefer not to answer
Registration status at SAPC	Pharmacist		Pharmacist assistant
	Responsible pharmacist		Owner
Educational level	Grade 12	Certificate	Diploma
	Degree	Masters	Doctorate
Years of experience in pharmacy	Up to 1 year		1–5 years
	6–10 years		>10 years
Total number of personnel at your pharmacy	Front shop		Dispensary
Opening times of your pharmacy	Monday to Friday		
	Saturday		
	Sunday		
	Public holiday		
Employment type	Owner		Part-time employee
	Full-time employee (full day)		Locum
	Full-time employee (half day)		Other (specify)
On average in a typical day in the pharmacy when you consider dispensing prescriptions			
How many items are dispensed (not including OTC medicines) in a typical day during the past week?	Number		Don't know
Of these, how many of the items dispensed are antibiotics in a typical day in the past week?	Number		Don't know
What are the classes of antibiotics that are typically kept in the pharmacy? Select all that apply			
For each class selected, indicate the approximate percentage (%) in relation to all classes of antibiotics currently kept in the pharmacy (i.e. their number assuming 100 antibiotic items are currently being kept in the pharmacy – what would be the number for each class)			
Penicillins, e.g., amoxicillin, co-amoxiclav - %	Macrolides, e.g., erythromycin, azithromycin, clarithromycin - %		Fluoroquinolones, e.g., ciprofloxacin, levofloxacin - %
Cephalosporins, e.g., cephalexin, cefuroxime - %	Others - total%		Don't know
What are the common infectious diseases that patients typically present with when an antibiotic is dispensed in your pharmacy during the past week? For each disease indicate the approximate percentage (%), i.e., number out of 100, in relation to all other infectious diseases			
Upper respiratory tract infection, e.g., colds, sore throat, or influenza - %	Skin and soft tissue infections, e.g., abscess, skin infection - %		
Lower respiratory tract infection, e.g., bronchitis - %	Childhood diarrhoea - %		
Sexually transmitted infection - %	Urinary tract infection - %		
Other - %	Don't know		
Thinking of the past fortnight, how many times did you dispense an antibiotic without a prescription?			
On average in a typical day in the pharmacy when antibiotics are dispensed, thinking of the past 2 to 3 days (if none skip the next question)			
What percentage of antibiotics (i.e. out of 100) were dispensed without a prescription?	%		Don't know
Approximately what number of those dispensed without a prescription (out of 10) would be given to children (under 12)?	Number		Don't know
Approximately what number (out of 10) of those dispensed without a prescription would be given to adults?	Number		Don't know
Thinking of the past 2 to 3 days, what are the classes of antibiotics that are dispensed without a prescription? For each class selected, indicate the approximate percentage (%) in relation to all antibiotic classes (i.e. number assuming 100 antibiotic items were dispensed without a prescription)			
Penicillins	%	Cephalosporins	%
Macrolides	%	Others	%
Fluoroquinolones	%	Don't know	
When patients present with self-limiting infectious disease symptoms such as a cough, cold or influenza, at the pharmacy			
a) I typically only suggest OTC medication	Always	Mostly	Sometimes	Never
b) I typically suggest OTC medication before antibiotics	Always	Mostly	Sometimes	Never
c) I typically first offer antibiotics before OTC medication	Always	Mostly	Sometimes	Never
Have you received any training on the appropriate use of antibiotics?			Yes	No
If yes, indicate the source of this training and in which year you received the training. Select all options that apply		University/college Year	CPD Year	Other Year

Please circle the appropriate response; alternatively, provide answers to the stated questions

Supplementary Table 3: Ascertaining the knowledge of pharmacists/assistants regarding antibiotics and AMR

Please circle the appropriate response; alternatively, provide answers to the stated questions

Type of pharmacy	**Independent**		**Franchise**	**Chain**
Age (years)				
Biological sex assigned at birth	Male		Female	Prefer not to answer
Registration status at SAPC	Pharmacist			Pharmacist assistant
	Responsible pharmacist			Owner
Educational level	Grade 12		Certificate	Diploma
	Degree		Masters	Doctorate
Years of experience in pharmacy	Up to 1 year			1–5 years
	6–10 years			>10 years
Total number of personnel at your pharmacy			Front shop	Dispensary
Opening times of your pharmacy	Monday–Friday			
	Saturday			
	Sunday			
	Public holiday			
Employment type	Owner		Part-time employee	
	Full-time employee (full day)		Locum	
	Full-time employee (half day)		Other (Specify)	
Please tick the appropriate answer				
When I dispense antibiotics to patients, I provide information	Verbally	Written	Both	None

Indicate whether the following statements are true or false

Antibiotics are only effective for treating bacterial infections	True	False	Don't know
Antibiotics are effective against the common cold or influenza.	True	False	Don't know
Antibiotic resistance only occurs when antibiotics are not taken as prescribed.	True	False	Don't know
The misuse of antibiotics contributes to the development of antimicrobial resistance.	True	False	Don't know
Antibiotic resistance is a global health concern that affects all countries	True	False	Don't know
Antibiotics can prevent future bacterial infections	True	False	Don't know
Antibiotics can relieve pain	True	False	Don't know
Patients can stop taking antibiotics when symptoms improve	True	False	Don't know

Indicate how much you agree or disagree with each of the following statements

I am aware of the risks associated with obtaining antibiotics without a prescription	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
I understand the importance of completing a full course of antibiotics as directed in treatment guidelines					
Educating patients about the appropriate use of antibiotics can help reduce antibiotic resistance					
Many infections are becoming increasingly resistant to treatment with antibiotics					
Antibiotic resistance can affect me or my family					
Antibiotic resistance is a huge problem in the world					
Antibiotics must only be prescribed by an authorised healthcare worker					
Doctors should only prescribe antibiotics when necessary					
Everyone should take responsibility for using antibiotics responsibly					
People should wash their hands regularly					
Pharmacists are responsible for promoting the optimal use of antibiotics					
Pharmacists are responsible for educating healthcare professionals, patients and the public regarding antibiotics					
Pharmacists are responsible for preventing the misuse of antibiotics					
The prevention of infections is important in reducing future antibiotic resistance					
Antibiotic resistance can be transmitted from person to person					