

Supplementary Tables

Supplementary Table 1 - 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 in 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		More than 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)	

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 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 health care 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					

Supplementary Table 2 – Concerns with the prescribing of antibiotics in primary care in South Africa

Author and year	Aim and methods	Key findings
Farley et al., 2018 (1)	<ul style="list-style-type: none"> • Research KAP towards antibiotics and resistance among primary care prescribers • Cross sectional survey with a self-administered questionnaire • 264 prescribers completed the survey – 98.3 % were physicians with 84.8 % practising in the private sector 	<ul style="list-style-type: none"> • 95.8% of interviewed prescribers believed antibiotic resistance is a major problem in South Africa • 87.5% of those interviewed expressed a desire for education on the appropriate use of antibiotics, with 96.2% requesting data on local antibiotic resistance patterns • There was also interest in the provision of STGs in various formats to improve future prescribing • However, 66.5% of surveyed prescribers felt pressure from patients to prescribe antibiotics for their infectious disease irrespective of the need for antibiotics
Gasson et al., 2018 (2)	<ul style="list-style-type: none"> • Assess antibiotic prescribing among PHCs and compare prescribing against national STGs (Quality Indicator) • Retrospective review of antibiotic prescribing alongside assessing reasons for non-adherence • 654 patient records reviewed 	<ul style="list-style-type: none"> • Appreciable prescribing of antibiotics with 68.7% of patients prescribed an antibiotic • However, adherence to STGs was low at only 45.1% of prescriptions • Principal reasons for non-adherence to STGs included a number of factors: undocumented diagnoses (30.5% of prescriptions), antibiotics not being required, e.g. self-limiting viral infections (21.6%), incorrect doses prescribed (12.9%), incorrect duration of therapy prescribed (9.5%) and incorrect treatment (1.5%)
Truter and Knoesen 2018 (3)	<ul style="list-style-type: none"> • Determine current antibiotic prescribing habits among primary care physicians via a self-administered questionnaire • 16 community pharmacists participated 	<ul style="list-style-type: none"> • 81.3% of surveyed community pharmacists believed antibiotics were being over-prescribed by physicians, which included for viral infections, exacerbated by patient pressure • Amoxicillin /co-amoxiclav were the most prescribed antibiotics followed by clarithromycin, ciprofloxacin and azithromycin • Community pharmacists believed URTIs and sinusitis were the most common infectious diseases for which antibiotics were prescribed
van Hecke et al., 2019 (4)	<ul style="list-style-type: none"> • Determine the perceptions of clinicians working in publicly funded clinics about antibiotic prescribing for acute coughs and UTIs coupled with their experiences concerning point-of-care testing • Qualitative interviews among 23 prescribers 	<ul style="list-style-type: none"> • Prescribing decisions regarding antibiotics among participating HCPs were typically influenced by a number of factors. These included: their clinical assessment of patients, patient comorbidities and perceived patient expectations • However, difficulties in communication between prescribers and patients often hampered efforts to explain non-antibiotic management strategies including for viral infections • As a result, clinicians were typically positive towards current and future point-of-care testing especially for viral infections to help support evidence-based antibiotic prescribing • However, concerns with resources and workflow issues with the uptake of such tests as part of routine care

Author and year	Aim and methods	Key findings
Mathibe and Zwane, 2020 (5)	<ul style="list-style-type: none"> Questionnaire based study among guardians accompanying children aged five years or less diagnosed with acute URTIs 	<ul style="list-style-type: none"> 306 parents/guardians participated in the study with 233 (76%) receiving antibiotics for URTIs for their children 67% (n=156) of these did not make requests for antimicrobial therapy from the prescriber Overall, irrespective of whether parents/guardians received antibiotic therapy for their children, 73% (n = 223) did not ask the doctors/nurses to prescribe antibiotics
Balliram et al., 2021 (6)	<ul style="list-style-type: none"> Assess the KAP of doctors, pharmacists and nurses regarding antimicrobials, AMR and AMS National online survey of doctors, alongside pharmacists and nurses 	<ul style="list-style-type: none"> Encouragingly, 96.4% for doctors saw AMR as a severe global threat, with 96.6% believing it is a significant problem in South Africa However, only 37.70% of doctors felt $\leq 50\%$ confidence in their knowledge of antimicrobials, AMR and AMS, although 94.9% believed antibiotics were not effective against viral infections (vs. 75.3% for nurses) and 99.1% that common colds are caused by viruses (vs. 90.2% nurses). As a result, 80.1% expressed a need for more education and training on antimicrobial use, AMR, and AMS 91.61% of participating HCPs believed the overuse of antimicrobials greatest contributor to AMR followed by patient pressure (75.26%) and non-adherence to prescribed treatments (73.26%) Doctors identified educational campaigns (91.22%), use of STGs (84.72%), and improved infection control measures (66.31%) as important strategies to combat AMR.
Govender et al., 2021 (7)	<ul style="list-style-type: none"> Evaluating the use and implementation of STGs/EML by prescribers (nurses) at a public tertiary institution and associated PHC facilities Mixed approach evaluating patient records and interviews using a structured questionnaire 	<ul style="list-style-type: none"> 41% of nurses had access to the latest STG/EML All nurses surveyed often/ sometimes referred to the STG/EML when managing patients. However, only 41% of them had access to the latest STG/EML There was a 59.7% adherence rate for prescriptions to the STG/EML. However, 94.9% of surveyed nurses requested training on the use of STGs/EML to improve their future prescribing including antibiotics/ infectious diseases as most had not received formal training on its use
Alabi et al, 2022 (8)	<ul style="list-style-type: none"> Assess the appropriateness of antibiotic prescribing among GPs in the private sector Analysis of antibiotic prescriptions (188,141) among 174,889 patients Appropriateness based on ICD-10 classification and whether an antibiotic was warranted or not 	<ul style="list-style-type: none"> 92.9% of surveyed patients were prescribed one antibiotic, with 7.1 % prescribed two or more antibiotics Penicillins were the most prescribed antibiotics (40.7%) of all antibiotics prescribed, followed by the macrolides (16.8%) and cephalosporins (15.7%) Diseases of the respiratory system accounted for 46.1% of all diagnoses 8.8% of all the prescriptions were appropriate; 32.0% potentially appropriate, 45.4% inappropriate and 13.8% could not be assessed due to a lack of specific codes/ contained unlisted codes/ contained unclear descriptions

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De Vries et al., 2022 (9)	<ul style="list-style-type: none"> Evaluate the impact of a multidisciplinary audit and feedback intervention to improve future antibiotic prescribing Monthly feedback meetings at 13 PHCs with 10 prescriptions randomly selected for peer review Prescriptions subsequently scored for adherence to seven key measures including antibiotic choice in STGs Antibiotic utilisation patterns also assessed 	<ul style="list-style-type: none"> Adherence to STGs was suboptimal at the start of the study at only 11% - which increased to 53% over a 2-year period Adherence to STGs was though significantly lower in the winter and spring - concurrent with higher antibiotic prescribing/ consumption - potentially reflecting inappropriate antibiotic prescribing for viral ARIs during these months Only 19% correct prescriptions in the first 6 months. However, rising to a mean of 47% correct prescriptions in the last 6 months of the study ($p<0.001$) following active interventions. This was associated with a 19.3% decrease in antibiotic consumption over the study period
Guma et al., 2022 (10)	<ul style="list-style-type: none"> Assess current empiric prescribing rates of antibiotics among private GPs for patients with ARIs and associated key factors Semi-structured web-based questionnaire based on the literature with 209 GPs taking part 	<ul style="list-style-type: none"> 55.5% of surveyed GPs prescribed antibiotics empirically for patients with ARIs more than 70% of the time - primarily for symptom relief and the prevention of complications GPs with more experience and working alone were slightly less likely to prescribe antibiotics empirically Key factors significantly associated with empiric prescribing were workload/time pressures, diagnostic uncertainty and the use of a formulary
Keuler et al., 2022 (11)	<ul style="list-style-type: none"> Assess the treatment of UTIs in PHCs and determine compliance with current STGs/EML Retrospective review of medical records of patients diagnosed with UTIs 6 PHCs took part - involving 401 UTIs among 383 patients 	<ul style="list-style-type: none"> Antibiotics were prescribed in all male and 98.5% of females with uncomplicated UTIs and 98.3% of complicated UTIs Nitrofurantoin was prescribed in the majority of UTIs (57.1%), followed by ciprofloxacin (39.7%), with nitrofurantoin appropriately selected in 75.0% of patients uncomplicated UTIs In complicated cases, compliance was higher with ciprofloxacin (44.4%) vs. nitrofurantoin (25.6%) Overall compliance with STGs was greater for uncomplicated (61.5%) vs. complicated UTIs (52.9%), with failure to comply with STGs mostly due to inappropriate antibiotic selection for complicated UTIs and duration of therapy
Lagarde and Blaauw, 2023 (12)	<ul style="list-style-type: none"> Assess prescribing practices for young and healthy simulated patients (SP) presenting with viral bronchitis among both private (99 SPs) and public PHCs (102 SPs) 125 providers (across sectors) were also interviewed face-to-face 	<ul style="list-style-type: none"> Antibiotics were recommended in 72.6% of consultations, higher in the public sector (78.4%) vs. private sector (66.7%) - enhanced by perceived patient pressure - despite 84% of prescribers knowing the SP case was likely a viral infection (88% in the private sector vs. 77% in the public sector) and 58% of prescribers knowing that antibiotics would not hasten recovery (40% public vs. 68% private; $p=0.002$) 47% of public prescribers thought patients would not come back if no antibiotics were prescribed – higher in the private sector at 72% ($p=0.008$) - despite SPs not demanding antibiotics

Author and year	Aim and methods	Key findings
		<ul style="list-style-type: none"> Antibiotic prescribing rates were lower in both sectors (20% lower) when HCPs were explicitly told by patients that they did not want antibiotics unless they were really necessary (13)
Van Hecke et al, 2024 (14)	<ul style="list-style-type: none"> Assess the impact of a pharmacist-prescriber partnership to appraise antibiotic prescribing in public PHCs 457 patients with acute coughs were enrolled at 5 PHCs. 	<ul style="list-style-type: none"> 84% of enrolled patients were prescribed an antibiotic for their acute cough The most prescribed antibiotics for these patients were amoxicillin (63%), co-amoxiclav (13%) and phenoxymethylpenicillin (6%), with a diagnosis of 'community-acquired pneumonia' the top indication (35%) Overall, a significant proportion of patients were prescribed an antibiotic for 'acute cough' which needs addressing
Wieters et al., 2024 (15)	<ul style="list-style-type: none"> Assess antibiotic use by WHO AWaRe classification among patients visiting healthcare facilities in 4 African countries including South Africa Infectious diseases surveyed included acute febrile disease of unknown cause (AFDUC), gastro-intestinal (GI) infections and RTIs 	<ul style="list-style-type: none"> Out of the 36.8% of patients across the 4 countries stating antibiotic use in the previous 10 days, 41.5% were prescribed for RTIs, 30.3% for AFDUC and 22.6% for GI infections. There were similar rates for RTIs in South Africa at 41.4% and AFDUC at 27.8% The most common antibiotic prescribed was ceftriaxone (31.7% of antibiotics prescribed – lower in South Africa Among patients with RTIs, ampicillin was highest South Africa (22.8%) – with ceftriaxone at 15.0%
Chigome et al, 2025 (16)	<ul style="list-style-type: none"> Point prevalence survey among PHCs in two Provinces and repeated Part of a larger study 	<ul style="list-style-type: none"> Data for 615 patients were recorded with the most common symptoms for antibiotics being a genital discharge (21.8%), painful urination (18.4%), acute cough (17.7%), and a sore throat (13.5%), with patients potentially having more than one symptom At least one antibiotic was prescribed for 87.0% of patients with Access antibiotics accounting for 53.4% and 46.6% Watch antibiotics of these. Ceftriaxone (29.7%), amoxicillin (29.4%) and azithromycin (28.4%) the most frequently prescribed antibiotics Overall considerable concerns with current prescribing practices
Maluleke et al., 2025 (17)	<ul style="list-style-type: none"> 128/169 (75.7%) operational pharmacies in this rural province participated in this questionnaire-based study, with independent pharmacies representing the majority of these (60.9%) Overall, a 78.3% response rate from 400 distributed questionnaires - 106 pharmacists and 207 pharmacist assistants 	<ul style="list-style-type: none"> Antibiotics accounted for 47.9% of all medicines dispensed with penicillins the most dispensed (41.1%). 47.2% of antibiotics dispensed included cephalosporins, macrolides and fluoroquinolones – typically Watch antibiotics. STIs (33.5%) and URTIs (25.8%) were the most frequent indications for antibiotics with limited dispensing of antibiotics without a prescription - estimated at only 8.6% of the total volume of antibiotics being dispensed Encouragingly, 98.1% of community pharmacists and 97.6% of pharmacist assistants indicated they always or mostly offered symptomatic relief before suggesting/ dispensing antibiotics without a prescription to patients with typically self-limiting conditions

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Sono et al., 2025 (18)	<ul style="list-style-type: none"> Pilot study to assess patients' understanding of key terms including antibiotics when leaving community pharmacies Patients also questioned if leaving with antibiotics whether prescribed or dispensed 	<ul style="list-style-type: none"> 11 patients took part in the pilot to assess their understanding with key terms using their own language Among patients dispensed an antibiotic with a prescription – the majority (66.7%) were for URTIs with 33.3% for STIs STIs were also the most prevalent indication when antibiotics were dispensed without a prescription with limited dispensing of antibiotics without a prescription for URTIs (12.5%)

NB: AMR = Antimicrobial Resistance; AMS = Antimicrobial Stewardship; ARIs = Acute Respiratory Infections; AWaRE: Access, Watch, Reserve (19); EML = Essential Medicines List; HCPs = Healthcare Professionals; KAP = Knowledge, Attitudes and Practices; PHCs = Primary Healthcare Clinics; RTIs = Respiratory Tract Infections; STGs: Standard Treatment Guidelines; STIs = Sexually Transmitted Infections; URTIs = Upper Respiratory Tract Infections; UTIs = Urinary Tract Infections

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