

Can increasing the number and role of community pharmacists in South Africa help address rising antimicrobial resistance rates, and what are the implications?

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Supplementary Tables

Supplementary Table S1: Concerns with antibiotic prescribing in primary care in South Africa in recent years		
Author and year	Aim and methods	Key findings
Farley et al., 2018 ¹	<ul style="list-style-type: none"> Research KAP regarding antibiotics and AMR 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 prescribers interviewed believed ABR is a major problem in South Africa 87.5% expressed a desire for education regarding the appropriate use of antibiotics, with 96.2% requesting data on local ABR patterns There was also interest in pertinent STGs being provided 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 whether they needed antibiotics or not
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"> There was considerable prescribing of antibiotics with 68.7% of patients prescribed an antibiotic Adherence to STGs was low at only 45.1% of prescriptions The 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 self-limiting 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. Key factors 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 among patients 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, there were concerns with resources and workflow issues with the uptake of such tests as part of routine care
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 parents/guardians 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

Supplementary Table S1: Concerns with antibiotic prescribing in primary care in South Africa in recent years		
Author and year	Aim and methods	Key findings
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 37.7% 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 91.6% of participating HCPs believed that the overuse of antimicrobials was greatest contributor to AMR followed by patient pressure (75.3%) and non-adherence to prescribed treatments (73.3%) Doctors identified educational campaigns (91.2%), use of STGs (84.7%), and improved infection control measures (66.3%) 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 nurses 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 nurses 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 the 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
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 ARI during these months Only 19% of prescriptions were correct 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 patients 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 with 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

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Author and year	Aim and methods	Key findings
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 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 necessary¹³
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 use 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% of antibiotics and Watch 46.6% of antibiotics. Ceftriaxone (29.7%), amoxicillin (29.4%) and azithromycin (28.4%) were 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
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 study 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: ABR = Antibacterial Resistance; 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

Supplementary Table S2 - Impact of pharmacists' prescribing of antibiotics across countries for agreed indications		
Country, Author and Year	Aims and Methods	Key Findings
Canada – Beahm et al., 2018 ²⁰	<ul style="list-style-type: none"> Prospective registry trial among 750 patients with UTIs treated at 39 community pharmacies Pharmacists were permitted to prescribe antibiotics, modify current prescriptions for antibiotics, provide education only or refer the patients to a physician 	<ul style="list-style-type: none"> 88.9% of patients achieved a clinical cure Adverse events were reported by 7.2% of patients, with 88.9% continuing their medication – most were gastrointestinal-related and transient Overall, very high levels of satisfaction for the care they received from community pharmacists as well as for trust and accessibility
Canada – Sanyal et al., 2019 ²¹	<ul style="list-style-type: none"> The objective was to compare the costs and outcomes of community pharmacist-initiated management of UTIs vs. physicians or emergency management UTI cure rates and utilities were derived from published studies 	<ul style="list-style-type: none"> Community pharmacist-initiated management had the lowest cost (\$72.47) vs. physician (\$141.53) or emergency management (\$368.16) Outcomes (quality-adjusted-life-months) were comparable across the 3 strategies If only 25% of patients with uncomplicated UTI were managed by community pharmacists over the next 5 years - resultant net total savings would be approximately \$51 million
New Zealand – Gauld et al., 2017 ²²	<ul style="list-style-type: none"> Assess the impact of trained community pharmacists to supply trimethoprim to women with uncomplicated cystitis Women were invited to self-complete a questionnaire, with national prescribing data extracted for antibiotic use 	<ul style="list-style-type: none"> Baseline data were provided by 139 pharmacies with 120 providing post-implementation data, with prescriptions for cystitis primarily for trimethoprim. Overall antibiotic use did not increase post-implementation Overall, trimethoprim use by specially trained pharmacists within strict criteria appeared to have little overall effect on total antibiotic use, i.e. no increase
United Kingdom - Booth et al., 2013 ²³	<ul style="list-style-type: none"> Compare the care pathway of patients with UTI symptoms attending GP services with those receiving management, including trimethoprim supply Trimethoprim could be provided by community pharmacists under a patient group direction (PGD) initiative for moderate-to-severe uncomplicated UTIs 	<ul style="list-style-type: none"> Data on 153 patients were recorded 97 patients were treated by GPs with prescriptions 56 patients presented directly to community pharmacist with symptoms suggestive of UTIs - 41 subsequently received trimethoprim via a PGD and 15 had symptomatic management Overall, there was demand and support from patients for access to antibiotics for UTIs from community pharmacists
United Kingdom – Hind 2018 ²⁴	<ul style="list-style-type: none"> Assessment and treatment of uncomplicated lower UTIs in adult women by community pharmacists Audit of 349 anonymised patient treatment assessment forms 	<ul style="list-style-type: none"> Community pharmacists saw patients quickly - around 90% of patients were seen in less than 10 minutes Some patients commented this process was quicker and easier than visiting a GP Trimethoprim was provided to 299 patients with 21 patients rereferred as they could not be treated by the pharmacist Pharmacists were able to treat UTIs appropriately including the correct use of trimethoprim Re-treatment levels were less than seen in similar audits with GPs
United Kingdom – Stewart et al., 2018 ²⁵	<ul style="list-style-type: none"> A 'Pharmacy First' scheme was introduced in one locality in Scotland for the management of UTIs, impetigo and the exacerbation of COPD Trained pharmacists supplied a limited range of prescription medicines with a quantitative evaluation undertaken of the service 	<ul style="list-style-type: none"> 175 pharmacies and 55 GP practices participated with 1189 cases managed principally for UTIs (75.4%) Of all cases, 77.9% were prescribed medication by the pharmacist, 9.1% were only given advice and 16.7% were referred to the GP Overall, patients were very satisfied with the service - most frequently citing the 'quick and efficient' access to treatment and a 'professional service' 67% of GPs and 59% of reception staff found the service useful – principally because it reduced pressure on GP appointments
United Kingdom – Thornley et al., 2020 ²⁶	<ul style="list-style-type: none"> Evaluate the effectiveness and uptake of a lower UTI test-and-treat service for women presenting with UTIs in a community pharmacy Antibiotics could be prescribed if deemed necessary by the pharmacist 	<ul style="list-style-type: none"> 764 women who presented to 23 community pharmacies Lower UTIs were seen as likely in 372/496 (75.0%) women - most of whom purchased antibiotics on the same day If the service was not there – ¾ would have visited their GP at some point with more than ½rd using self-care Overall, a community pharmacy-led UTI test-and-treat service for women with urinary symptoms provided accessible and timely care

Multiple countries – Jebara et al., 2018 ²⁷	<ul style="list-style-type: none"> Critically appraise, synthesize and present available evidence on the views and experiences of stakeholders on community pharmacist prescribing Present perceived facilitators and barriers for global implementation. 	<ul style="list-style-type: none"> 65 studies were identified, mostly from the UK (n = 34) and Australia (n = 13), with most studies reporting pharmacists' perspectives, with fewer on patients' perspectives The principal benefits of pharmacist prescribing were (1) ease of patient access; (2) improved patient outcomes; (3) better use of pharmacists' skills and knowledge (4) improved pharmacist job satisfaction, and (5) reduced physician workload
Multiple countries – Wu et al., 2021 ²⁸	<ul style="list-style-type: none"> Conducted a systematic review to characterize existing studies regarding community pharmacist prescribing of systemic antimicrobials 3 793 articles were identified with 14 meeting the inclusion criteria 	<ul style="list-style-type: none"> Antibiotics were being prescribing for UTIs, acute pharyngitis and cold sores Prescribing was associated with (1) high rates of clinical improvement (4 studies), low rates of retreatment and adverse effects (3 studies) and decreased health care use (7 studies). Patients were highly satisfied as they accessed care sooner or more easily Pharmacists' interventions reduced unnecessary prescribing for acute pharyngitis (2 studies) and increased the appropriateness of prescribing for UTIs (3 studies).
Multiple countries – Swart et al., 2024 ²⁹	<ul style="list-style-type: none"> To systematically gather, assess, and synthesize peer-reviewed published papers regarding the management of uncomplicated UTIs by community pharmacists in women aged 16–65 years Qualitative studies and non-primary studies were excluded 	<ul style="list-style-type: none"> 2129 records were assessed in the review with high self-reported cure rates of UTIs of between 84 and 89% Referral rates to physicians were low at approximately 7% were reported However, there were no randomized controlled trials and the papers were of variable quality limiting the conclusions

NB: UTI = Urinary Tract Infection

Supplementary Table S3 - Impact of activities among community pharmacists in LMICs to reduce unnecessary dispensing of antibiotics without a prescription to patients

Country	Author and year	Key findings
Egypt	Kandeel et al., 2019 ³⁰	<ul style="list-style-type: none"> Following educational courses/ campaigns among 596 participating pharmacists to raise awareness of the appropriate management of acute respiratory infections (ARIs), the % of participating pharmacists indicating that they never dispensed antibiotics (even sometimes) for patients with ARIs decreased from 58.4% to 25.2% Attitudes regarding not overusing antibiotics to prevent resistant bacteria also improved among participating pharmacists.
Indonesia	Ferdiana et al., 2024 ³¹	<ul style="list-style-type: none"> A 7-month ASP was undertaken comprising: online educational sessions for pharmacists; awareness campaign targeting patients; (3) peer visits; and (4) pharmacy/ pharmacist certification 80 pharmacies participated These was a significant reduction post-intervention in the % of antibiotics dispensed for URTIs, UTIs and childhood diarrhoea from 82.3% of consultations in the control group to 55.4% (p value < 0.001) in the active group The pre-post difference in the dispensing of antibiotics without a prescription in the active group was 20.9% (76.3%–55.4%) vs. only 2.3% (84.6%–82.3%) in the control group (p value < 0.001). Overall, dispensing of antibiotics without a prescription was less likely in the active group (OR = 0.19; 95% CI 0.09 to 0.43)
Kenya	Mukokinya et al., 2018 ³² ; Opanga et al., 2021 ³³ ; Kimathi et al., 2022 ³⁴ ; Sono et al., 2023 ³⁵	<ul style="list-style-type: none"> The training of community pharmacists at Universities in Kenya has reduced the dispensing of antibiotics without a prescription to patients following discussions with them. This is reflected by: <ul style="list-style-type: none"> No antibiotics were dispensed without a prescription, even with requests, to patients presenting with common colds or influenza at community pharmacies allied to the University of Nairobi - enhanced by their knowledge base In addition, only symptomatic relief/ advice was offered to patients presenting with COVID-19 during the pandemic with good knowledge of antibiotics and AMR This contrasts with a high degree of self-medication with antibiotics among patients presenting with COVID-19 at community pharmacies/ drugs stores (23.6%) in Kenya in the study of Kimathi et al., 2022
Namibia	Kamati et al., 2019 ³⁶ ; Kibuule et al., 2019 ³⁷ ; Sono et al., 2023 ³⁵	<ul style="list-style-type: none"> Training of community pharmacists at the University, coupled with ongoing monitoring of pharmacy activities and discussions with patients in Namibia, has limited inappropriate dispensing of antibiotics without a prescription This was reflected by: <ul style="list-style-type: none"> No dispensing of antibiotics without a prescription to children under 5 with acute respiratory tract infections. Symptomatic treatments were provided instead - including cold/ flu medicines, paracetamol and decongestants. Training and symptomatic treatments were given to patients during the COVID-19 pandemic with no dispensing of antibiotics

Republic of Srpska	Marković-Peković et al, 2017 ³⁸ ; Bojanić et al, 2018 ³⁹	<ul style="list-style-type: none"> The provision of guidelines for the most frequent diseases/conditions seen in everyday practice alongside training of community pharmacists to improve their communication skills with patients alongside greater enforcement of the regulations and fines for the dispensing of antibiotics without a prescription - resulted in: <ul style="list-style-type: none"> Dispensing of antibiotics without a prescription decreasing from 58% to 18.5% of surveyed pharmacies. Symptomatic relief was offered to pertinent patients in 72.3% of pharmacies visited - up from 67.2% in previous studies
Multiple countries	Raju et al., 2024 ⁴⁰	<ul style="list-style-type: none"> Review to highlight the contributions made by community pharmacists in LMICs as possible AMR stewards to improve future use in the community The authors concluded that community pharmacists could optimize their advocacy contributions by focusing on One Health AMS Based on their findings, they believed that transformational and actionable patient and population-centric AMS programmes were feasible combining the synergy of policymakers and other HCPs in the implementation of possible AMS policies
Multiple countries	Vieira de Souza et al., 2025 ⁴¹	<ul style="list-style-type: none"> Systematic review to assess the effectiveness of educational interventions with improving antimicrobial dispensing habits among community pharmacists The review demonstrated evidence regarding the effectiveness of educational interventions with improving verbal and/or written counselling by community pharmacists and patients' intentions to follow recommendations. There was also a reduction in the dispensing of antibiotics without a prescription, with multifaceted interventions leading to better outcomes versus single interventions

NB: AMR = Antimicrobial Resistance; AMS = Antimicrobial Stewardship; ASP = Antimicrobial Stewardship Programme; HCPs = Healthcare Professionals; LMICs = Low- and Middle-Income countries; URTIs = Upper Respiratory Tract Infections; UTIs Urinary Tract Infections

Supplementary Table S4 – Examples of community pharmacists working with prescribers to improve future antibiotic use

Country	Author and year	Key findings
South Africa	Van Hecke et al., 2024/2025 ^{14,42}	<ul style="list-style-type: none"> Assess the impact of a pharmacist-prescriber partnership to improve antibiotic prescribing in publicly funded PHCs in South Africa At each PHC, a prescriber-pharmacist team gathered prospective antibiotic prescribing data for acute coughs, and provided prescribing feedback (50% of clinics) The proportion of pharmacy dispensed antibiotics concordant with local guidelines was 95% In terms of quality indicators against AWaRe guidance, 97% of antibiotics prescribed belonged to the 'Access' group
Multiple countries	Lambert et al., 2022 ⁴³	<ul style="list-style-type: none"> Systematic review is to assess the effects of community pharmacist-led interventions to optimise the use of antibiotics Overall, there were some positive results from pharmacist-led interventions
Multiple countries	Saha et al., 2019 ⁴⁴	<ul style="list-style-type: none"> Systematic review to assess the effectiveness of ASPs involving community pharmacists with improving antibiotic prescribing 18 trials were included in the meta-analysis, with interventions successful in decreasing antibiotic prescribing (OR 0.93, 95% CI 0.90–0.95) and increasing guideline adherence (OR 1.72, 95% CI 1.04–2.84) when implemented by a pharmacist–GP team Overall, GP education plus prescribing feedback, and group meetings were effective with improving outcomes, with GP education, academic detailing and workshop training effective with improving guideline adherence
Multiple countries	Lambert et al., 2025 ⁴⁵	<ul style="list-style-type: none"> Community pharmacists can have an appreciable potential to optimise antibiotic use and mitigate against AMR This includes helping to inform all key stakeholder groups regarding local AMR patterns and the implications as well as becoming antibiotic prescribers for an agreed number of infectious diseases (Supplementary Table S2). In addition, taking part in public health educational campaigns They can also become involved in academic detailing activities to improve antibiotic prescribing among physicians⁴⁶

NB: AMR = Antimicrobial Resistance; ASP = Antimicrobial Stewardship Programme; PHC = Primary Healthcare Centre

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