

**UNIVERSITY OF PAVIA–IUSSSCHOOL  
FORADVANCED STUDIESPAVIA**

Department of Brain and Behavioral Sciences (DBBS)  
MSc in Psychology, Neuroscience and Human Sciences



**Behavioral Change Techniques in Antimicrobial Stewardship: A Scoping Review of  
Pharmacist-Led Communication and Patient Engagement Interventions**

**Supervisor:**

Prof. Serena Barello

**Co-Supervisor:**

Dr. Michela Monaci, PhD Candidate

**Thesis written by:**

Aleema Gull

**Student ID:** 549729

**Academic Year 2025-2026**

## Contents

### Table of Contents

|                                                                                       |     |
|---------------------------------------------------------------------------------------|-----|
| ABSTRACT.....                                                                         | 4   |
| ACKNOWLEDGEMENTS .....                                                                | 6   |
| ABBREVIATIONS .....                                                                   | 7   |
| INTRODUCTION.....                                                                     | 10  |
| 1.1 Antimicrobial Resistance (AMR) and Antimicrobial Stewardship (AMS) .....          | 10  |
| 1.2 Behavioural Determinants of Antibiotic Use .....                                  | 16  |
| 1.3 Role of Pharmacists in Antimicrobial Stewardship .....                            | 18  |
| 1.4 Behaviour Change, Communication and Patient Engagement in Pharmacist-LED AMS..... | 21  |
| 1.5 Existing Evidence and Knowledge Gap: .....                                        | 32  |
| 1.6 Rationale, Aim and Review Questions.....                                          | 37  |
| METHOD.....                                                                           | 40  |
| 2.1 Study Design .....                                                                | 40  |
| 2.2 Protocol Registration.....                                                        | 40  |
| 2.3 Research Questions.....                                                           | 40  |
| 2.4 Eligibility Criteria .....                                                        | 41  |
| 2.5 Information Sources and Search Strategy.....                                      | 43  |
| 2.6 Study Selection .....                                                             | 45  |
| 2.7 Data Charting Process .....                                                       | 46  |
| RESULTS .....                                                                         | 47  |
| 3.1 Search results .....                                                              | 47  |
| 3.2 Characteristics of the included studies .....                                     | 49  |
| 3.2.1 Country and year of publication.....                                            | 49  |
| 3.2.2 Study designs.....                                                              | 49  |
| 3.2.3 Settings and study populations .....                                            | 50  |
| 3.2.4 Pharmacist role and intervention characteristics .....                          | 50  |
| 3.3 Main findings .....                                                               | 138 |
| 3.3.1 Behavioral Theories and Frameworks .....                                        | 138 |
| 3.3.2 Behaviour Change Techniques (BCTs).....                                         | 139 |
| 3.3.3 Communication Strategies.....                                                   | 145 |

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| 3.3.4 Patient Engagement Strategies .....                               | 146 |
| 3.3.5 Target Behaviours.....                                            | 148 |
| 3.3.6 Integration of behavioural frameworks and patient engagement..... | 149 |
| 3.3.7 Barriers and facilitators .....                                   | 151 |
| <b>DISCUSSION</b> .....                                                 | 153 |
| 4.1 Overview .....                                                      | 153 |
| 4.2 The use of Behavioural Theory.....                                  | 154 |
| 4.2.1 The theory-practice gap.....                                      | 155 |
| 4.3 Selection of Behaviour Change Techniques.....                       | 156 |
| 4.4 Patient Engagement and Shared Decision-Making .....                 | 158 |
| 4.5 Two Different Intervention Logics: Patients and Professionals.....  | 160 |
| 4.6 Limitations.....                                                    | 162 |
| 4.6.1 Limitations of the Review Methodology .....                       | 162 |
| 4.6.2 Evidence Base Limitations.....                                    | 162 |
| 4.6.3 Conceptual and Synthetic Limitations.....                         | 163 |
| 4.7 Implications for Practice, Design, and Future Research .....        | 164 |
| 4.7.1 Implications for practice and future research.....                | 164 |
| 4.7.2 For Pharmacy Practice.....                                        | 164 |
| 4.7.3 For Future Research.....                                          | 165 |
| <b>CONCLUSION</b> .....                                                 | 166 |
| <b>REFERENCES</b> .....                                                 | 169 |

## **ABSTRACT**

Antimicrobial resistance is understood as a behavioural and communication challenge, not only a microbiological or prescribing issue, and pharmacists are well-placed to help implement antimicrobial stewardship (AMS) principles into patient-facing action, but the extent to which pharmacist-led interventions have utilised behavioural theory, Behaviour Change Techniques (BCTs) and patient engagement is poorly understood. This scoping review aimed to examine the ways in which pharmacist-led AMS interventions have incorporated behaviour modification and patient involvement to change antibiotic-related practices, investigating which theories of behaviour have been applied and to what degree, what BCTs have been employed and which appear lacking, how communication strategies were designed, and in what settings and populations the interventions operated,

Following Joanna Briggs Institute methods and the PRISMA-ScR guideline, a systematic search was undertaken across five databases (PubMed, Scopus, Web of Science, PsycINFO, CINAHL). There were 20 studies that met the inclusion criteria and were synthesised using a structured narrative synthesis, reporting numbers and percentages.

These findings suggest that pharmacist-led AMS interventions have, in a small number of studies, demonstrated that applying behavioural theory and a wider range of BCTs can be meaningfully integrated into AMS practice, but this was not found to be a common practice, with patient engagement rarely extending to shared decision-making and evidence being found predominantly in UK community pharmacy. The next steps for research in this area could include investigating theory-informed design beyond the UK, examining the impact of the use of more active BCTs and investigating whether lack of shared decision-making reflects a limitation of antibiotic-related decisions or an area of practice that is underdeveloped.

**Keywords:** antimicrobial stewardship, pharmacist-led interventions, behaviour change techniques, behavioural theory, patient engagement, communication, scoping review

## **ACKNOWLEDGEMENTS**

I would like to express my sincere gratitude to my supervisor, Prof. Serena Barello and Co-supervisor Michela Monaci for encouragement, guidance, and academic support. I am truly grateful to both of them because this work would not have been possible without their valuable contributions. Their guidance helped me not only academically but also as an independent researcher. Their constant support played an important role in helping me shape this thesis.

I would like to express my heartfelt gratitude to my partner for his unwavering support throughout my academic journey. He supported me not only academically but also emotionally. During the time of mental exhaustion, his reassurance helped me regain perspective. He has listened to my worries, celebrated my achievements, and stood by me. Having someone who believed in me even when I struggled to believe in myself made this journey much easier for me.

Finally, I want to thank my family for sacrifices and unconditional support. Thankyou for encouraging me to pursue my goals and standing by me through thick and thin. Every achievement have been made possible by the values, encouragement and sacrifices you have given me.

## ABBREVIATIONS

|                   |                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------|
| <b>N</b>          | Sample Size                                                                                         |
| <b>PRISMA-ScR</b> | Preferred Reporting Items for Systematic Reviews and Meta-Analyses<br>Extension for Scoping Reviews |
| <b>RCT</b>        | Randomized Controlled Trial                                                                         |
| <b>COM-B</b>      | Capability, Opportunity, Motivation – Behaviour Model                                               |
| <b>AACTT</b>      | Actor, Action, Context, Target, Time Framework                                                      |
| <b>BCW</b>        | Behaviour Change Wheel                                                                              |
| <b>TDF</b>        | Theoretical Domains Framework                                                                       |
| <b>BCTTv1</b>     | Behaviour Change Technique Taxonomy Version 1                                                       |
| <b>NHS</b>        | National Health Service                                                                             |
| <b>PHE</b>        | Public Health England                                                                               |
| <b>IDSA</b>       | Infectious Diseases Society of America                                                              |
| <b>SHEA</b>       | Society for Healthcare Epidemiology of America                                                      |
| <b>AMS</b>        | Antimicrobial Stewardship                                                                           |

## LIST OF TABLES

|                                                            |    |
|------------------------------------------------------------|----|
| Table 1- Characteristics of Included Studies (N = 20)..... | 51 |
| Table 2 – Main Findings of Included Studies (N = 20).....  | 85 |

## LIST OF FIGURES

|                                                                              |    |
|------------------------------------------------------------------------------|----|
| Figure 1 – PRISMA flow diagram of study selection and inclusion process..... | 48 |
|------------------------------------------------------------------------------|----|

## **CHAPTER 1 – INTRODUCTION**

### **1.1 Antimicrobial Resistance (AMR) and Antimicrobial Stewardship (AMS)**

Antimicrobial Resistance pertains to microorganisms, including bacteria, fungi, parasites, and viruses, developing resistance to the antimicrobial agents previously employed for their treatment (WHO, 2026). Although antimicrobials have significantly improved health care results, the capacity of bacteria to develop resistance to antimicrobial exposure has created a complex issue for health care and public health. Nevertheless, due to the swift rise of resistant diseases and the limited development of novel antimicrobials, antimicrobial resistance is now regarded as one of the foremost public health issues of the 21<sup>st</sup> century (Prestinaci et al., 2015). The disparity between increasing resistance and the scarcity of novel pharmaceuticals represents one of the most significant medical challenges of our era and could impede conventional medical care and innovative medical technologies.

Misuse of AMR medications is a critical contributor to their application and spread. Misuse of antibiotics, lack of usage, improper dosages, and prescription inaccuracies have accelerated the development of resistant microbes (Estany-Gestal et al., 2024). AMR is not confined just to clinical healthcare settings; it is also influenced by the application of antimicrobials in food production systems, agricultural livestock, and environmental contexts. AMR must be regarded not merely as an issue of medical prescriptions, but as a complex concern affecting humans, animals, and the environment. Due to its pervasive and gradual emergence, AMR is termed a ‘Silent Pandemic,’ suggesting that immediate action and intervention are necessary rather than postponing them as a future health concern (Founou et al., 2021). Present projections suggest that without successful global interventions, antimicrobial resistance could rank among the top three causes of mortality by 2050. Worldwide, it is projected that in 2019, antimicrobial resistance was responsible for more

than 1.2 million fatalities; with the possibility of around 10 million annual deaths by 2050 if mitigation strategies are enacted (O'Neill, 2016). Conclusion: These forecasts suggest that even antimicrobial resistance represents a significant strain on healthcare resources and systems, in addition to presenting clinical and socioeconomic challenges (Salam et al., 2023).

There is much discourse regarding the utilization of the terms antimicrobial resistance and antibiotic resistance, although they are regarded as distinct concepts. Antibiotic resistance refers to the ability of bacteria to withstand the effects of antibiotics, which are drugs used to treat bacterial illnesses. Consequently, it represents a more limited notion that just takes into account bacterial resistance to antibiotic medications (MacGowan & Macnaughton, 2017). Antimicrobial resistance, conversely, represents a broader phenomenon, involving resistance to numerous antimicrobial agents such as antibiotics, antivirals, antifungals, and antiparasitics, as well as a diverse array of microorganisms including bacteria, viruses, fungi, and parasites (Tang et al., 2023). Antibiotic resistance is a component in the broader context of antimicrobial resistance. This instance is pertinent because, if solely antibiotic resistance were considered, the worldwide resistance dilemma would seem less complex, as several therapeutic avenues can be influenced by resistant pathogens present in diverse microbiological categories. Consequently, a comprehensive strategy addressing AMR is essential, emphasizing surveillance, antimicrobial stewardship, infection control, and collaborative efforts across human, animal, and environmental health domains (MacGowan & Macnaughton, 2017).

The rise of antimicrobial resistance has created a considerable worldwide health challenge, necessitating ongoing surveillance of the prevalence, trends, and impacts of antimicrobial usage on human health. Antimicrobial resistance presents a significant challenge in the United Kingdom (UK), with 65,162 individuals diagnosed with AMR infections in 2019, an increase from 61,946

in 2018 (Adam & Bruce, 2023). These statistics demonstrate the escalating challenge of AMR within a high-income healthcare framework; however they may not encompass the full extent of the burden due to variations in diagnostic capabilities and monitoring methodologies. Similarly, the European Centre for Disease Prevention and Control (ECDC) reports that antimicrobial resistance results in more than 670,000 infections annually within the European Union (EU), and these infections persistently strain healthcare systems, notwithstanding the implementation of antimicrobial stewardship initiatives (WHO Regional Office for Europe & European Centre for Disease Prevention and Control, 2022).

In contrast to affluent nations, antimicrobial control and monitoring frameworks are generally strong; however antimicrobial issues persist at elevated levels in wealthy countries through several channels. Significant contributing elements encompass the excessive prescription of antibiotics in medical establishments and the indiscriminate application of antibiotics in agriculture and veterinary practices (Caneschi et al., 2023). Significantly, the disparity between developed and developing nations is diminishing due to worldwide shifts in antibiotic usage. China, historically classified as a developing nation, accounted for over 45% of worldwide veterinary antimicrobial usage in 2017, with projections indicating it will maintain the highest consumption levels in the coming years. Nevertheless, several advanced nations have effectively diminished antibiotic usage by targeted stewardship initiatives; in the United Kingdom, antimicrobial sales decreased by 39.2% between 2015 and 2017 (GOV.UK, 2021). This illustrates the dual nature of the scenario in which antimicrobial resistance (AMR) constitutes a worldwide public health crisis necessitating synchronized and clear interventions across all environments – including antimicrobial stewardship initiatives, judicious antibiotic prescribing, public involvement, and alterations in behavior to address practices leading to superfluous antimicrobial usage.

The utilization of antibiotics has significantly increased over the past several decades, with crucial consequences for antimicrobial resistance and public health. This is the inaugural extensive update that methodically assesses antibiotic usage trends across 204 countries over the past two decades (2000 – 2018) with assistance from the Global Research on Antimicrobial Resistance (GRAM) Project. The findings indicated a 46% increase in worldwide antibiotic consumption throughout this period, reflecting a growing need for antimicrobial medications internationally (Browne et al., 2021). The utilization of antibiotics stands at 14.3 defined daily doses (DDD) per 1,000 individuals daily (95% uncertainty interval: 13.2–15.6), equating to approximately 40.2 billion DDD each year, surpassing the WHO global mean of 12.5 DDD per 1,000 individuals daily in 2018, in contrast to 9.8 DDD in 2000 (Browne et al., 2021). Although antibiotics have enhanced the treatment of infectious diseases, their increasing utilization also presents dangers linked to misuse or unwarranted exposure, as well as the emergence of resistance pathogens.

Anticipated trends indicate that antibiotic consumption will rise, and without proactive management via stewardship initiatives, this could lead to the development of multidrug-resistant organisms (MDROs), jeopardizing the efficacy of existing antibiotic therapies and the health of patient demographics. The employment of unsuitable antibiotic treatments remains a major contributor to antimicrobial resistance (AMR), with mounting evidence indicating a rising reliance on last-resort antimicrobials as an alarming trend. The utilization of polymyxins in the European Union/European Economic Area (EU/EEA) has surged by 67% in recent years, despite their classification as second-line agents for addressing multidrug-resistant bacteria (MDRb) responsible for serious infections (ECDC & EMA, 2022). This presents a contradiction, since the increased utilization of reserve antibiotics may lead to the very anti-infectives required for managing resistant infections becoming agents that exacerbate resistance. To execute these

strategies, prospective AMR threats must be alleviated by (1) advocating for essential antibiotic utilization instead of superfluous intake, (2) implementing focused antimicrobial stewardship initiatives, and (3) enhancing the capabilities of surveillance frameworks while fostering behavioral modifications among healthcare professionals and patients to address AMR and guarantee sustainable antibiotic application. (Browne et al., 2021)

Antimicrobial stewardship, a significant public health concern, seeks to optimize the efficacy of existing antimicrobials while reducing their appropriate utilization. Characterized as a strategy concerning health and the coordination of care that can facilitate the optimal utilization of antimicrobials through selection, administration, monitoring, and assessment (Burgess & MacGowan, 2026). In 2007, the Infectious Diseases Society of America (IDSA) officially promoted the enhancement of physicians' prescribing competencies to facilitate "evidence-based" antibiotic utilization and optimize patient outcomes, ensuring the appropriate antibiotic is chosen, the accurate dosage is given, the proper administration route is utilized, and the correct treatment duration is adhered to (Donà et al., 2020). AMS represents a more equitable strategy than merely decreasing antibiotic consumption, emphasizing the provision of effective antimicrobial treatment while limiting superfluous antimicrobial exposure. The objective is to provide patient-centered care that effectively addresses pathogenic bacteria, enhances prescribing for optimal clinical outcomes, reduces superfluous healthcare costs associated with improper antimicrobial usage, and mitigates unwarranted selection for antimicrobial resistance (Dik et al., 2016). Consequently, AMS is a crucial component of the global strategy for AMR prevention and must be propelled by collaboration among healthcare practitioners, policymakers, and the public to ensure the sustainable use of antimicrobials (Barsola et al., 2024).

For optimal efficacy, AMS will predominantly depend on the tenets of evidence-based prescribing, commonly summarized as the ‘appropriate antibiotic, appropriate antibiotic, for the appropriate patient, at the appropriate time, with the appropriate dosage, administration route, and treatment duration’ (Beck et al., 2018). This paradigm highlights the necessity for judicious antibiotic prescribing and stresses the importance of accurate diagnoses, relying on clinical data instead of conjecture regarding antimicrobial sensitivity. AMS programs can be effectively employed to prevent the unwarranted use of antimicrobial medications in individuals when there is little therapeutic advantage, particularly in instances of self-limiting illnesses with minimal benefit, as outlined by the (UK Government, 2019). Essential measures encompass the formulation of antimicrobial guidelines and restrictive policies, evaluation of prescriptions, and the choice of narrow-spectrum antibiotics that are less likely to foster resistance when clinically suitable (Hembach et al., 2017). Combination therapy may be advantageous in particular situations, especially when dealing with severe infections caused by multidrug-resistant Gram-negative bacteria, owing to the synergistic effects of the drug combination; nonetheless, indiscriminate prescribing of broad-spectrum antibiotics can result in increased selective pressure and foster resistance. Consequently, AMS insists that the necessity for immediate efficacy be judiciously weighed against the endeavors of future generations aimed at antimicrobial effectiveness.

The primary objective of antimicrobial stewardship is to advocate for the judicious and efficient utilization of antimicrobial agents, ensuring the appropriate medication is administered at the correct time and location while preventing needless exposure. The objective of AMS is to enhance antimicrobial utilization by bettering patient outcomes, reducing the emergence and spread of antimicrobial resistance, averting complications and adverse effects of pharmacotherapy, and curtailing superfluous healthcare costs (Majumder et al., 2020). It additionally seeks to promote

sound prescribing habits among healthcare practitioners and enhance patient knowledge to sustain the efficacy of any antimicrobial treatment for prolonged application (Notarbartolo et al., 2024).

Antimicrobial stewardship constitutes a collaborative, multi-professional initiative that transcends individual prescribing choices, necessitating cooperation among healthcare practitioners including physicians, pharmacists, microbiologists, nurses, infectious disease experts, veterinarians, and IT specialists (Liaskou et al., 2018). It has evolved from a hospital-centric model to a comprehensive “One Health” framework, emphasizing the interconnections among human, animal, and environmental health. Veterinary antimicrobial stewardship is essential in addressing antimicrobial usage, since the improper application of antimicrobials in both agricultural and companion animals might facilitate the transmission of resistant microbes between species (Dyar et al., 2017). In this cohesive methodology, HA engaged with specialists to create a comprehensive surveillance system, evidence-driven recommendations, educational initiatives, and oversight measures aimed at identifying and reducing excessive AMR usage across many sectors (Lloyd & Page, 2018). Moreover, the execution of effective practices is challenging due to the variations in health system governance, capabilities, and methodologies both within and within nations, particularly between high and low resource burden health systems.

## **1.2 Behavioural Determinants of Antibiotic Use**

Antibiotics remain among the most commonly utilized medications in healthcare facilities; nonetheless, there are clear risks associated with their improper usage. Inaccurate pharmaceutical prescriptions elevate the likelihood of adverse effects occurring and contribute to the rise of germ resistance. Ensuring the judicious use of antibiotics is therefore essential for addressing the worldwide issue of antimicrobial resistance. Rational prescribing relies on understanding the appropriate medication, the correct dosage, the disease and antibody knowledge, as well as the

drug's pharmacological properties and cost-effectiveness. Combination antibiotic therapy (Gezmu et al., 2026) may be essential for severe or complex infections, yet it must adhere to clinical protocols and take into account the activity spectrum and pharmacodynamics of the utilized agents to enhance effectiveness and mitigate resistance development.

Numerous individuals are anticipating an antibiotic, particularly when the ailment is chronic and may want suitable antimicrobial therapy, such as in urinary tract infections. However, the expectations of patients do not consistently align with the advantages provided by medications; it is crucial for patients to understand the adverse effects of these therapies and the risk of antimicrobial resistance. A unified initiative must be undertaken to facilitate effective communication with the healthcare provider regarding the acceptable circumstances for antibiotic utilization and the dangers associated with overuse or misuse. Facilitating patient education regarding the responsible use of antibiotics and the urgency of their application is vital for enhancing compliance, curtailing superfluous usage, and strengthening public health initiatives through effective antimicrobial stewardship.

Self-medication with antibiotics (SMA) constitutes a significant concern about the improper use of antimicrobials and plays a crucial role in the emergence of antimicrobial-resistant bacteria. SMA can represent a significant global public health issue, stemming from misdiagnosis, unsuitable treatment choices, pharmacological interactions, and bad effects. It also hinders prompt access to therapy, leading to increased morbidity, death, and healthcare costs, as it necessitates more intricate or potent treatment approaches due to resistant infections. Moreover, in the post-antibiotic era (Torres et al., 2019), there is a diminished influx of antimicrobials in the pharmaceutical industry, so limiting the options available for efficiently managing infectious infections (Chavada et al., 2023).

Health literacy plays a crucial role in comprehending antibiotic utilization and the emergence of antimicrobial resistance. Individuals lacking a comprehensive understanding of diseases, antibiotics, and resistance frequently engage in the overuse or improper application of antimicrobials (e.g., utilizing USB antibiotic day packs for viral infections and prematurely discontinuing prescribed antibiotics). Improving patient health literacy empowers individuals to make informed choices, adhere to treatment protocols accurately, and engage proactively in their healthcare (Muflih et al., 2021), consequently contributing significantly to the decrease in antibiotic consumption among patients, thereby lowering the prevalence of resistant pathogens.

Human conduct is a crucial factor in the spread of antibiotic resistance. Selective pressure is intensified by several behaviors such as self-medication, non-adherence to treatment regimens, eagerness to provide unnecessary medicines to physicians, and the utilization of surplus medications, thus resulting in a gradual rise in antibiotic resistance. The proliferation of resistant strains is further exacerbated by practices in the agricultural and veterinary sectors, including the use of antibiotics for prophylaxis or growth enhancement (Smith et al., 2025). Nonetheless, efforts to address AMR must adopt a person-centric and system-oriented strategy, incorporating education, stewardship initiatives, and regulatory measures to foster responsible antibiotic utilization.

### **1.3 Role of Pharmacists in Antimicrobial Stewardship**

The function of pharmacists in patient education presents a crucial opportunity to tackle the factors contributing to antibiotic resistance. Through organized communication, they may convey the rationale for prescription antibiotic usage, emphasize the differences between bacterial and viral infections, and enhance understanding of the dangers of antibiotic resistance. Specifically, pharmacist-led patient education enhances understanding and influences expectations, facilitating

judicious and efficient antibiotic prescribing and health-seeking actions (Kusuma et al., 2022). Research indicates that education provided at the site of dispensing substantially enhances adherence and fosters lasting behavioral modifications, underscoring its importance as a fundamental component of AMS therapies.

Pharmacist-directed consultation offers personalized advice and support, encompassing both therapeutic and behavioral aspects, to address antibiotic utilization. Pharmacists can mitigate prevalent overuse practices contributing to AMR by addressing proper administration, potential adverse effects, and the importance of completing recommended regimens. Counseling provides an opportunity to elucidate misconceptions, extend support and motivational direction, and customize therapies to the individual's unique circumstances and environment, particularly pertinent for groups with diminished health literacy (Dighriri et al., 2023). Ultimately, effective counseling serves as the previously absent connection between prescription and adherence, so positioning the pharmacist as a crucial component in translating stewardship policy into practical application (Garau & Bassetti, 2018).

This is where compliance assistance is crucial in pharmacists' role in antimicrobial stewardship. Non-compliance such as premature cessation, neglecting to provide, or administering inappropriate dosages or timing—can foster resistance if microorganisms are insufficiently exposed to the antibiotic. These hazards are mitigated by techniques employed by pharmacists to promote compliance, such as reminders, a simplified regimen, and subsequent consultations. Primarily, adherence support constitutes a behavioral intervention that directly influences microbial outcomes, thereby serving a unique function as a public health initiative, where pharmacists are ideally situated to link patient adherence behaviors with broader resistance patterns.

Variations in patient demographics, prescribing independence, and oversight capabilities lead to divergent responsibilities for pharmacists in antimicrobial stewardship between community settings and hospitals. Community pharmacists engage in patient counseling, assess adverse drug reactions, and conduct educational initiatives, whereas hospital pharmacists participate in multidisciplinary rounds, frequently evaluate more complex medication regimens, and bear greater accountability for overseeing high-risk antibiotics. Significantly, these auxiliary positions underscore the importance of the pharmacist's role throughout the entire care continuum: Hospital pharmacists (Dighriri et al., 2023) concentrate on prescribing methodologies within a clinical environment and on immediate results in hospitals, whereas Community pharmacists influence enduring outcomes regarding patient behavior and antibiotic utilization in the broader community.

Pharmacists are uniquely positioned to facilitate behavior modification owing to their interactions with both patients and prescribers at several tiers of antimicrobial utilization, hence enabling them to influence behavior change on numerous fronts. Primarily, contextually relevant and informed interventions are the most efficacious method for altering health-related behaviors, and pharmacists, as health professionals, can serve both as facilitators and educators, implementing stewardship policies into sustainable, patient-focused practices to diminish the prevalence of AMR over time (Kusuma et al., 2022).

The recommendations from the Centers for Disease Control and Prevention (CDC) and the Infectious Diseases Society of America (IDSA) emphasize the significance of efficient interdisciplinary collaboration for a successful antimicrobial stewardship program (ASP). These suggestions emphasize the necessity for an antimicrobial stewardship team to possess diverse skills and knowledge among its members (Centers for Disease Control and Prevention, 2014). However, as stewardship practices, clinical training, and healthcare technologies have advanced, the roles of

team members have evolved. This transformation has been crucial in redefining the pharmacist's role, allowing them to transcend the mere provision of medicinal information. Historically, the pharmacist's primary function was to dispense medications, whereas more intricate therapies or medical advice were reserved for physicians (Parente & Morton, 2018).

Contemporary antimicrobial stewardship increasingly include pharmacists contributing to antimicrobial evaluations, optimizing treatments, and delivering professional communication and patient support services. They may engage in discussions with prescribers regarding the selection of suitable antimicrobials and the duration of treatment when it is suboptimal; recognizing improper antimicrobial usage; interacting with patients and promoting compliance with antimicrobial therapy (Centers for Disease Control and Prevention, 2014). The expanded responsibilities go directly to the pharmacist and the engagement and communication strategies with patients, as pharmacists are situated nearer to the context in which the recommendations are integrated and where patient feedback is essential. The creation of specialized postgraduate programs (pGPs) in Pharmacy, along with antimicrobial stewardship certificate courses and professional certification assessments, has afforded pharmacists the chance to enhance their skills in antimicrobial stewardship and infectious diseases. In accordance with this development, IDSA recommends that pharmacists assuming leadership roles in antimicrobial stewardship programs pursue additional postgraduate education and concentrate on specialized training (Dellit et al., 2007).

## **1.4 Behaviour Change, Communication and Patient Engagement in Pharmacist-LED AMS**

### **1.4.1 Behaviour Change in Pharmacist-LED AMS**

In the realm of healthcare, comprehending and/or influencing behavior is crucial, particularly when initiatives aim to enhance antimicrobial stewardship (AMS). Determining the appropriate

threshold for the sufficiency of evidence to justify a behavioral intervention or the necessity for additional evidence can be challenging. Human conduct can either exacerbate antibiotic resistance or mitigate it. Individuals' or groups' informed decisions, including those of the public, healthcare practitioners, and organizations, are shaped by psychological, social, and environmental influences. Although antimicrobial stewardship and antibiotic resistance require a collaborative effort, a systematic method of behavioral science can be employed to pinpoint factors contributing to excessive improper antimicrobial usage and formulate methods for more judicious application. The emphasis on behavior modification for this purpose and the necessity to integrate it into global and national AMR action strategies has resulted in behavior change being a significant focus in the Department of Health and Social Care's AMR action plan over the past month (UK Government, 2019). The significance of behavioral interventions in attaining AMS has been increasing, and these strategies have demonstrated efficacy in addressing unnecessary antibiotic consumption (specifically for irreversible conditions) and the application of antimicrobials with awareness of non-medical purposes (Charani et al., 2014).

A strategy for behavioral science in this scenario would encompass the application of health psychology theories, methodologies, and behavior modification approaches to understand and affect health-related behaviors. It offers pragmatic resources and/or instruments to recognize obstacles and enablers, to select suitable intervention elements, and to evaluate for modifications (World Health Organization, 2015). Qualitative research becomes especially beneficial in this scenario since it allows for an in-depth exploration of individuals' comprehension of antimicrobial usage, as well as the motivations behind particular behaviors and the experiences associated with its application. Behavioral science, along with an emphasis on qualitative elements, can therefore

facilitate the creation and assessment of more contextually relevant and focused strategies for AMS interventions (Van Den Bergh & Brink, 2021).

Modifying behavior is essential for effective antimicrobial stewardship, as antibiotic prescriptions rely on clinical reasoning, communication skills, social interactions, accessible resources, and the intents of prescribers. (Borek et al., 2019) discerned many behavioral elements of the therapies, encompassing all 14 domains of the Theoretical Domains Framework, eight intervention functions, and 34 Behavior Change Techniques. The environmental context and resources were the most frequently targeted influences, receiving significant attention. Only the environmental context and resources were addressed as frequently as they were referenced, while other factors like skills and emotions were less emphasized. The highest level of targeting was observed in environmental context and resources, which were mentioned with equal frequency and attention, unlike skills and emotions that received less focus. The findings of this study suggest a modification in the AMS strategy, advocating for pharmacists' counselors to extend their role beyond mere education to encompass decision-making tools, social support, and resources that assist patients, thereby enhancing the influence on prescribing practices and patient behaviors. The investigation centered on why selective decontamination of the digestive tract (SDD) was so infrequently employed in intensive care units (ICUs), despite robust evidence from 12 meta-analyses encompassing 36 randomized controlled trials (Gillies et al., 2021). They employed a Delphi poll utilizing the Theoretical Domains Framework (TDF) to evaluate the significance of various elements influencing clinical behavior and to ascertain the necessity for forthcoming trials.

The TDF serves as a structure for examining behavior by deconstructing it into 14 categories, such as knowledge, emotion, and behavioral control (Gillies et al., 2021). Recognizing which areas pose obstacles or support allows interventions to be tailored to specific behavioral determinants. In the

ICU study, apprehensions regarding the relevance of findings from prior research, the possibility of patients being underweight, and the practicality of SDD led to a reluctance to adopt SDD on a wide scale.

For instance, utilizing this behavioral science methodology in examining antimicrobial stewardship by pharmacists enables researchers and healthcare leaders to comprehend the inconsistent implementation of recommended interventions such as patient counseling, adherence support, and guideline-conformant prescriptions. Evaluating behavioral variables can guide treatments that effectively modify the actions of prescribers and patients, ensuring that stewardship initiatives are grounded in evidence and feasible for implementation (Smith et al., 2025). This methodology also supports the strategizing of forthcoming trials by pinpointing the behavioral elements that must be addressed to exhibit tangible enhancements in antibiotic utilization and a decrease in resistance.

To execute successful implementation strategies inside health systems, there have been swift progressions in methodologies for formulating these interventions, particularly concerning antibiotic utilization. A significant challenge lies in selecting and adjusting behavior modification strategies that effectively address obstacles and supports to recommended habits. A systematic methodology comprises four phases: initially determining the individuals responsible for altering their actions; subsequently recognizing the situational, motivational, and cognitive elements influencing the execution of the action; then devising methods to choose behavior modification strategies or techniques to tackle these factors; and finally assessing and appraising the resultant behavioral changes (Patey et al., 2023). The application of these methodical and theory-based strategies has been shown to enhance the likelihood of effective execution.

Alternative systematic methodologies include Intervention Mapping and implementation mapping, which offer a structure for creating multi-tiered treatments aimed at altering behaviors among healthcare practitioners. It is particularly relevant in antimicrobial stewardship to address intricate antimicrobial practices, such as judicious prescribing, patient counseling, and adherence surveillance (Moore et al., 2022). The Intervention Mapping process consists of six phases: assessing the issue to discern behaviors and the target demographic, creating matrices that link performance objectives to behaviors and their determinants, selecting theory-based methods, converting theoretical intervention methods into practical strategies, amalgamating strategies into a unified program design, preparing for adoption and execution, and formulating an evaluation plan to assess outcomes.

These methodical, theoretical frameworks empower healthcare researchers and leaders to develop interventions targeting behavioral determinants. These approach are effective in addressing both prescriber and patient behaviors in pharmacist-led antimicrobial stewardship, improving adherence to guidelines, and providing an opportunity for quantifiable alterations in antibiotic usage (Patey et al., 2023). Combining behavioral strategies with a systematic method for implementation planning can provide direction on translating research into action, enhancing the efficacy of stewardship programs, and addressing antimicrobial resistance (AMR).

In the realm of healthcare, a theoretical framework seeks to formulate, execute, and assess interventions grounded in established insights from behavioral and psychological sciences. These techniques enable the methodical recognition of elements and processes that affect the occurrence or non-occurrence of behavior change, encompassing knowledge and attitude determinants, alongside social and environmental influences, thereby permitting interventions to address the mechanisms that either promote or inhibit behavior change (Byrne-Davis et al., 2022). In

antimicrobial stewardship, measures grounded in theory can ensure that interventions are based on evidence, while also tackling the behaviors of prescribers and patients to enhance adherence, proper antibiotic utilization, and communication, so boosting efficacy. A planned and theoretical approach enhances the likelihood of enduring behavioral transformation and a more significant overall effect of stewardship initiatives.

The COM-B model is an uncomplicated yet potent framework for comprehending behavior through the examination of the interplay of Capability, Opportunity, and Motivation. It implies that behavior can occur when individuals possess the requisite physical and psychological support, social and physical opportunities, as well as the drive to engage in the behavior. From the viewpoint of antimicrobial stewardship (AMS), the COM-B model can guide the formulation of interventions by providing a framework to address prescriber expertise, patient information accessibility, and factors influencing antibiotic behavior and adherence.

The TDF expands upon behavioral theory by incorporating other domains that affect behavior, including knowledge, skills, beliefs regarding outcomes, social effects, and emotions. A comprehension of these domains has been attained by methodical assessment and can be utilized to guide healthcare strategies that tackle the obstacles and enablers of prescriber and patient conduct. Within the framework of pharmacist-driven antimicrobial stewardship, TDF can contribute to the development of a customized intervention that improves adherence to guidelines, patient counseling procedures, and judicious antibiotic utilization (Acampora et al., 2023).

The BCT (Behaviour Change Techniques) Taxonomy provides an organized catalog of methods for altering behavior, such as goal establishment, feedback, cues, and reinforcement. Targeting specific factors can be employed in AMS initiatives to modify the behavior of prescribers and/or patients. Utilizing BCTs will ensure that treatments are based on evidence, standardized, and

reproducible, therefore enhancing their efficacy in promoting rational antibiotic use and adherence (Marques et al., 2024).

#### **1.4.2 Communication and Patient Engagement in Pharmacist-LED AMS**

Effective communication is a crucial component of antimicrobial stewardship, facilitating collaboration among pharmacists and other primary care team members, including general practitioners (Bardet et al., 2015). Effective communication channels allow pharmacists to assess antibiotic prescriptions, provide feedback, address patients' concerns regarding antibiotics, and engage in choices related to antibiotic treatment. Certain pharmacists observed that access to general practitioner services is not consistently optimal and that contacting the prescriber may be challenging, thereby diminishing the efficacy of the GP-pharmacist collaboration and undermining the impact of antimicrobial stewardship initiatives. Evidence suggests that collaborations between pharmacists and general practitioners can aid in reducing improper antibiotic prescriptions and enhancing adherence to antibiotic prescribing guidelines (Saha et al., 2019). Consequently, the establishment of multidisciplinary networks (AMS), collaborative learning groups, and dependable communication systems could bolster pharmacist-led AMS by promoting knowledge exchange among professionals, consistently addressing patient expectations, and coordinating stewardship activities tailored to local community needs (Borek et al., 2019).

Patient involvement encompasses the active participation of individuals in their healthcare and treatment choices. Individuals exhibiting engagement are more inclined to adhere to recommended treatments, clinical recommendations, and practices aimed at mitigating AMR. Education, dialogue, and collaborative decision-making serve as a successful strategy to promote engagement in AMS interventions (Van Dijk et al., 2023). Improving antibiotic use in hospitals through antimicrobial stewardship programmes (ASPs) is recommended by the IDSA and SHEA national

guidelines as an important strategy for addressing the growing problem of antimicrobial resistance . However, most ASPs have traditionally concentrated on monitoring hospital-wide antibiotic use and changing the prescribing behaviour of individual physicians. This professional-centred approach may overlook the potential contribution of patients. Patients can represent an important and underused resource within AMS when they are encouraged to participate actively in discussions, ask questions about their treatment, and understand why an antibiotic is or is not required. Pharmacists can support this involvement by providing accessible information, reinforcing appropriate antibiotic-use messages, and enabling patients to participate in shared treatment decisions.

Using the Health Belief Model (Champion & Skinner, 2008) several behavioural factors can influence patients' willingness to engage in antimicrobial stewardship during hospital care. These include perceived susceptibility to antimicrobial resistance, understanding of the consequences of inappropriate antibiotic use, confidence in communicating with healthcare professionals, and exposure to prompts that encourage stewardship-related behaviour. Patients may possess a high level of self-efficacy and believe that they should contribute to ensuring the appropriate use of antibiotics. However, engagement may remain limited when patients receive insufficient communication or behavioural cues from clinicians (Heid et al., 2016). Pharmacist-led counselling, educational conversations, medication reviews, and targeted questions can therefore act as behavioural change techniques that encourage patients to become more active participants in AMS.

Patients often express strong confidence in physicians' ability to prescribe antibiotics accurately and only when clinically necessary. Trust in physicians has been associated with patient satisfaction and adherence to recommended treatment (Müller et al., 2014). Although patient–

physician trust is an essential element of shared decision-making, unquestioning or blind trust may encourage patients to adopt a passive role in decisions concerning their treatment (Kraetschmer et al., 2004). When patients assume that healthcare professionals are already controlling inappropriate antibiotic use and monitoring resistance, they may perceive themselves as having little responsibility within stewardship activities. Pharmacists can address this barrier by maintaining patient trust while explaining that appropriate antibiotic use is a shared responsibility involving prescribers, pharmacists, nurses, and patients.

Another important behavioural barrier is the misunderstanding that antibiotic resistance occurs because the human body becomes tolerant to antibiotics after repeated use. This confusion between tolerance and microbial resistance has also been identified in previous research (Brookes-Howell et al., 2012). Patients who hold this belief may assume that they are unlikely to experience a resistant infection if they have rarely used antibiotics themselves. Consequently, antimicrobial resistance may be perceived as a distant public health issue rather than a direct personal risk. Patients may also fail to recognise that resistant microorganisms can spread between individuals, including within hospital environments. Pharmacist-led communication can correct these misconceptions by clearly explaining that resistance develops in microorganisms rather than in the patient's body. Improving this understanding may increase patients' perceived susceptibility, strengthen awareness of the personal relevance of AMR, and encourage participation in stewardship behaviours such as asking about the necessity, duration, possible alternatives, and correct use of antibiotic treatment.

Trust and assurance between patients and healthcare practitioners are essential for improved compliance and implementation of antimicrobial stewardship initiatives. Elevated trust between patients and physicians is crucial for patients' openness to advice, compliance, and general

inclination to avoid self-medication, therefore promoting judicious antibiotic use (Hickey et al., 2024).

Patient-centered care emphasizes the unique requirements, preferences, and values of patients, along with necessary modifications to the delivery of treatment. In AMS, a patient-focused methodology guarantees that interventions align with personal requirements and circumstances, cultural contexts, and understanding of antibiotics, thus enhancing the pertinence, acceptance, and efficacy of antimicrobial stewardship initiatives to promote responsible antibiotic usage (Van Dijk et al., 2023).

Motivational interviewing is an collaborative communication approach that facilitates patient's intrinsic motivation to change. The tool can be used in the healthcare context to assist patients to complete their full course of antibiotics and to educate them of the consequences of premature termination. It also reminds patients to follow-up with their physicians and to not seek antibiotics if they don't need them. Healthcare providers can support patients to make lasting and meaningful choices by being attentive and understanding of their emotions and working at their comfort pace (Cole et al., 2023).

Successful antimicrobial stewardship programmers require a strong focus on effective communication, which helps to enable informed decision making, facilitate patient engagement and enable appropriate prescribing of antibiotics. However, there have been only a few studies to assess structured communication-skills training for health professionals that prescribe antibiotics. Learning with information and communication activities can enhance ASA in primary care, as shown in the work of the Stemming the Tide of Antibiotic Resistance (STAR) educational programme (S. A. Simpson et al., 2009). The objective of the programme was to enhance

clinicians' capacity to engage with patients about the use of antibiotics and to promote use of appropriate, clinically informed antibiotics.

The results of a STAR programme evaluation revealed that AB prescribing by trained healthcare professionals was significantly reduced compared to the control group (not taking part in the intervention) (Butler et al., 2012). Important, this one did not lead to an increase in admissions to hospital, meaning that better antibiotic stewardship can be achieved without compromising patient safety. These results underscore that communication-based behavioral interventions are effective for achieving aspects of the goals of ASPs without compromising quality of care.

The STAR intervention was based on several educational strategies: face-to-face seminars to elicit reflection by clinicians on their prescribing behaviours, web-based learning modules, and consultation skills exercises in a natural clinical environment to practise and assess consultation skills. The programme was based on the principles of Motivational Interviewing, which focus on the concepts of collaborative communication, patient-centred discussion and behaviour change during health-care consultations (Miller et al., 2008). The programme covered a combination of practical training, self-reflection and behavioural methods and improved the knowledge, confidence and communication skills of the clinicians. The enhancements will support key issues identified in the COM-B (Capability, Opportunity, Motivation, Behaviour) framework, allowing healthcare professionals to connect well with patients and choose the right antibiotic for the appropriate use within the antimicrobial stewardship programme (Miller et al., 2008).

Collaborative decision-making involves patients and healthcare professionals integrating their insights, expertise, convictions, and values to arrive at consensual treatment choices that align with evidence-based standards and patient desires. Embracing preferred prescribing and compliance with clinical guidelines, while reducing superfluous antibiotic usage, constitutes a good strategy

in antimicrobial stewardship. It fosters trust, instills a sense of accountability, and empowers patients with their treatment results (Dennison Himmelfarb et al., 2023).

Counseling constitutes a crucial element of patient involvement and allows healthcare providers to customize their recommendations for medication administration, adverse effects, and compliance. Pharmacist-led counseling bolsters antimicrobial stewardship by helping patients understand the necessity of antibiotics, proper management of their usage, and the risks associated with inappropriate use, thus decreasing unnecessary antibiotic consumption and supporting national AMR control (Van Dijk et al., 2023).

Lucid, uniform, and tailored communication directed at patients and healthcare professionals constitutes effective communication tactics. Employing straightforward language, visual cues, supportive tools, and offering process-related feedback can enhance comprehension and compliance. These methodologies can be implemented in AMS initiatives to reinforce the rationale for appropriate antibiotic utilization, address misconceptions, and advocate for evidence-based antibiotic prescribing (Hickey et al., 2024).

### **1.5 Existing Evidence and Knowledge Gap:**

The notion of pharmacist-directed antimicrobial stewardship initiatives has garnered traction as an effective strategy for enhancing antibiotic utilization and mitigating antimicrobial resistance globally. The participation of pharmacists in stewardship initiatives has been demonstrated to enhance compliance with Clinical Guidelines, mitigate incorrect prescribing, and improve overall patient outcomes (Beck et al., 2018).

Clinical trials conducted in hospital environments demonstrate a quantifiable effect of pharmacists in the evaluation, modification, and supervision of antibiotics, leading to a reduction in

inappropriate antibiotic misuse (British Society for Antimicrobial Chemotherapy, 2018). Exceptions encompass the diminishment of self-medication and the advocacy for judicious antibiotic utilization via community pharmacy initiatives like patient counseling and prescription validation, (Kumar et al., 2022). Pharmacists have been incorporated into the multidisciplinary AMS teams, enhancing the AMS in hospital and primary care initiatives and facilitating more cooperation in efforts to avert resistance (MacGowan & Macnaughton, 2017).

Pharmacist-driven antimicrobial stewardship is based on behavioral tactics aimed at influencing the actions of both prescribers and patients to reduce improper antibiotic utilization. Interventions that have proven effective include audit and feedback systems, prescriber education, decision aids, and organized patient interaction (Tang et al., 2023). Knowledge dissemination, motivational dialogue, and compliance enhancement are fundamental tenets of behavioral modification frameworks, designed to encourage judicious antibiotic utilization (Maher et al., 2025).

Substantial data indicates that the combination of education and environmental/system-level interventions, like formulary limits and pre-authorization protocols, is more effective than education alone (Founou et al., 2021). These approaches aim to modify the prescribing culture, patient expectations, and community behaviors to address the key elements contributing to antimicrobial resistance (O'Neill, 2016). Pharmacists are strategically situated to execute these initiatives across various tiers, including consultation and institutional notification, as illustrated by (MacGowan & Macnaughton, 2017).

The cornerstone of an AMS's success lies on proficient communication, which serves to inform the patient and enhance collaborative efforts among professionals. Organized consultations with pharmacists may improve patients' understanding of infection management, antibiotic utilization, and adherence to antibiotic schedules (Beck et al., 2018). Communication encompasses comments

regarding local antimicrobial resistance, the application of antibiograms, and the discourse on guideline-congruent therapy with prescribers (British Society for Antimicrobial Chemotherapy, 2018). Research centered on communities indicates that disseminating affirmative messages to deter inappropriate antibiotic consumption can reduce self-medication and patient demand for antibiotics (Do et al., 2021). In medical facilities, pharmacists participate in round-based discussions and stewardship meetings, effectively promoting evidence-based recommendations to the clinical staff (WHO Regional Office for Europe & European Centre for Disease Prevention and Control, 2022). These approaches suggest that proficient communication customized to the requirements of both patients and healthcare providers is essential for the efficacy of AMS therapies (Chokshi et al., 2019).

The involvement of pharmacists in antimicrobial stewardship has been shown to enhance prescribing behaviors and diminish the reliance on broad-spectrum antibiotics, hence mitigating antimicrobial resistance (Lambert, Van Dijk, et al., 2025). Interventions incorporating teaching, behavioral assistance, and monitoring are more efficacious in both hospital and community settings (Maher et al., 2025). Analyses indicate that pharmacists' participation in decision-making, provision of guidance about protocols, and patient counseling favorably affect clinical results, resulting in enhanced therapy adherence (Beck et al., 2018). Notwithstanding these benefits, there are acknowledged difficulties: Insufficient incorporation of pharmacists in resource-constrained environments, prevailing disparities in foundational education, and absence of governmental backing (Do et al., 2021). In conclusion, the data underscores the pivotal function of pharmacist-led initiatives as a significant component of worldwide efforts to combat AMR (Tiseo et al., 2020).

A significant volume of studies has been conducted on antimicrobial stewardship (AMS) and pharmacist-led initiatives; nevertheless, there are deficiencies in the literature concerning

behavioral and personal-level interventions. Limited research has predominantly focused on clinical outcomes, like reduced utilization of broad-spectrum antibiotics, adherence to guidelines, or financial savings, without thoroughly examining the pharmacist's influence on patient behavior (Beck et al., 2018). The pharmacist's role in developing health literacy and modifying patient expectations to reduce self-medication is insufficiently studied. Furthermore, the data available within the community pharmacy setting is limited, as this serves as a point of interaction for patients potentially acquiring antibiotics without prescriptions, particularly in poor and middle-income nations (Do et al., 2021).

The significance of antimicrobial stewardship has been acknowledged as a collaborative effort involving multiple disciplines, with pharmacists occupying an essential position within these teams. They are recognized for their involvement in various capacities regarding antimicrobials, including evaluating antimicrobial usage, offering guidance on the selection and administration of antimicrobial medications, delivering audits and feedback, and participating in the formulation of institutional antimicrobial stewardship policies (Parente & Morton, 2018).

Nevertheless, there was an absence of literature detailing the scope of clinical, organizational, and medication management contributions within the pharmacist's position. The influence of community and associated factors on patient engagement with antibiotic practices has been insufficiently researched and recorded, especially concerning the pharmacists' role. The existing guidance fails to provide a comprehensive overview of pharmacists' counseling and education, adherence assistance, and other tactics that emphasize the patient as a behavioral factor in AMS interventions (Dellit et al., 2007).

A synthesis of expertise, perceptions about the ramifications of antimicrobial application, societal influences, emotions, intents, and resource accessibility collectively influence antimicrobial usage,

rendering it a behavior amenable to research intervention. Prior studies indicate that AMS interventions should be more focused, thus the application of behavioral theories, frameworks, and BCTs is advised for the design of AMS interventions (Borek et al., 2020).

Nonetheless, the majority of this information has concentrated on the prescribing behaviors of healthcare professionals, rather than the dynamics between pharmacists and patients. For example, (Borek et al., 2019) examined treatments aimed at antibiotic prescribing in English primary care and identified behavioral elements across all TDAF classifications and the Behavior Change Technique Taxonomy. Although this study demonstrates the significance of theory-based AMS, it fails to specifically outline how pharmacists employ these concepts during patient interactions and discussions regarding therapy.

The involvement of pharmacists in collaboration with general practitioners has been advocated previously. (Bardet et al., 2015) delineated the frameworks and factors influencing collaboration between physicians and community pharmacists, whereas (Saha et al., 2019) shown that pharmacist interventions in antimicrobial stewardship could reduce antibiotic prescriptions and enhance adherence to prescribing recommendations among general practitioners. The majority of the evaluations, however, were confined to interprofessional dynamics and outcomes associated with the prescriber. Research provides a somewhat inadequate comprehension of the contacts pharmacists maintain with patients, including their management of antibiotic expectations, interpretation of treatment choices, facilitation of adherence, and involvement of patients in antimicrobial decision-making. Consequently, it is unclear how frequently patients interact and engage with the service (in-person, through alternative methods, or not at all), the manner in which this communication occurs, and whether behavioral mechanisms may be influenced.

Communication, education, public engagement, and behavioral modification are fundamental elements identified in international and UK policy texts addressing AMR (UK Government, 2019). Nevertheless, acknowledging a policy has not been accompanied by a concentrated synthesis of pharmacist-driven behavioral, communication, and patient engagement activities. Nevertheless, a more comprehensive examination and understanding of the efficacy of interventions in specific patient populations or diverse healthcare environments is necessary, since those deemed ‘successful’ in one context may not yield the same results in another (Borek et al., 2019). Consequently, a scoping review is essential to develop a comprehensive overview of the various behavioral models and methodologies utilized in AMS directed by pharmacists, delineate the diverse communication and engagement strategies from the patients’ viewpoint, ascertain their application across different environments, and underscore areas for future investigation.

The evaluation will be documented in accordance with the PRISMA Extension for Scoping Reviews (PRISMA-ScR) checklist, a thorough framework designed to enhance transparency, completeness, and repeatability. Embracing this approach enhances scientific rigor, relative to subsequent evaluations, and bolsters the credibility of the conclusions regarding pharmacist-led AMS interventions and their impact on behavior modification and AMS outcomes.

## **1.6 Rationale, Aim and Review Questions**

Widespread use of antibiotics has led to a growing awareness of the wrong use of them and of antimicrobial resistance. Thus, antimicrobial stewardship programmes are crucial to the right prescribing, to the effectiveness of current antibiotics and to the timely only treating those who need it. The inclusion of stewardship principles in healthcare education can reinforce the knowledge, prescribing confidence and expertise of healthcare professionals when using antibiotics in clinical practice (Beck et al., 2018)

But in addition to clinical knowledge, factors including patient's expectations, communication, beliefs and misconceptions about antibiotic resistance also play a role in antimicrobial use. Patients may think that antibiotics would be beneficial for self-limiting illnesses or sense that they are not at risk because they think they get used to antibiotics (Brookes-Howell et al., 2012), so their perception of risk decreases. These factors underscore the importance of interventions aimed at increasing patient understanding, facilitate shared decision-making and help healthcare professionals manage patient's expectations for antibiotics with clear, patient-centred communication (Boiko et al., 2020).

Despite numerous efforts to develop antimicrobial stewardship policies, guidelines, and professional learning, there is inconsistent development and implementation of behaviour and communication-based AMS interventions (Dennison et al., 2023). Behaviours can be used as a tool to identify barriers to capability, opportunity and motivation and may assist in creating more effective interventions tailored to the needs of the healthcare professionals and patients. Therefore, a scoping review is necessary to review the use of behavioural change techniques in interventions involving communication and engagement with patients within antimicrobial stewardship programmes and identify evidence gaps to guide the creation of more effective and sustainable AMSPs (Cole et al., 2023).

To delineate how pharmacist-driven antimicrobial stewardship initiatives integrate behavior modification frameworks and patient involvement tactics to enhance antibiotic-related practices.

The following are the goals:

1. To ascertain the behavioral theories and models (e.g., COM-B, TDF, BCW) utilized in pharmacist-led AMS interventions and the extent of their systematic application.

2. To delineate the particular Behavior Change Techniques (BCTs) applied in these treatments and ascertain which categories are insufficiently employed (e.g., motivating, problem-solving, shared planning).
3. To investigate the manner in which pharmacists organize and convey communication and counseling techniques during patient-oriented AMS initiatives.
4. To investigate the environments, demographics, and contextual elements surrounding pharmacist-led AMS initiatives, focusing specifically on deficiencies in community and outpatient services.

### **Primary Questions:**

RQ1. In what ways do pharmacist-led antimicrobial stewardship initiatives integrate behavior modification frameworks and patient involvement tactics to affect antibiotic-related practices?

### **Secondary Research Questions**

- RQ2. Which behavioral theories and models (e.g., COM-B, TDF, BCW, have been used in pharmacist-led AMS interventions, and how rigorously are they applied?
- RQ3. Which Behavior Change Techniques (BCTs) are employed within pharmacist–patient interactions, and which BCT categories appear underused or insufficiently represented?
- RQ4. How are communication and counselling strategies structured and delivered by pharmacists in patient-facing AMS activities?
- RQ5. In which settings, populations, and contexts do pharmacist-led AMS interventions take place, and what gaps exist in community, outpatient, or other patient-facing environments?

## **CHAPTER 2 – METHOD**

### **2.1 Study Design**

This research was designed as a scoping review to systematically map the literature addressing how pharmacist-led antimicrobial stewardship (AMS) interventions integrate behavioral change techniques (BCT) and communication strategies to support patient engagement and improve behavioral changes related to antibiotic use. A scoping review was selected because the aim of this study is not to evaluate the efficacy of one intervention over another, but to record a comprehensive and methodologically diverse literature and identify gaps for future studies.

This review followed the methodological approach suggested by Arksey, developed and refined by (Arksey & O'Malley, 2005) and by the Joanna Briggs Institute (Peters et al., 2020). As directed by the framework, five stages were used in the process: identifying relevant studies, Data charting, collating, summarizing, and reporting the results. The guidelines of Analyses Extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018) were also used to guide the analyses.

### **2.2 Protocol Registration**

No protocol was registered on any platform, like OSF, for this research. It is generally good practice to register in advance, but for this study, this is included in the limitations due to time constraints. Registering it would have made it more transparent and reproducible to review it.

### **2.3 Research Questions**

The research addresses the following principal research question

**RQ1.** In what ways do pharmacist-led antimicrobial stewardship initiatives integrate behavior modification frameworks and patient involvement tactics to affect antibiotic-related practices?

## Secondary Research Questions

- **RQ2.** Which behavioral theories and models (e.g., COM-B, TDF, BCW) have been used in pharmacist-led AMS interventions, and how rigorously are they applied?
- **RQ3.** Which Behavior Change Techniques (BCTs) are employed within pharmacist–patient interactions, and which BCT categories appear underused or insufficiently represented?
- **RQ4.** How are communication and counselling strategies structured and delivered by pharmacists in patient-facing AMS activities?
- **RQ5.** In which settings, populations, and contexts do pharmacist-led AMS interventions take place, and what gaps exist in community, outpatient, or other patient-facing environments?

## 2.4 Eligibility Criteria

The eligibility criteria were created following the Population, Concept, and Context (PCC) as recommended to use in the Joanna Briggs Institute framework:

**Population:** Pharmacists (community, hospital, clinical, or primary care) and the patients with whom they interact when they use Antibiotic stewardship programs (ASPs).

**Concept:** Behavioral and psychological interventions incorporating communication and approaches to improve patient engagement to support adherence and responsible antibiotic use, and stewardship, specifically those implementing behavioral theories or identifiable Behavior Change Techniques.

**Context:** “Antimicrobial stewardship” settings refer to patients directly engaged with healthcare workers like doctors, nurses, and other healthcare providers (dispensing, counselling, telepharmacy, education), in clinical and community settings.

**Inclusion criteria.** Studies were included if they fulfilled the following criteria:

1. An antimicrobial stewardship study that was pharmacist-led or pharmacist-associated and included
2. An antibiotic-related intervention.
3. It encompassed a patient-centred element (e.g., counselling, education, communication, or engagement).
4. It referred or mentioned, explicitly or implicitly, to a framework or model of behaviour (e.g., Behaviour Change Wheel) or specified a Behaviour Change Technique.
5. It referred to communication strategies that would affect antibiotic-related communication behaviors.
6. It reported an empirical study design (quantitative, qualitative, mixed-methods) or a feasibility/pilot (or implementation) study.
7. It was published in English.
8. This was a peer-reviewed article.

**Exclusion criteria.** Studies were excluded if any of the following applied:

1. Pharmacists not involved in any aspect of the intervention.

2. Studies that do not include patients in the focus of stewardship or studies that only involve physicians or prescribers.
3. Studies with no involvement of the health-care provider in the data analysis or interpretation or behavioural/ communication element.
4. No mention of behaviour frameworks, behaviour change, BCTs or communication strategies, even implicitly.
5. Editorials, opinion pieces, commentaries and conference abstracts without data or data without commentaries.
6. Articles that lack detail concerning methodology.
7. Secondary literature (other reviews, scoping, systematic, narrative, and/or meta-analyses).
8. Publications not in English.

The studies published since the year 2000 were accepted as eligible, in order to capture the evolution of behavioural science interventions for antimicrobial stewardship in the last decade.

## **2.5 Information Sources and Search Strategy**

The literature search was conducted across five databases: PubMed/MEDLINE, Scopus, Web of Science, PsycINFO, and CINAHL. The search across these platforms was a mix of controlled vocabulary and free-text keywords, including population-based safety and policy, Pharmacists and Pharmacy Practice, antibiotic use and adherence, behavior change, communication, and patient engagement. The syntax and indexing requirements of each database were taken into consideration in the adaptation of search strategies.

The search strategy was 'iteratively designed' to include the overlap between pharmacists and pharmacy practice, antimicrobial stewardship and antibiotic-related behaviour, and behaviour change, communication, and patient engagement. A combination of controlled vocabulary (e.g., MeSH terms in PubMed) and free-text keywords was used, with the addition of truncation (e.g., pharmacist\*, antimicrobial stewardship, antibiotic\*, behavior\* change, communication\*) and Boolean operators to enhance the sensitivity of the search. Each database had its own syntax and indexing needs, and search strategies were customized to each of these. These are the complete search strategies (available in Appendix 1). An example of the search string is also included to increase transparency.

## **PubMed**

```
((pharmacist*[Title/Abstract] OR "community pharmacist*" [Title/Abstract] OR "hospital pharmacist*" [Title/Abstract] OR "clinical pharmacist*" [Title/Abstract] OR "primary care pharmacist*" [Title/Abstract] OR "outpatient pharmacist*" [Title/Abstract] OR "pharmacy practice" [Title/Abstract]) AND ("antimicrobial stewardship" [Title/Abstract] OR "antibiotic stewardship" [Title/Abstract] OR "antimicrobial resistance" [Title/Abstract] OR "antibiotic use" [Title/Abstract] OR "antibiotic adherence" [Title/Abstract] OR "antibiotic consumption" [Title/Abstract] OR "appropriate antibiotic*" [Title/Abstract] OR "responsible antibiotic*" [Title/Abstract] OR "antimicrobial use" [Title/Abstract])) AND (behavior [Title/Abstract] OR behaviour [Title/Abstract] OR "behavior change" [Title/Abstract] OR "behaviour change" [Title/Abstract] OR "behavioral intervention*" [Title/Abstract] OR intervention* [Title/Abstract] OR "behavioral counseling" [Title/Abstract] OR "behavioral counselling" [Title/Abstract] OR "patient coaching" [Title/Abstract] OR "patient
```

support"[Title/Abstract] OR COM-B[Title/Abstract] OR TDF[Title/Abstract] OR "Behaviour Change Wheel"[Title/Abstract] OR "motivation"[Title/Abstract] OR "facilitat\*"[Title/Abstract] OR barrier\*[Title/Abstract])

## 2.6 Study Selection

After initial research the total number of records identified (n = 3,768) were uploaded into Rayyan for duplication checking, title/abstract. After performing deduplication, the selection process was done in two steps as follows:

**Phase One:** The titles and abstracts of all retrieved records were screened independently by two reviewers in Phase One. Studies that were excluded were those that were not focused on with no involvement of the health-care provider, no mention of behaviour frameworks, studies not including patients in the focus of stewardship as detailed in 2.4.

**Phase Two:** All remaining potentially relevant articles were retrieved and screening and eligibility decisions were mainly conducted by one reviewer and then verified/discussed with the supervisor. Inconsistencies between reviewers were addressed by discussion, consensus, or by a third reviewer. The entire process of selection is explained in a PRISMA-ScR flowchart and detailed reasons for exclusion at the full-text stage.

## 2.7 Data Charting Process

With the help of the co-supervisor, a data charting form was drafted which would standardize the extraction of the relevant data from each of the included studies. The fields on the extraction form were a total of 23; these could be summarized into 7 larger domains for reporting purposes.

The research identification and design included cover the author(s) and year, country, study aim, and study design. The setting, the participants and the sample size (N) were set. For the pharmacist role, it was indicated whether the pharmacist led the intervention, co-led with another pharmacist, or supported only one of the interventions.

Characteristics of the intervention were intervention type or name and a description that highlighted aspects that were patient-facing, behavioural, communication-based, or antimicrobial stewardship specific. Behavioral Content included the Target Behavior, Behavioral Theory/Framing, Application of the Behavioral Theory/Framing, and Behavioral change techniques (BCT) coded, if applicable, in the BCT Taxonomy v1. Communication and engagement dealt with the communication strategies, the patient engagement strategies, and the materials or tools used to deliver the communication, known as the measurements (leaflets, decision aids, digital platforms). Outcomes and findings mainly included outcomes assessed, main findings (only those relevant to the review question), and barriers and facilitators to implementation, delivery, or acceptability.

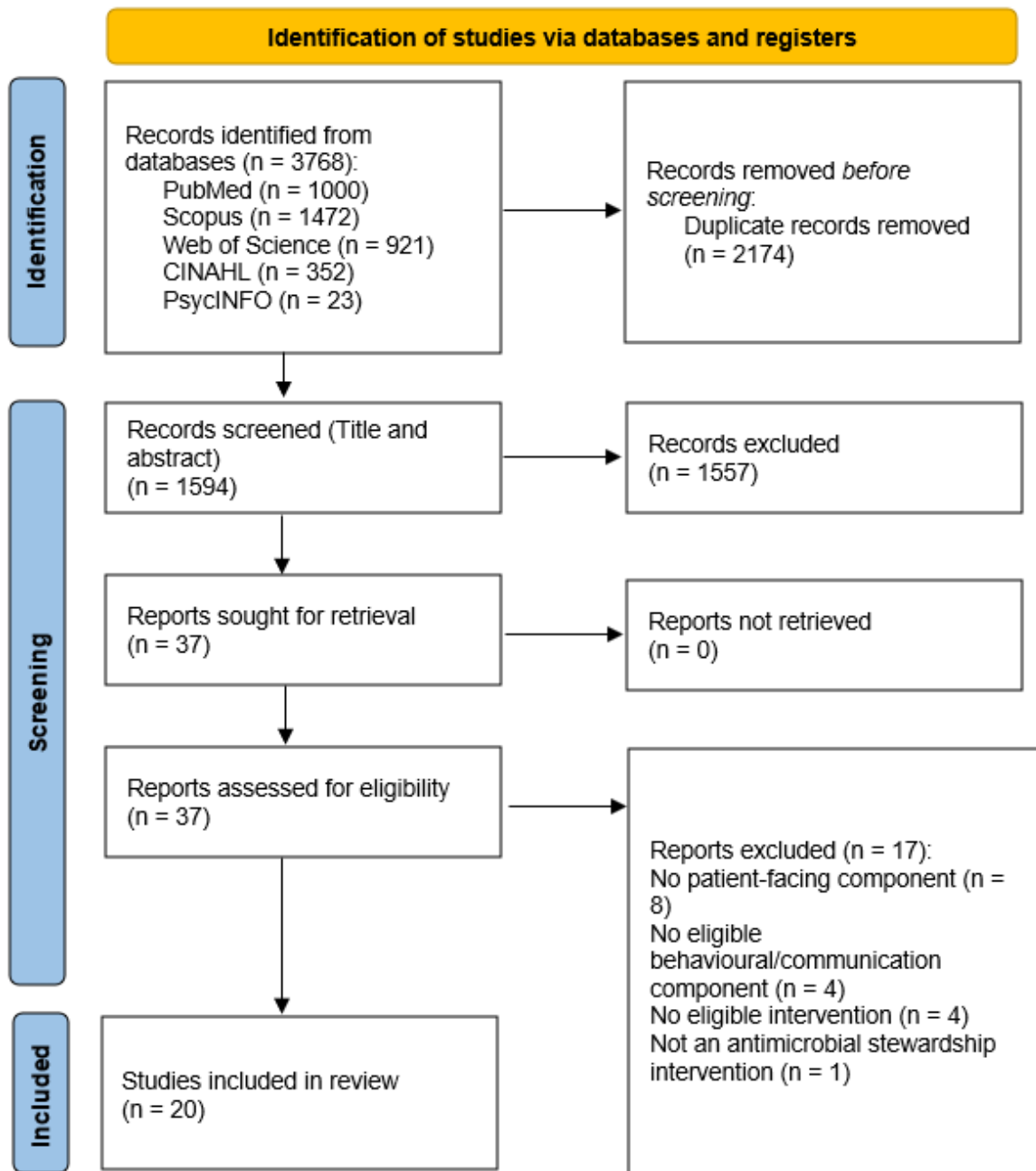
Information was only reported and not inferred across all fields. Two or more clearly different interventions which were not easily represented in one row were each given a row of their own if a study presented such interventions. A separate row was provided for each of two or more clearly different interventions which could not reasonably be represented in a single row if a study presented two or more such interventions. The researcher consistently applied the standardized abbreviations NR, meaning that the authors did not report the information; NA, meaning that the information was not applicable; Unclear, meaning that information was provided, but not sufficient, or not clear; and None reported, meaning that no theory, framework, BCT, or communication strategy was identified.

## **CHAPTER 3 – RESULTS**

### **3.1 Search results**

The database searches identified a total of 3,768 records. After removal of 2,174 duplicate records, 1,594 records were screened by title and abstract, of which 1,557 were excluded. The remaining 37 reports were sought for retrieval and all were successfully retrieved and assessed for eligibility. Following full-text assessment, 17 reports were excluded because they did not meet the eligibility criteria, resulting in a final sample of 20 studies included in the scoping review. The study selection process and reasons for exclusion at the full-text stage are presented in Figure 1.

**Figure 1 – PRISMA flow diagram of study selection and inclusion process**



## **3.2 Characteristics of the included studies**

### **3.2.1 Country and year of publication**

The selected dataset for the research comprises geographically diverse studies from a wide range of countries. England (UK) is the most represented country, with six researches (30.0%) (Allison et al., 2020; Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023; Jones et al., 2018; Lakha et al., 2023). Three researches were from India (15.0%) (Attar et al., 2025; Radhakrishnan et al., 2023; Warriar et al., 2025). The other eleven researches (55.0%) were from different countries, such as Indonesia (Ari Kristina et al., 2021), Ghana (Sneddon et al., 2022), Spain (Muñoz et al., 2014), Qatar (Paravattil et al., 2021), Jordan (Almomani et al., 2023), Nigeria (Aika & Enato, 2023), Croatia (Vilić et al., 2025) France (Angoulvant et al., 2013) and the United States (Collazo et al., 2025); one research particularly was conducted in five European countries concurrently (Pierce et al., 2021): France, Greece, Lithuania, Poland and Spain).

### **3.2.2 Study designs**

20 studies were selected for this review. Study designs were greatly diverse, with five (25.0%) using a randomized controlled trial design (Almomani et al., 2023; Angoulvant et al., 2013; Ashiru-Oredope et al., 2020; Radhakrishnan et al., 2023; Vilić et al., 2025). Seven using (35.0%) a quasi-experimental or non-randomized before and after research design (Aika & Enato, 2023; Ari Kristina et al., 2021; Attar et al., 2025; Lambert, Benko, et al., 2025; Muñoz et al., 2014; Paravattil et al., 2021; Warriar et al., 2025), three qualitative studies (15.0%) (Collazo et al., 2025; Jones et al., 2018; Sneddon et al., 2022), two mixed methods designs (10.0%) (Hayes et al., 2022; Lakha et al., 2023) and remaining three (15.0%) accounted for one feasibility study (Allison et al., 2020), one service evaluation (Hayes et al., 2023) and one quality improvement project (Pierce et al., 2021).

### **3.2.3 Settings and study populations**

The most common setting was community pharmacy 7 studies, 35.0% (Hayes et al., 2023; Allison et al., 2020; Hayes et al., 2022; Ashiru-Oredope et al., 2020; Muñoz et al., 2014; Paravattil et al., 2021; Lambert et al., 2025) followed by hospital or inpatient setting 6 studies, 30.0% (Sneddon et al., 2022; Warriar et al., 2025; Attar et al., 2025; Almomani et al., 2023 [in part]; Vilić et al., 2025; Angoulvant et al., 2013) and primary care or general practice or outpatient clinic 5 studies, 25.0% (Lakha et al., 2024; Almomani et al., 2023 [in part]; Aika & Enato, 2023; Collazo et al., 2025; Pierce et al., 2021). The other two studies were conducted in community settings other than pharmacies: a community medicine-awareness course 5.0% (Ari Kristina et al., 2021) and a rural medical camp 5.0% (Radhakrishnan et al., 2023).

There were also differences in study populations according to the target population. Within the studies, 75.0% (n=15) had direct contact with patients/caregivers, and 25.0% (n=5) were conducted with pharmacy personnel or prescribers without direct patient contact during the intervention.

### **3.2.4 Pharmacist role and intervention characteristics**

The study method was led by the pharmacist in 15 studies (75.0%), either leading the content or directing and delivering the intervention. Pharmacists co-led the intervention along with a multidisciplinary team in 2 studies (10.0%) (Ashiru-Oredope et al., 2020; Attar et al., 2025). In one study (5.0 %) (Collazo et al., 2025), pharmacists supported only one of a multi-component intervention. In the other 2 studies (10.0%) (Jones et al., 2018; Sneddon et al., 2022), pharmacists were not the ones performing the intervention, but were interview subjects describing either current practice or future recommendations for practice.

Table 1 summarizes characteristics and Table 2 main findings of studies included in the review

**Table 1- Characteristics of Included Studies (N = 20)**

| Author(s),<br>year    | Country                                                       | Study aim                                                                                                                                                                                                                                                        | Study design &<br>setting                                                                                                                                                                                                                             | Participants & sample<br>size (N)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Pharmacist role                                                                                                                                                                                                                                                                            | Intervention & comparator                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Delivery format &<br>duration/intensity                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aika & Enato,<br>2023 | Nigeria<br>(Benin City,<br>Edo State,<br>Southern<br>Nigeria) | To evaluate and<br>compare two<br>educational<br>interventions for<br>improving<br>paediatric<br>caregivers' knowledge of<br>antibiotics and<br>their appropriate<br>use, and to<br>identify the more<br>effective approach<br>for delivering this<br>education. | Study design:<br>Non-randomised<br>two-arm before-<br>after (pre-post)<br>analytical cross-<br>sectional study.<br>Setting: Paediatric<br>out-patient waiting<br>area of Central<br>Hospital, a<br>secondary<br>healthcare facility<br>in Benin City. | Participants: Parents<br>recruited from the<br>paediatric outpatient<br>waiting area while waiting<br>to take their children for<br>physician consultation,<br>who had used paediatric<br>antibiotics in the past. All<br>60 participants were<br>female; mean age 34.10<br>(SD 6.435), 56.7% aged<br>31-40; 93.3% married;<br>50% post-secondary<br>education, 38.3%<br>secondary, 11.7% primary;<br>56.7% employed; and<br>74.5% had two or more<br>children.<br>N: 60 caregivers with 30 in<br>the one-on-one education | Both arms were<br>delivered by the same<br>academic and clinical<br>pharmacist with 8<br>years of experience<br>and 4 years of<br>combined community<br>and hospital practice,<br>who serves as a<br>clinical preceptor for<br>undergraduate PharmD<br>and Master's clerkship<br>students. | Intervention name: NR but<br>described simply as one-on-one<br>educational intervention and group<br>educational intervention.<br>Intervention description: Two<br>educational arms delivered by the<br>same pharmacist in Nigerian<br>Pidgin, with identical content but<br>different formats. In the one-on-<br>one arm, Each participant was<br>individually provided oral<br>education structured around the<br>questionnaire items they<br>completed. In the group arm, the<br>same content was presented to<br>participants collectively, supported<br>by a poster flip chart to aid visual<br>understanding. Both ended with an<br>opportunity for participants to ask<br>questions for clarification The<br>content covered the causes of | Delivery format:<br>Face-to-face and<br>oral. One arm<br>individual, the other<br>group-based with a<br>poster flip chart.<br>Duration/intensity: A<br>single session per<br>participant. One-on-<br>one sessions lasted<br>10-20 minutes and<br>were delivered over<br>three consecutive<br>days (10 participants<br>per day); the group<br>session lasted 40<br>minutes and was<br>delivered on a single<br>day, one week after<br>the one-on-one<br>sessions. Post-test |

|  |  |  |  |                                        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                      |
|--|--|--|--|----------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|  |  |  |  | arm and 30 in the group education arm. |  | <p>childhood infection other than just bacteria; what antibiotics can and cannot treat (e.g., they do not treat malaria, all diarrhoea and dysentery); completing antibiotic courses even if symptoms appear to improve; possible antibiotic side effects; infection prevention, covering immunisation, hand hygiene, food hygiene, respiratory hygiene, and maintaining a clean home and proper waste disposal; practical guidance on paediatric antibiotic use such as how to reconstitute powder antibiotics correctly using cooled water instead of hot or warm, how to measure the correct volume, how to store the medicine, why reconstituted antibiotics should not be reused or shared, why a previously prescribed antibiotic should not be repurchased without first consulting a healthcare professional, and how to follow</p> | <p>administered immediately after the education.</p> |
|--|--|--|--|----------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|

|                      |              |                                                                                                                                                                                                               |                                                                             |                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                             |
|----------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |              |                                                                                                                                                                                                               |                                                                             |                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                     | <p>the recommended dosing times.</p> <p>Comparator: The two arms, one-on-one vs group education, serve as comparators for each other and each arm additionally has its own pre-education baseline. There is no usual-care or no-intervention control.</p>                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                             |
| Allison et al., 2020 | England (UK) | To develop and assess the feasibility of PAMSI, an intervention designed to strengthen community pharmacy staff capability, opportunity, and motivation to check antibiotic appropriateness and provide self- | <p>Study design: Feasibility study.</p> <p>Setting: Community pharmacy.</p> | <p>Participants: Community pharmacy staff (15 pharmacists, 2 pre-registration trainee pharmacists, 5 healthcare counter staff, 17 dispensary staff, 2 technicians, 1 pharmacy manager, 1 pharmacy assistant) and pharmacy users (patients or carers collecting antibiotic prescriptions).</p> <p>N: 12/111 pharmacies (11%) trialed the intervention, out of</p> | Pharmacists completed the clinical assessment page while pharmacy staff delivered verbal advice tailored to the patient's reported knowledge gaps and infection-specific self-care advice, and shared patient information leaflets. | <p>Intervention name: PAMSI, centred on the Antibiotic Checklist.</p> <p>Intervention description: PAMSI consisted of four components including a 20-minute staff webinar on AMS and Checklist use; an A5 folded paper Antibiotic Checklist completed by patients at hand-in (infection, prior antibiotic use, risk factors, self-rated knowledge sections) and pharmacists at dispensing (allergies, interactions, dose and duration against guidance sections), with tailored verbal</p> | <p>Delivery format: Face-to-face, individual, at the pharmacy counter, using a paper checklist and take-home leaflets; staff education delivered online; and user follow-up questionnaires by email/SMS.</p> <p>Duration/intensity: Checklist used for 4 weeks (February 2019); one 20-</p> |

|                       |        |                                                                                                 |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                 |
|-----------------------|--------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |        | care and adherence advice.                                                                      |                                                                                                             | which 17 expressed interest, 15 consented, 2 withdrew, 1 non-responsive; 43 pharmacy staff evaluated the webinar, 13 completed the post-intervention questionnaire; 931 Antibiotic Checklists were completed by patients/carers; 201 users gave contact details, 68 completed user Questionnaire A and 24 completed Questionnaire B; and 57 users rated intervention components.. |                                                                                                                           | advice at hand-out; a suite of reinforcing materials including posters, counter mats, bag stickers, staff badges and TARGET infection leaflets carrying three messages (take antibiotics as advised, do not share or keep leftovers, return unused to the pharmacy); and feedback to staff on Checklist completion rates and pharmacy-user follow-up data. Comparator: NA.. | minute webinar; weekly researcher visits to each pharmacy to answer questions, collect checklists and replenish resources; pharmacy-user Questionnaire A soon after the visit and Questionnaire B approximately one week later. |
| Almomani et al., 2023 | Jordan | To evaluate the impact of an educational intervention on short-term antibiotic adherence and to | Study design: Prospective, single-blinded randomized controlled trial. Intention-to-treat analysis was used | Participants: Adults aged 18 years or over, diagnosed with an acute infection confirmed by a consultant and prescribed antibiotic pills for a short course < 30 days to take at                                                                                                                                                                                                   | A trained clinical pharmacist acting as research assistant enrolled and randomised patients, delivered the pharmaceutical | Intervention name: NR but described as pharmaceutical care intervention. Intervention description: Individualised face-to-face pharmaceutical education about the prescribed antibiotic, delivered                                                                                                                                                                          | Delivery format: Individual, face-to-face verbal education at recruitment, with an individual telephone call for outcome assessment.                                                                                            |

|  |  |                                              |                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                   |
|--|--|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | describe patterns of antibiotic utilisation. | for missing data. Setting: Outpatient clinics and the hospital pharmacy waiting area of King Abdullah University Hospital, one of the largest tertiary referral hospitals in Jordan. | home. Immunocompromised patients and those on prophylactic antibiotics were excluded. Median age 45 years (IQR 31-55, range 18-88); 65.2% female; 78.1% married; 54.6% university educated; 36.3% employed; 41.9% had comorbidities. Most common infections were respiratory (51.1%) and urinary tract (28.1%). N: 589 patients completed the study (297 control, 292 intervention). 743 patients were approached, 612 were randomised and 23 dropped out during follow-up. | education to the intervention group, and conducted the follow-up telephone calls for both groups. He also performed recruitment, allocation, intervention delivery and outcome assessment. | by a clinical pharmacist at recruitment. To standardise delivery, the 10 most frequently prescribed antibiotics were identified in advance from hospital records (amoxicillin or amoxicillin/clavulanic acid, ciprofloxacin, levofloxacin, azithromycin, cefuroxime, cephalixin, clindamycin, doxycycline, metronidazole, trimethoprim/sulfamethoxazole) and the education content for each was prepared from the Lexicomp drug information database. Each session covered the mechanism of action and use of the antibiotic, the correct administration method and timing, possible adverse effects together with self-management strategies for dealing with them, and what the patient should do if a dose was missed. Interviews averaged 20-25 minutes per patient in the | Duration/intensity: A single education session of 20-25 minutes at recruitment, followed by one telephone call two days after completion of the antibiotic course. Study conducted August 2020 to September 2021. |
|--|--|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                         |                |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                |
|-------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                |                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                              | <p>intervention group compared with 10 minutes in the control group.</p> <p>Comparator: Ordinary care control group with routine pharmaceutical care provided by the dispensing pharmacist in the hospital, with the research assistant interviewing patients for data collection only.</p>                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                |
| Angoulvant et al., 2013 | France (Paris) | <p>To evaluate whether therapeutic education delivered in a paediatric emergency department improves parents' satisfaction with antibiotic information and their attitudes towards judicious antibiotic use.</p> | <p>Study design: 1:1 Block randomised controlled trial with two parallel groups and intention-to-treat analysis. Parents were blinded to the existence of two groups and outcome assessors were blinded to allocation.</p> <p>Setting: Paediatric emergency department of</p> | <p>Participants: Parents of children aged 1 month to 6 years (with children present) discharged from the paediatric emergency department with a prescription for 5-10 days of an oral liquid antibiotic for an acute respiratory tract infection (mainly tonsillitis, acute otitis media, lower respiratory tract infection or adenitis) or a urinary tract infection (pyelonephritis or cystitis). Excluded were those with</p> | <p>The intervention and control sessions were designed by a clinical pharmacist trained in therapeutic education, and five clinical pharmacists trained in therapeutic education delivered the sessions. Pharmacists blinded to allocation and trained to administer the questionnaire also conducted the telephone outcome assessments.</p> | <p>Intervention name: Parent therapeutic education on antibiotic use.</p> <p>Intervention description: A single 30-minute face-to-face therapeutic education session with the parents in a private room, following the four WHO stages of therapeutic patient education. The pharmacist began by exploring what parents already knew, believed and did about the prescribed treatment, using well-defined opening questions to guide an interactive discussion (educational diagnosis). From this, the pharmacist and</p> | <p>Delivery format: Face-to-face, individual and family-level where both parents attended in a private room when both accompanied the child. Outcome assessment by telephone.</p> <p>Duration/intensity: A single 30-minute session. Telephone assessment at day 14 but attempted at least</p> |

|  |  |  |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                 |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>Robert Debré Hospital, Assistance Publique-Hôpitaux de Paris, a tertiary mother-and-child teaching hospital serving a culturally and linguistically diverse population in Paris.</p> | <p>chronic conditions affecting drug dosing, known or suspected allergy to the prescribed antibiotic, no contact telephone number, and parents with poor knowledge of French. Median child age 19 months (Q1-Q3 11-36); 50% female; acute otitis media was the leading indication and amoxicillin-clavulanate the most prescribed antibiotic. N: 300 children randomised with 150 per arm; 298 (99.3%) received the full education session; 259 evaluated at day 14 (129 intervention, 130 control); 38 lost to follow-up. Second assessment at month 6.</p> |  | <p>parents jointly agreed what the session should achieve (educational contract). The education itself covered how to prepare, administer and store the oral liquid antibiotic and what side effects to expect, with a practical demonstration using different oral solution forms and tips for avoiding spitting and masking the flavour, illustrated with drawings and information sheets (education). Parents then worked through everyday situations where doses might be skipped, using role-play and Barrows cards, and jointly identified the best times in the day to give the antibiotic. The session ended with a brief comprehension check where the parents were asked in their own words what they would do to make sure the treatment worked (evaluation). Teaching goals were that parents could correctly</p> | <p>three times between days 14 and 17, median 10 minutes to administer; and a second assessment 5-7 months after the visit.</p> |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|--|--|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  |  |  |  |  | <p>prepare and give the antibiotic, recognise and manage side effects, explain the importance of the treatment to other caregivers, identify the antibiotic by its generic name and specify a preferred flavour when collecting it from the pharmacist. A standardised interview grid kept all five pharmacist-educators consistent. Illustrated information sheets were given to parents at the end to take home.</p> <p>Comparator: Parents in an active control arm received a 30-minute therapeutic education session with the same structure, teaching tools and methods as the intervention, but covering fever control instead of antibiotic use. In both arms, the treating physician provided their usual verbal information about fever control and antibiotic treatment, with no specific</p> |  |
|--|--|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|                             |              |                                                                                                                                                                                                                |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             |              |                                                                                                                                                                                                                |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                    | instructions given to physicians about what to say.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                    |
| Ashiru-Oredope et al., 2020 | England (UK) | To evaluate the effect of antimicrobial stewardship webinar training combined with the TARGET TYI-RTI leaflet on general practitioner referrals and the provision of self-care advice in community pharmacies. | Study design:<br>Two-armed, non-blinded cluster randomised controlled trial.<br>Setting:<br>Independent and multiple/chain community pharmacies in urban and rural areas of South West England and one London locality, Southwark, London. | Participants: Community pharmacy staff and patients of any age presenting with common self-limiting respiratory tract infections. Excluded: patients requesting a specific product without seeking advice, patients presenting with an antibiotic prescription, and non-RTI self-care requests..<br>N: 272/903 pharmacies (30%) expressed interest and were randomised; 182 (67%) submitted consultation data (92 intervention, 90 control); 3,649 patient consultations recorded (1726 | Consultations were conducted by pharmacists (31.9% intervention, 28.4% control) and by healthcare counter staff (68.1% and 71.6%), with support staff able to refer patients on to the pharmacist. Pharmacy staff delivered self-care advice, provided the written leaflet, signposted to over-the-counter medicines, and made referral decisions. | Intervention name: TARGET 'Treating Your Infection - Respiratory Tract Infection' (TYI-RTI) community pharmacy leaflet plus an AMS training webinar.<br>Intervention description:<br>INTERVENTION ARM: a live AMS webinar for pharmacy staff (January 2018) covering AMS and instructions on using the TARGET TYI-RTI leaflet, and 50 printed copies of the TARGET TYI-RTI community pharmacy leaflet for use in everyday practice over four weeks with additional copies available on request or by photocopying. The leaflet functions as staff resource and take-home patient information covering the usual duration of common self-limiting respiratory | Delivery format:<br>Face-to-face, individual patient consultations in the pharmacy using a printed leaflet as both consultation and take-home resource; staff training delivered by live online webinar with an online recording; and data recorded on paper then entered into the PharmOutcomes online portal.<br>Duration/intensity:<br>One webinar and leaflet in use for 4 weeks. Consultation |

|                    |                |                                                                                                                                     |                                                                                                                                  |                                                                                                                                                                                                                                                      |                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                             |
|--------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                |                                                                                                                                     |                                                                                                                                  | intervention, 1923 control), mean 13.5 and 15.5 per pharmacy respectively. 296 COM-B questionnaires were completed by staff in 157 pharmacies (86% response) and process evaluation questionnaires were completed from 156 pharmacies and 177 staff. |                                                                                                                                                                          | infections, how to self-care, and when to seek further advice, and signposts patients to the Antibiotic Guardian pledge campaign. Pharmacies obtained further copies as needed. Comparator: CONTROL ARM: a live webinar covering only how to participate in the study. Control pharmacies continued normal practice with regular patient interactions for unaltered minor conditions, received no printed TARGET leaflets, but still completed data collection. | data was collected over a 2-week period (22 January - 4 February 2018), extended by a further 2 weeks at participating pharmacies' request because of workload.             |
| Attar et al., 2025 | India (Sangli) | To evaluate the impact of an antimicrobial stewardship programme on antibiotic utilisation and on antimicrobial resistance patterns | Study design: Prospective analytical before-after study. Setting: A 950-bed multispecialty private-sector tertiary care hospital | Participants: Consultants, resident doctors, and nursing staff across all patient care areas; and bacterial isolates from patient samples for resistance data. Patients were not enrolled directly and the requirement for                           | 5 clinical pharmacists co-led the programme's implementation efforts as part of a multidisciplinary AMS team. They conducted daily rounds in patient care areas with the | Intervention name: NR but defined as an AMS programme, established per ICMR guidelines and the CDC seven core elements. Intervention description: A multidisciplinary AMS committee formed at the end of 2021 and put together an antibiotic policy, updated against the current                                                                                                                                                                                | Delivery format: Face-to-face through rounds, meetings, lectures, and case discussions; written through antibiotic policy booklet, justification forms, structured feedback |

|  |  |                                         |                                                                                                                                                          |                                                         |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--|--|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | among organisms isolated from patients. | comprising 6 intensive care units, 7 surgical wards, 4 medicine and paediatrics wards and 4 high-dependency units; all patient care areas were included. | informed consent was waived.<br>N: NR for participants. | microbiologist, checked antibiotic justification forms, monitored escalation and de-escalation against culture reports, and delivered audit and feedback. | antibiogram, handed out in booklet form to every resident and consultant. Pharmacists and the microbiologist checked empirical therapy against policy on daily rounds. Residents had to fill out an antibiotic justification form in each patient's file within 24 hours of starting antibiotics. Consultants got day 7 or day 10 reminders to review continuation, and unjustified cases came up in weekly meetings. Quarterly meetings reviewed stewardship metrics and gave feedback to the consultants. Senior consultants counselled staff on culture-based therapy, backed by lectures, quizzes, and poster competitions through the year, and a WhatsApp group for updates on optimal antibiotic use. Residents worked from an MIC guiding table and VITEK AST guidance. Training covered day-one MDRO screening | forms, indicator reports, and MIC guiding table; and digital via WhatsApp group. Both individual and group. Duration/intensity: Five-year study period; pre-intervention 2019-2021 and post-intervention 2022-2023. Daily ward rounds; antibiotic justification form within 24 hours of initiation; day 7 or 10 review reminders; weekly case meetings; quarterly AMSP meetings and indicator feedback; and sensitisation |
|--|--|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                       |                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                                                                                                                                             |                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                           |
|----------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                       |                                                                                                                                                       |                                                                                                                                                                 |                                                                                                                                                                                                                                                             |                                                                                                                                                                                             | <p>for previously hospitalised patients, and PCR respiratory panels helped separate viral from bacterial pneumonia. The formulary was revised against the National List of Essential Medicines to cut irrational fixed-dose combinations, alongside infection control measures and staff training.</p> <p>Comparator: Pre-intervention period (2019-2021) in the same hospital but no concurrent control group.</p> | activities throughout the year.                                                                                                                                                           |
| Collazo et al., 2025 | United States (Texas) | To develop and pilot-test a patient-focused bilingual educational tool, created with patient and provider stakeholder input, to address inappropriate | <p>Study design: Qualitative two-phase study (development and pilot-testing), analysed by hybrid deductive-inductive thematic analysis.</p> <p>Setting: Two</p> | Participants: Patients (6 patient advisory board members; 12 pilot-phase patients, 6 per clinic) and healthcare professionals (8 focus group participants; 6 pilot-phase providers, 3 per clinic), including nurses, medical assistants, pharmacists, nurse | Pharmacists were among the non-prescriber healthcare professionals who participated in the development focus groups, giving feedback on content clarity, design, timing of distribution and | <p>Intervention name: Antibiotics - What You and Your Family Should Know, a trifold educational brochure functioning as a provider-patient communication tool.</p> <p>Intervention description: A bilingual (English and Spanish) trifold brochure developed iteratively with patient and</p>                                                                                                                       | <p>Delivery format: Printed brochure handed to patients in the clinic waiting area before the visit, then used face-to-face during the individual patient-provider consultation; also</p> |

|  |  |                                                              |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                        |
|--|--|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | antibiotic expectations and non-prescription antibiotic use. | community-based primary care clinics within the publicly funded Harris Health System, Houston, Texas, serving low-income and uninsured residents. The first is a continuity care clinic with a predominantly Black patient population. The second is a walk-in same-day clinic serving a predominantly Spanish-speaking Hispanic population, where patients may not have an assigned | practitioners and physicians. Patient advisory board members were bilingual adult residents of Harris County recruited via the Harris Health Patient Council. N: 32 participants in both phases; 18 patients and 14 healthcare professionals. In the pilot phase, 12 of 19 patients approached agreed to participate. | integration into clinical workflows. The tool itself was delivered by clinic staff and used by prescribers (physicians and nurse practitioners) during consultations. | provider stakeholder input over a two-step participatory process, informed by the research team's earlier quantitative survey and qualitative interviews on non-prescription antibiotic use. The brochure includes sections on appropriate antibiotic use, potential antibiotic harms, safe access to healthcare, and how to manage symptoms with over-the-counter alternatives, with an insert giving OTC medication recommendations for specific common symptoms. Content directly addresses misconceptions that antibiotics can treat colds, allergies and pain; discourages retaining, sharing or using leftover or non-medically sourced antibiotics; and covers completing the course, recognising a reaction, when it is appropriate to stop, and when to seek help. It was designed with health literacy and Hispanic | functions as a take-home resource for sharing with family and community. Duration/intensity: Pilot-testing ran from September to November 2023, with the brochure given once before a single clinic visit and discussed during that visit. The development phase comprised four patient advisory board meetings (August 2020 to September 2021) and three healthcare professional focus groups (2023). |
|--|--|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |              |                                                                                                                                                                           |                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                         |
|--------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |              |                                                                                                                                                                           | primary care provider.                                                                                                                                         |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                               | cultural and linguistic competency expertise for clear, concise language and an uncrowded layout. In the pilot, patients were randomly selected in clinic waiting areas, given the brochure before their visit and encouraged to discuss it with their provider; and providers used it during the consultation.<br><br>Comparator: NA.                                              |                                                                                                                                                                                                                                         |
| Hayes et al., 2023 | England (UK) | To assess the national implementation and uptake of the TARGET Antibiotic Checklist, antimicrobial stewardship e-learning, and the Antibiotic Guardian pledge through the | Study design: Service evaluation as part of a national implementation study with a cross-sectional follow-up questionnaire.<br><br>Setting: Community pharmacy | Participants: Community pharmacy teams and patients presenting with an antibiotic prescription.<br><br>Follow-up questionnaire respondents were mainly pharmacist managers (40%) and pharmacists (37%), from both chains and independents.<br><br>N: 10488 pharmacies declared completion of the AMS e-Learning (54399 | Pharmacists and the wider pharmacy team completed the safety and appropriateness checks, discussed the prescription with prescribing clinicians and the patient, delivered tailored counselling and self-care advice, and developed pharmacy- | Intervention name: Pharmacy Antimicrobial Stewardship Intervention (PAMSI), delivered nationally through the English Pharmacy Quality Scheme (PQS) through TARGET Antibiotic Checklist.<br><br>Intervention description: COM-B multiple component AMS intervention completed in 2020/21 PQS through staff e-Learning and Antibiotic Guardian pledge, and in 2021/22 PQS through the | Delivery format: Face-to-face, individual, at the pharmacy counter or in the consultation area; checklist completed on paper and/or directly online (UKHSA SnapSurvey). Staff education delivered online (e-Learning).<br><br>Follow-up |

|                    |              |                                                                                             |                                                            |                                                                                                                                                                                                                                                                                                                                                         |                                                                                |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|--------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |              | Pharmacy Quality Scheme, and to explore continued resource use and implementation barriers. |                                                            | registered pharmacists/technicians) with 148357 e-Learning session launches; Out of 11232 registered pharmacies, 8374 submitted data (74.5%) and 9950 (88.5%) committed to the AMS criteria; 213,105 TARGET Antibiotic Checklists were submitted (range 1-181 per pharmacy); and 105 staff completed the follow-up questionnaire (2% of 4,628 invited). | level AMS action plans.                                                        | TARGET Antibiotic Checklist. Patients self-report infection, risk factors, allergies and antibiotic knowledge; pharmacy staff use it to tailor counselling, run safety and appropriateness checks, contact prescribers where needed, and share TARGET self-care leaflets.<br>Comparator: NA | questionnaire online. Duration/intensity: Checklist used for 4 weeks (extendable to 8 weeks) to reach a minimum of 25 patients per pharmacy. PQS AMS domains ran across two consecutive years (2020/21 and 2021/22) and data submission window was September 2021 to March/May 2022 with Follow-up questionnaire 2-3 months after PQS declaration (July-October 2022). |
| Hayes et al., 2022 | England (UK) | To evaluate changes in community pharmacy staff                                             | Study design: Mixed-method before-after service evaluation | Participants: 101 pharmacy staff; 59% pharmacists, 18% dispensers, 11% managers,                                                                                                                                                                                                                                                                        | Pharmacists and the wider pharmacy team completed the AMS e-Learning, used the | Intervention name: PAMSL. Intervention description: Multiple component AMS intervention completed through staff e-                                                                                                                                                                          | Delivery format: Face-to-face in the community pharmacy during the                                                                                                                                                                                                                                                                                                     |

|  |  |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--|--|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | self-reported antimicrobial stewardship behaviours before and after PAMSI and to identify barriers and facilitators to implementation. | including pre and post intervention staff questionnaires and semi-structured staff interviews analysed by six-stage inductive thematic analysis. A supplementary patient follow-up questionnaire was also collected. Setting: Boots UK community pharmacies across England from various regions and store types. | 7% technicians, 4% pre-registration pharmacists, 1% trainee technician. 91 staff members completed the pre and 81 the post intervention questionnaire, and 6 pharmacists were interviewed. Separately, 2,043 patients completed a TARGET Antibiotic Checklist and 89 (10%) responded to the patient follow-up. N: 101 staff from 66 pharmacies; 6 interviewees; and 2,043 patient checklists. | TARGET Antibiotic Checklist with patients, performed safety and appropriateness checks against each prescription, tailored infection and antibiotic advice to patient-reported knowledge gaps, and asked prescribers where concerns arose. | Learning, the TARGET Antibiotic Checklist, and patient-facing materials. Staff used the patient's self-assessment to tailor counselling to identified knowledge gaps and to prompt conversations with prescribers. Comparator: NA. | dispensing episode with some checklists completed verbally on the patient's behalf, and leaflets included in deliveries or given to representatives. Staff e-Learning was delivered online. Duration/intensity: Staff used the resources for 4-6 weeks (October-December 2020). Estimated additional time was approximately 5 minutes per patient. Post-intervention questionnaires were December 2020-January 2021 and |
|--|--|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                        |                                                                                                                                                                         |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                                                                      |                                                                                                                                                                                                                               |
|--------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                        |                                                                                                                                                                         |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                                                                      | interviews February 2021.                                                                                                                                                                                                     |
| Jones et al., 2018 | England and Wales (UK) | To explore the experiences and perceptions of community pharmacists and pharmacy teams regarding antimicrobial stewardship in order to inform intervention development. | Study design: Qualitative study using semi-structured interviews and focus groups.<br>Setting: Community pharmacy; national pharmacy organisations and commissioning bodies. | Participants: Community pharmacists and pharmacy staff, general practitioners, primary care commissioners, a local authority programme manager, and representatives of pharmacy organisations (RPS, Pharmacy Voice, CPPE, PSNC, APTUK, NHS England, NPA).<br>Pharmacists aged 24-63 (mean 41); 18 male, 10 female; 16 independent, 5 small chain, 18 large chain, 2 locums.<br>N: 58 participants, including 28 pharmacists, 13 pharmacy staff, 8 GPs, 6 organisation | Study participants. | Intervention name: NA.<br>Intervention description: NA delivered.<br>Comparator: NA. | Delivery format: NA but data was collected through telephonic and face to face interviews as well as focus groups held within pharmacies.<br>Duration/intensity: NA but the interviews and focus groups lasted 30-60 minutes. |

|                       |                                 |                                                                                                                                                |                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                              |
|-----------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |                                 |                                                                                                                                                |                                                                                                             | representatives, 2 primary care commissioners, and 1 local authority programme manager.                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                              |
| Kristina et al., 2021 | Indonesia (Yogyakarta province) | To evaluate the effects of a pharmacist-initiated educational intervention on appropriate antibiotic use and self-medication with antibiotics. | Study design: Quasi-experimental single group pre-post intervention study.<br>Setting: Community residents. | Participants: Adult residents of Yogyakarta attending the Gema Cermat course recruited by convenience sampling.<br>65% female; 72% aged 25-45; 67.2% urban; 64% with a bachelor's degree; 51% with monthly income not more than 2 million IDR; 68% named pharmacists as their source of antibiotic information; 56% had taken antibiotics in the previous three months.<br>N: a pilot with 10 non-sample respondents and a total of 268 participants for the main study. | Designed and delivered the educational course, and face-validated the content and methods. | Intervention name: NR but delivered through the Indonesian 'Gema Cermat' community medicines-awareness programme.<br>Intervention description: A single structured two-hour didactic educational session delivered by pharmacists, combining lecture-based teaching with case presentation and discussion.<br>Content assessed respondents' knowledge of antibiotics on the basis of indication, access, administration, and resistance to antibiotics and their practice of usage.<br>Comparator: NA | Delivery format: Face-to-face, group-based.<br>Duration/intensity: One session of two hours. Pre-test administered one hour before the session; post-test administered to the same participants two weeks after the session. |

|                       |                           |                                                                                                                                                                                                                                   |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lakha et al.,<br>2024 | England and<br>Wales (UK) | To explore the impact of TARGET resources on the capability, opportunity, and motivation of pharmacy technicians in general practice when managing patients with acne, and to assess the usefulness of the acne review resources. | Study design: Mixed-methods, primarily quantitative pilot study.<br><br>Setting: Primary care and general practice. | Participants: UK-registered pharmacy technicians working in general practice. 17 were familiar with TARGET resources and 14 were not; post-registration experience ranged from 0-5 years to more than 20 years; responses came from England and Wales.<br><br>N: 31 pharmacy technicians (17 familiar with TARGET resources; 14 not familiar). Of those familiar, 2 used the resources regularly and only 1 had used the acne 'How to...' resource. | Pharmacy technicians are positioned as the workforce undertaking structured clinical reviews of patients on long-term or repeated antibiotics for acne, giving self-care advice, stepping down treatment and referring to the GP or pharmacist. | Intervention name: TARGET acne<br><br>'How to...' review resources; accompanying clinical scenarios.<br><br>Intervention description: The TARGET acne 'How to...' toolkit and clinical scenarios support structured review of patients on long-term acne treatment, to ensure prescribing is appropriate and to reinforce self-care and non-antimicrobial options. It covers acne information and modifiable risk factors, baseline and post-review clinical-system searches, implementation planning, the patient consultation, self-care, treatment, specialist referral, a flowchart for reviewing long-term antibiotic use, and embedding quality improvement. The study evaluated perceived usefulness of and familiarity with these resources via survey.<br><br>Comparator: Non-randomised between-group comparison within | Delivery format:<br><br>Online survey (Qualtrics XM), with a link to the toolkit provided in the survey. The toolkit itself is a written/online resource for individual practitioners and supports individual, one-to-one consultations between the practitioner and their acne patients.<br><br>Duration/intensity: NR. The survey was open for a limited timeframe; no session numbers, contacts or durations |
|-----------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                  |                                                                                                                        |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                  |                                                                                                                        |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                  | the survey. 17 Pharmacy technicians familiar with TARGET resources versus 14 not familiar.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | are reported for use of the resources.                                                                                                                                                                                                                                                                                                                                 |
| Lambert et al., 2025 | France, Greece, Lithuania, Poland and Spain (EU) | To evaluate the impact of a multifaceted intervention on the quality of antibiotic dispensing in community pharmacies. | <p>Study design: Prospective, non-randomised before-after implementation study conducted according to the Audit Project Odense (APO) methodology; reported per SQUIRE guidelines.</p> <p>Setting: Community pharmacies in five EU countries with differing levels and patterns of antibiotic use;</p> | <p>Participants: Community pharmacists and pharmacy technicians/assistants (English fluency not required), and patients presenting with a prescription for an oral antibiotic (prophylactic and veterinary dispensing was excluded). Approximately 60% of dispensings were to female patients; approximately 80% were dispensed by pharmacists and 20% by other pharmacy staff, ranging from 67% by pharmacists in Spain to 93% in Poland. N: 121 pharmacies signed</p> | <p>Community pharmacists and pharmacy technicians/assistants were simultaneously the target and the deliverers; they audited their own dispensing practice via a self-registration form, attended the feedback and communication training, and delivered safety checks, advice and patient educational materials at the point of dispensing.</p> | <p>Intervention name: HAPPY PATIENT (Health Alliance for Prudent Prescribing and Yield of Antibiotics in a Patient-Centred Perspective) multifaceted intervention.</p> <p>Intervention description: The HAPPY PATIENT intervention had four components delivered between the two audit rounds. The first was audit and feedback with peer review where pharmacy staff from each country attended an online or face-to-face meeting at which country-average results from the first self-registration were presented in collective reports, while individual pharmacy results were sent confidentially. Staff then discussed</p> | <p>Delivery format: Staff-facing components delivered were face-to-face and/or online, varying by country with Lithuania and Spain partly face-to-face and others, mostly or entirely online because of COVID-19 or geographical distance. There were also group meetings with small-group discussion, role-play, confidential individual feedback reports, and an</p> |

|  |  |  |                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>purposive sampling from local lists, with no restrictions on pharmacy size, location, staff expertise or experience.</p> | <p>up and completed the demographic questionnaire; 105 (87%) completed the first registration (2593 dispensed prescriptions); 91 (75%) completed both registrations and were included in the final analysis, with 2461 dispensed prescriptions in 2023 (5054 dispensings across both rounds). In 2022, there were 22 pharmacies from France, 15 from Greece, Lithuania 25, Poland 23, and Spain 20. Overall pharmacy dropout 12.5% (20% in Lithuania and Spain).</p> |  | <p>these results in small groups to identify where the dispensing process could improve, guided by local coordinators who asked open ended questions . The second was communication training, delivered in same or separate meeting, which taught basic techniques of patient professional communication and had staff practise clinical cases with colleagues through role play. Third was an online e-learning platform with intervention materials, first audit results, the EU Guidelines for the Prudent Use of Antimicrobials for Human Consumption, and a quiz on dispensing antibiotics which also let staff discuss clinical cases with other pharmacies. Finally, there was a set of patient education materials, co-designed across the five countries using a modified Delphi technique alongside the</p> | <p>individually used online platform. Patient-facing components were delivered face-to-face and individually at the point of dispensing, supplemented by a poster displayed in the pharmacy. Duration/intensity: Registration for at least 5 days or until 25 dispensed prescriptions per pharmacy, conducted at baseline (February 2022) and after the intervention (February 2023). One intervention meeting between the two rounds, with the communication</p> |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                               |
|--|--|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  |  |  | <p>scientific literature and the research group's practical experience, then produced in local languages by forward and backward translation from English and posted to each pharmacy. These included a poster on infections caused by viruses or bacteria for pharmacy display, a patient information leaflet used to tailor information on antibiotic dispensing, and cards with general information about antimicrobial resistance and antibiotic use. All materials were made freely available online and introduced to the staff during communication training who practised using them and were asked to use them when dispensing too.</p> <p>Comparator: Baseline, pre-intervention, registration in the same pharmacies in February</p> | <p>training delivered in the same or a separate meeting, plus ongoing access to the e-learning platform. Session durations NR.</p> <p>Attendance at intervention meetings varied with France having 59% attendance, Greece 73%, Lithuania 72%, Poland 65%, and Spain 80%.</p> |
|--|--|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                |                                                                                                                             |                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                |                                                                                                                             |                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                              | 2022 but no separate control group.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                   |
| Muñoz et al., 2014 | Spain (Murcia) | To assess the effectiveness of an educational intervention on antibiotic adherence and patient-reported symptom resolution. | Study design: Open-label controlled experimental study with systematic sequential assignment. Setting: A community pharmacy in Murcia, Spain. | Participants: Adults aged 18 years or over attending the pharmacy to collect oral antibiotics prescribed for themselves or for someone in their care. Mean age 44.6 years; approximately 67% female; commonest infection sites respiratory (43.7%) and dental (29.4%). N: 126 participants completed the study (62 control, 64 intervention). 140 were invited, 138 consented and 12 were lost to follow-up because they could not be contacted by telephone. | The head pharmacist drew up the antibiotic dispensing protocol and wrote a Dispensing Guideline that contained the most important pharmacological data on each antibiotic. The pharmacist assessed patient knowledge before the intervention, delivered the individualised verbal information, checked for clinically relevant interactions or contraindications, and assessed treatment effectiveness at repeat dispensing. | Intervention name: NR but described as an informed antibiotic dispensing protocol; the study itself is named Intervention in Compliance of AntiBiotics (ICAB). Intervention description: A structured verbal educational intervention delivered at dispensing where the pharmacist provided individualised spoken information to the patient or carer about the treatment characteristics of the prescribed antibiotic (duration, dose, dosing regimen and how to use it) together with information on correct adherence. The conversation took place privately and lasted approximately 20 minutes. Patient knowledge was assessed beforehand and | Delivery format: Face-to-face, individual, verbal counselling at the point of dispensing, delivered in a designated area away from the counter. Duration/intensity: A single session of approximately 20 minutes per patient. Adherence was assessed once, by telephone interview seven days after dispensing (delayed to the treatment end date for longer courses), conducted by an interviewer |

|  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                        |
|--|--|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  |  |  | <p>personalised information was provided to make up any detected gaps. On the first dispensing, the pharmacist also screened for any reason not to dispense the drug and confirmed the patient understood how to use it. On repeat visits, treatment effectiveness and safe and correct use were assessed using the same knowledge test. Written information was deliberately not provided.</p> <p>Comparator: A routine care control group where pharmacists followed their usual dispensing practice and answered any questions patients or carers raised on their own; they withheld the antibiotic when the criteria for non-dispensing were met. No structured education was given.</p> | <p>blinded to group allocation. The fieldwork for the study was conducted over eight months (January-August 2010).</p> |
|--|--|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|

|                            |              |                                                                                                                                                                                                           |                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Paravattil et al.,<br>2021 | Qatar (Doha) | To evaluate the appropriateness of antibiotic prescriptions in community pharmacy settings in Qatar and the implementation of an antibiotic call-back service to assess adherence and symptom resolution. | <p>Study design: Multicentre interventional study with cluster allocation and three arms; standard care, structured counselling, and call-back.</p> <p>Setting: Six community pharmacies in Qatar.</p> | <p>Participants: Patients presenting a prescription for an oral antibiotic to the community pharmacist and available to be contacted by telephone; both children (21.3%) and adults (52.5%) were included. Predominantly Asian (46.3%) and Qatari (22.5%) nationality; 61.3% male. Most common indications were dental (31.3%) and upper respiratory tract infection (30%), with the indication unknown in 21.3%. Two pharmacists from each participating pharmacy were invited to take part and received standardised training according to their arm.</p> <p>N: 80 patients completed the study; standard care</p> | <p>Community pharmacists were trained and assigned by arm and recruited patients. Study pharmacists delivered the intensive antibiotic counselling and, in the call-back arm, conducted the follow-up telephone call, during which they provided side-effect management counselling, antibiotic adherence counselling, and referral to the physician where symptoms were worsening.</p> | <p>Intervention name: NR but described as an interventional antibiotic call-back service with structured counselling.</p> <p>Intervention description: The study had two active arms, both delivered by trained community pharmacists. In the structured counselling arm, patients received intensive antibiotic counselling from the study pharmacist at the point of dispensing, covering how to take the antibiotic and its possible side effects. In the call-back arm, patients received the same intensive dispensing counselling plus a follow-up telephone call from the study pharmacist three to five days after starting the antibiotic, during which the pharmacist assessed progress, provided side-effect management counselling to 15% of patients and adherence counselling to a further 15%, and</p> | <p>Delivery format:</p> <p>Face-to-face individual pharmacist counselling at the point of dispensing (both active arms), plus an individual follow-up telephone call in the call-back arm.</p> <p>Duration/intensity: A single counselling session per patient at the point of dispensing, but duration NR. The call-back arm added one follow-up telephone call placed 3 to 5 days after antibiotic initiation, lasting a mean of 3.3 minutes (SD 2.388,</p> |
|----------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                     |                         |                                                                                                                                                                                                               |                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                          |
|---------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |                         |                                                                                                                                                                                                               |                                                                                                                                                                                                             | <p>25, structured counselling</p> <p>29, call-back 26.</p> <p>Pharmacist feedback was obtained from 4 pharmacists.</p>                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                        | <p>referred 3.8% to the physician where symptoms were worsening.</p> <p>Pharmacists in each arm received standardised training and instructions specific to their assigned group.</p> <p>Comparator: Standard care arm with routine dispensing in which counselling was provided at the discretion of the individual pharmacist.</p>                                                                                     | <p>range 1 to 10 minutes).</p>                                                                                                                                                                                                           |
| Pierce et al., 2021 | United States (Georgia) | <p>To implement and evaluate a pharmacist-managed culture and susceptibility review service aimed at reducing inappropriate antibiotic use by identifying mismatched antibiotic–bacteria combinations and</p> | <p>Study design: Quality improvement project with descriptive observational evaluation.</p> <p>Setting: Outpatient primary care and urgent care clinics at the Carl Vinson VA Medical Center, providing</p> | <p>Participants: Veterans presenting to primary care or urgent care clinics for therapy with positive culture, sensitivity results and a prescribed empiric antibiotic. Veterans not receiving antibiotic therapy were not eligible.</p> <p>Clinical/antimicrobial stewardship pharmacists delivered the service; healthcare providers were</p> | <p>Pharmacist-led and pharmacist-managed.</p> <p>Under an antimicrobial stewardship care coordination agreement signed by the medical review board, clinical pharmacists could modify existing antimicrobial regimens within their scope of practice without prior</p> | <p>Intervention name: Pharmacist-led (pharmacist-managed) culture and susceptibility review service.</p> <p>Intervention description: A care coordination agreement between pharmacy and outpatient healthcare providers permitted pharmacists to modify existing antimicrobial regimens within their scope of practice without contacting the provider first. A protocol based on current antimicrobial guidelines,</p> | <p>Delivery format: Telephonic individual patient contact and follow-up, supported by the electronic health record including CPRS dashboard, note templates, and electronic notification of providers. Also, certified letter if the</p> |

|  |  |                                                        |                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                   |
|--|--|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | characterising the cultures and organisms encountered. | care to approximately 30,000 veterans across central and southern Georgia; patient contact by telephone. | also affected by it. N: 675 veterans identified with pending culture results; 320 met the inclusion criteria; 10 required pharmacist intervention (7 regimen changes; 3 contacted but asymptomatic with no change made); 4 additional patients with positive cultures who were not on antibiotics were identified incidentally; 14 culture episodes were intervened on in total. | discussion with the prescriber. Pharmacists reviewed the culture dashboard daily, assessed antibiotic appropriateness, telephoned patients to assess symptoms, changed regimens where indicated, counselled and educated patients about the change, documented the intervention in the electronic record with the provider added as a co-signer, and conducted follow-up telephone calls after therapy completion. | commonly isolated organisms and local resistance patterns guided modification of therapy by culture type (e.g. skin and soft tissue, urine). A purpose-built Computerized Patient Record System (CPRS) dashboard identified patients with pending or completed cultures, displaying the initial antibiotics prescribed and the preliminary and final culture results. When a mismatched antibiotic-organism combination was identified, the pharmacist telephoned the patient and assessed symptoms; if the patient was still symptomatic, the pharmacist changed the antibiotic regimen and educated the patient about the change, documented an intervention note in CPRS and added the provider as a signer. After the regimen was complete, the pharmacist telephoned again to check that the medication had | patient could not be reached; and provider education by email and flyer. Duration/intensity: Service was implemented for 7 months (August 2019 - February 2020). Pharmacists reviewed the dashboard daily, spending 60-90 minutes on a typical day. Each intervened patient received one intervention call plus one follow-up call after regimen completion, with up to three telephone attempts. |
|--|--|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
|--|--|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  |  |  |  |  | <p>been taken as directed (number of days of therapy, tablets per day), to discuss any adverse effects and to assess symptom resolution; if symptoms persisted, the pharmacist contacted the primary care provider. If a veteran could not be reached after three telephone attempts, a certified letter was mailed. Providers were educated about the service by email and a flyer, and CPRS note templates were developed for interventions and follow-up.</p> <p>Comparator: NA formally; described against prior usual practice in which providers alone evaluated culture and susceptibility results and adjusted regimens. Providers continued to practise as usual while the service was implemented, and there was no concurrent control group.</p> |  |
|--|--|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|                            |                         |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radhakrishnan et al., 2023 | India (Potheri village) | To evaluate the effectiveness of pharmacist-delivered pamphlet-based and video-based educational tools in addressing gaps in public knowledge, attitudes, and practices related to antibiotic use. | <p>Study design: Concurrent parallel group single-blinded randomized control study with an allocation ratio of 1:1.</p> <p>Setting: A community outreach setting in the face of a medical camp run by SRM Medical College and Research Centre among the rural population of Potheri village, Kattankulathur, Tamil Nadu.</p> | <p>Participants: Adults aged over 18 from the rural population attending the medical camp, not from a healthcare background, and able to read and understand Tamil or English. 58% female; 30% aged 26-35, 26% aged 36-45; 43% intermediate education, 33% high school, 24% graduate/postgraduate; 53% middle income and 25% low income; 35% unemployed; and only 5% had a first-degree family member working in healthcare. All had taken antibiotics at least once, with 38% at least once every six months and 4% at least once a month.</p> <p>N: An estimate of 162 completing the study (81</p> | A lead clinical pharmacist delivered the counselling in both arms; and a team of clinical pharmacists and microbiologists developed, simplified and reviewed the educational content and confirmed the readability and reliability of the adapted questionnaire. | <p>Intervention name: NR but included video-based educational counselling by a clinical pharmacist compared to pamphlet-based counselling.</p> <p>Intervention description: Both arms received counselling from the same lead clinical pharmacist covering antibiotic-related information, antibiotic use, risk factors, antimicrobial resistance and adherence to the prescription. The intervention arm received video-based counselling, presenting this content visually through concise, simple demonstrations of appropriate antibiotic use and the reasons for antibiotic resistance; the usual care arm received the same content via a printed pamphlet. Content for both tools was drawn from WHO and Indian Council of Medical Research sources, simplified and reviewed by a team</p> | <p>Delivery format: Face-to-face, individual counselling at a medical camp; the intervention arm audiovisual (video-based) and the comparator arm printed pamphlet.</p> <p>Follow-up assessment conducted by telephone at three months.</p> <p>Duration/intensity: A single counselling session per participant with duration NR and pre-intervention assessment immediately beforehand and post-intervention</p> |
|----------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |       |                                                                                                                                                               |                                                                                                                                                                                                      |                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |
|----------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |       |                                                                                                                                                               |                                                                                                                                                                                                      | per arm), calculated from a pilot study at 95% CI with 5% error and allowing for 20% dropout. There was no loss to follow-up.                                                                                                                            |                                                                                                                                                                                                                                                            | of clinical pharmacists and microbiologists, and translated into Tamil by a senior faculty member from the Department of Tamil, with participants free to use Tamil or English materials. Comparator: Usual care group was the active comparator with pamphlet-based counselling delivered by the same clinical pharmacist and the same content. | assessment three months later by follow-up telephone call. The study was conducted from February to May 2022.                                                                                                                 |
| Sneddon et al., 2022 | Ghana | To explore antibiotic-prescribing behaviour among dental teams and their knowledge and beliefs regarding antimicrobial stewardship in two hospitals in Ghana. | Study design: Qualitative study using semi-structured interviews, with thematic analysis and behavioural specification using the AACTT framework. Setting: A 100-bed hospital in Accra and a 110-bed | Participants: 4 dentists, 4 pharmacists, 2 pharmacy technicians, 1 dental surgery assistant and 1 physician assistant, all involved in prescribing or supplying antibiotics for dental patients. N: 12 interviewees (7 at one hospital, 5 at the other). | Pharmacists and pharmacy technicians were 6 of the 12 participants, and the lead pharmacist at each hospital identified and approached potential participants as part of a wider Fleming Fund pharmacist-led UK-Ghana health partnership project (CwPAMS). | Intervention name: NA.<br>Intervention description: NA delivered or evaluated.<br>Comparator: NA.                                                                                                                                                                                                                                                | Delivery format: NA but data was collected through individual face to face or telephonic interviews conducted by a non-clinical researcher. Duration/intensity: Recruitment July-August 2021; interviews August-October 2021. |

|                    |                                      |                                                                                                                                                                                                           |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                      |                                                                                                                                                                                                           | government hospital in the Volta Region, both previously involved in AMS programmes.                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                | Participants described counselling and discussing antibiotic use with patients as part of the prescriber's role, but no pharmacist-delivered intervention was tested.                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                  |
| Vilić et al., 2025 | Croatia (Koprivnica-Križevci County) | To investigate the impact of clinical pharmacist counselling at hospital discharge on adherence to oral antibiotic therapy and to provide pilot evidence for the design of larger interventional studies. | Study design: Randomised controlled prospective interventional pilot study.<br>Setting: Department of Nephrology and Endocrinology, General Hospital Dr. Tomislav Bardek, Koprivnica; hospital inpatient | Participants: Adults aged 18 years or older, hospitalised at the Department of Nephrology and Endocrinology who were prescribed oral antibiotics at discharge. Excluded were those unable to communicate verbally, without a telephone, or declining consent. Median age 70 years (IQR 62-76); median 2 comorbidities (IQR 1-3), most commonly | The same clinical pharmacist performed the randomisation, administered the pre-discharge questionnaire, delivered the counselling intervention and conducted all follow-up telephone calls, ensuring uniformity of delivery and data collection. | Intervention name: NR but comprised of a clinical pharmacist counselling at hospital discharge.<br>Intervention description: Counselling was conducted by a clinical pharmacist, who first reviewed the discharge summary in the hospital information system to confirm the prescribed antibiotic, dosage, dosing interval, and treatment duration. The pharmacist then explained the importance of taking the antibiotic exactly as prescribed; discussed the potential consequences of | Delivery format: Face-to-face, individual, at the bedside before discharge; outcome assessment by individual telephone call.<br>Duration/intensity: A single counselling session at discharge but duration NR, followed by one telephone call within ten days of |

|                      |                                              |                                                                      |                                                                      |                                                                                                                                                                                                                                                                                                                                                                             |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                            |
|----------------------|----------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
|                      |                                              |                                                                      | at the point of discharge, with telephone follow-up after discharge. | hypertension (75.5%); 55.1% were taking five or more medications (polypharmacy), median 5 (IQR 2-8); 75.5% retired; and most had elementary or high school education. N: 98 participants randomised and allocated evenly in intervention and non-intervention groups (49 each) using Study Randomizer software; 94 included in the final adherence analysis (47 per group). |                                                                                     | inappropriate use (reinfection, rehospitalisation and antibiotic resistance); clarified the method of administration (dose, interval and duration); outlined possible side effects; and answered any patient questions about the therapy. All patient-specific advice, education and guidance was delivered before completion of the pre-discharge questionnaire. Comparator: Patients in the non-intervention group received no pharmacist counselling before discharge and left the ward following the hospital's standard discharge protocol. Both groups were informed of the follow-up phone call and completed the post-discharge questionnaire. | completing the prescribed antibiotic course. Recruitment ran from March 2022 to July 2025. |
| Warrier et al., 2025 | India (Kerala, Karnataka and Andhra Pradesh) | To evaluate the impact of clinical pharmacist-driven feedback within | Study design: Multicentre quasi-experimental before-after study      | Participants: All consecutive prescriptions for restricted antibiotics for inpatients during the                                                                                                                                                                                                                                                                            | A clinical pharmacist was recruited at each hospital and trained during ward rounds | Intervention name: NR but described as a clinical pharmacist-led AMS programme. Intervention description:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Delivery format: Face-to-face and by telephone; individual,                                |

|  |  |                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|--|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | <p>an antimicrobial stewardship programme across three hospitals operating without infectious disease physicians.</p> | <p>with three sequential phases. Setting: Inpatient setting in three private tertiary referral hospitals of differing sizes (600, 150 and 250 beds) within the same hospital system, in Kerala, Karnataka, and Andhra Pradesh. None had an established AMSP or an infectious disease physician on site, but all had published hospital antibiotic policies.</p> | <p>study period; prescribers (admitting doctors, residents and consultants) received the intervention. One clinical pharmacist was recruited at each of the three hospitals. N: Prescriptions for restricted antibiotics: 1,335 at baseline (3 months, about 445/month), 2,455 during intervention initiation (6 months) and 2,376 during consolidation (6 months, about 396/month). Three hospitals, three clinical pharmacists. No patient-level size reported.</p> | <p>and lectures by an infectious disease physician Project Champion on the hospital antibiotic policy and syndrome-based recognition of infections. Pharmacists reviewed all restricted-antibiotic prescriptions, assessed the indication against predefined criteria, and delivered same-day prospective feedback directly to prescribers.</p> | <p>Prospective audit and feedback delivered by clinical pharmacists across 3 phases. During 3-month baseline, pharmacists recorded policy adherence, dosing errors, and restricted antimicrobial consumption without any prescriber feedback or interaction. Over the next 6 months, pharmacists gave same-day individual feedback to prescribers, in person or by phone, on compliance with the hospital antibiotic policy for restricted antimicrobials. Because indications were undocumented, the pharmacist assessed them against predefined criteria. An infectious-diseases champion reviewed data weekly, fed back to pharmacists on syndrome-based diagnosis, and at six months presented aggregated indicators to prescribers, covering common deviations and possible</p> | <p>prescriber-level feedback, supplemented by a group presentation of aggregated data to prescribers. Duration/intensity: 15 months in total; baseline 3 months, intervention initiation 6 months, consolidation 6 months. Same-day feedback on every reviewed restricted-antibiotic prescription; weekly pharmacist-champion data review; and 6-monthly aggregate feedback presentation to prescribers.</p> |
|--|--|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
|--|--|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  |  |  |  |  | <p>improvements while inviting suggestions on how to improve adherence, changes to hospital antibiotic policy, and reducing errors. A final 6-month consolidation phase continued real-time prospective feedback on prescriptions.</p> <p>Comparator: Pre-intervention baseline audit period at the same three sites, during which there was no feedback or interaction between the clinical pharmacist and the prescriber or treatment team.</p> |  |
|--|--|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**Table 2 – Main Findings of Included Studies (N = 20)**

| Author(s), year    | Target behaviour                                                                                                                                                                                                                                                                                                                                                                          | Behavioural theory/framework & use                                                                                                                      | Behaviour Change Techniques (BCTs)                                                                                                                                                                                                                                                                                            | Communication & patient engagement                                                                                                                                                                                                                                                            | Measurements & outcomes assessed                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Main findings & barriers/facilitators                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aika & Enato, 2023 | PAEDIATRIC CAREGIVERS: appropriate antibiotic use including not requesting or pressing doctors or pharmacists for antibiotics, correct reconstitution and storage of powder antibiotics, correct dose measurement and dosing times, completing courses, not reusing or sharing antibiotics, and not re-purchasing antibiotics without consultation; also infection prevention behaviours. | Framework: None reported but the authors refer generically to behaviour change interventions as an antimicrobial stewardship strategy.<br>How used: NA. | 5.1 Information about health consequences (antibiotic side effects; what antibiotics can and cannot treat; consequences of misuse), 4.1 Instruction on how to perform a behaviour (how to reconstitute with cooled water, measure the dose, store the suspension and time doses), 6.1 Demonstration of the behaviour and 12.5 | Communication strategies: One-to-one counselling, explicitly described by the authors as mimicking a pharmacist counselling session in clinical practice; group oral presentation; visual communication via a poster flip chart; delivery in the local lingua franca (Nigerian Pidgin) rather | Measurements: Structured questionnaire in three sections developed from an extensive literature review; demographics, 10-item knowledge of antibiotics and infection prevention scored 0-50, 8-item appropriate antibiotic use scored 0-40, and five-point Likert with reverse scoring. Additionally, the poster flip chart for group arm, and SPSS v22 and GraphPad InStat. Outcomes assessed: Knowledge of antibiotics and infection prevention (score 0-50, good $\geq 40$ ); | Main findings: Across all 60 participants, good knowledge scores rose from 14 (23.3%) to 49 (81.7%), with mean knowledge increasing from 35.7 (SD 5.616) to 45 (SD 5.487) ( $p < 0.0001$ ). Good antibiotic use scores rose from 23 (38.3%) to 55 (91.7%), with mean use scores increasing from 29.82 (SD 4.949) to 36.92 (SD 3.997) ( $p < 0.0001$ ). Specific misconceptions were substantially corrected with belief that antibiotics treat malaria falling from 81.7% to 13.3%, antibiotics treat all diarrhoea and dysentery from 71.7% to 11.7%, bacteria are the only cause of cough, catarrh and cold from |

|  |  |  |                                                        |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--|--|--|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | Adding objects to the environment (poster flip chart). | than formal English; opportunity for participants to ask clarifying questions after the education. The authors also recommend that pharmacists supplement verbal with written instructions. Patient engagement strategies: Engagement was limited but the participants were able to ask questions for clarification after the education, and the education content was | appropriate antibiotic use practice score (0-40, good $\geq 32$ ); comparison between the one-on-one and group education arms. | 78.3% to 11.7%, antibiotics have no serious side effects from 51.7% to 15.6%, powder antibiotics can be reconstituted with hot or warm water from 71.7% to 6.7%, a previously prescribed antibiotic can be re-bought without consultation from 31.5% to 5%, and asking a doctor or pharmacist to prescribe antibiotics even when they do not want to from 26.7% to 5%. Both arms improved significantly, but one-on-one education was superior to group education after intervention for both knowledge (46.7, SD 4.027 vs 43.3, SD 6.249; $p = 0.0219$ ) and antibiotic use (37.9, SD 3.044 vs 35.93, SD 4.608; $p = 0.0399$ ).<br><br>Barriers/facilitators: BARRIERS: unregulated over-the-counter antibiotic sales in Nigeria, allowing caregivers to re-purchase a previously prescribed |
|--|--|--|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                                                                                                                                                                                                                          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>structured around the questionnaire the participant had just completed, giving some tailoring to identified gaps.</p> <p>No shared decision-making, goal setting, action planning or problem-solving is reported.</p> |  | <p>antibiotic without consultation; parental pressure on prescribers, with physicians risking loss of patients to other facilities or drug stores if they refuse antibiotic demands; caregivers rather than pharmacists reconstituting powder antibiotics at home because of limited hospital pharmacy manpower, compounded by a widespread misconception (71.7%) that hot or warm water may be used, which reduces efficacy; and lack of constant electricity for refrigerated storage, making pharmacist reconstitution of multiple bottles impractical.</p> <p>Authors also suggest that some environmental factors during delivery (such as noise from children and non-clinical staff calling names) and personal factors (such as caregiver impatience or distraction) may</p> |
|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                        | <p>have reduced the intervention's efficacy. FACILITATORS: one-on-one delivery tailored to the participant which mimics a clinical pharmacist counselling session and allows close observation; and delivery in the local lingua franca (Nigerian Pidgin) to ensure comprehension. The authors also recommend to supplement verbal reconstitution instructions with written ones.</p> |
| Allison et al., 2020 | <p>PHARMACY STAFF: checking antibiotic appropriateness and providing self-care and adherence advice when dispensing.</p> <p>PATIENTS AND CARERS: taking antibiotics as advised and at regular intervals, not sharing antibiotics, returning</p> | <p>Framework: Mainly COM-B model with cited Behaviour Change Wheel and Theoretical Domains Framework used by the preceding qualitative work that identified the determinants (Jones et al. 2018).</p> <p>How used: Used to develop the intervention and to frame the study aim and the evaluation questionnaires.</p> <p>Determinants had been identified in prior TDF-based qualitative work.</p> | <p>4.1 Instruction on how to perform a behaviour (verbal advice on how and when to take antibiotics, with/without food, at regular intervals),</p> <p>5.1 Information about health consequences (likely symptom duration,</p> | <p>Communication strategies: Personalised verbal counselling tailored to the patient's self-reported knowledge gaps; infection-specific self-care and safety-netting advice; plain-</p> | <p>Measurements: Antibiotic Checklist (A5 folded paper); TARGET infection-specific patient information leaflets (respiratory, urinary, dental, children's); posters, shelf signs, counter mats, prescription bag stickers, staff badges, Antibiotic Guardian window sticker; 20-minute educational</p> | <p>Main findings: 931 Checklists completed in one month, an average of 40% of antibiotics dispensed (range 3-100%). Patients/carers completed page 1 in 81% of cases and reported an indication in 93% (mainly respiratory 49% and urinary 22%). The knowledge page was completed by 80% and showed the largest gaps around expected recovery time, taking antibiotics</p>            |

|  |                                                                          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--|--------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | unused antibiotics to the pharmacy, and self-care for common infections. |  | side effects, consequences of incorrect use), 7.1 Prompts/cues (Checklist placed by the counter as a reminder; prescription bag stickers, posters, shelf signs, counter mats), 12.5 Adding objects to the environment (Checklist, leaflets, posters, counter mats, badges), 2.2 Feedback on behaviour (feedback to staff on checklist completion rate and user follow-up data), and 9.1 Credible source (pharmacist-delivered, | language written materials with patient-friendly graphics developed with information-design and health-literacy input; environmental prompts carrying consistent key messages; pharmacist-prescriber communication to query prescriptions. Patient engagement strategies: Patients/carers actively complete pages 1 and 2 of the Checklist, self-reporting | webinar (later converted to an e-learning module on e-LfH); PharmOutcomes recruitment platform; four electronic questionnaires (SelectSurvey); Epidata for data entry; CPD certificates for staff; GBP 10 high-street voucher for users completing Questionnaire A. Outcomes assessed: Feasibility (proportion of dispensed antibiotics for which a Checklist was completed; checklist completeness); staff-reported understanding, confidence, commitment and intention after the webinar; staff-reported facilitation of their AMS roles; patient/carer self-reported knowledge gaps and reported indication; | with food, side effects, use of alcohol, and returning unused antibiotics to the pharmacy. All 43 staff reported the webinar increased their understanding, confidence, commitment and intention to use the tools; 12/13 reported the webinar and tools facilitated their AMS role well or very well. The staff rated leaflets 77% essential and webinar/Checklist/poster/counter mat 69% each while users rated Antibiotic Checklist 86% essential and information provided by pharmacy staff 68%. Of user Questionnaire A respondents, 48% newly intended to return unused antibiotics and 50% already did so. All 24 Questionnaire B respondents reported taking their antibiotics at regular intervals as advised, and none reported sharing antibiotics. Barriers/facilitators: BARRIERS: |
|--|--------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |                             |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|--|--|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | NHS/PHE-branded materials). | <p>their infection, history, risk factors and their own knowledge gaps, which then directs the content of the consultation.</p> <p>Patient representatives were involved in co-designing the intervention across three workshops. No shared decision-making, goal setting or action planning reported.</p> | <p>patient intention to return unused antibiotics; self-reported adherence behaviour at ~1 week; staff and user views on which components were essential.</p> | <p>lack of funding and workload pressure (reasons for non-participation or withdrawal); the webinar being too quiet to hear in a busy pharmacy and hosted on a platform restricted in community pharmacy; February being an especially busy month because of national quality scheme deadlines (low recruitment); the paper format unusable for patients not collecting their own prescriptions; printing costs; and COVID-19 infection-prevention measures affecting paper-based tools. FACILITATORS: the Checklist fitted operational practice and the prescription basket; staff placed it by the front counter to act as a reminder; extensive stakeholder co-design gave staff ownership and fitness for purpose; the webinar could be accessed remotely at a convenient time; the Checklist overcame the</p> |
|--|--|--|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                        |                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |                                                                                                                                                        |                                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                | long-standing barrier of not knowing the indication; and CPD certificates for staff and vouchers for users supported participation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Almomani et al., 2023 | Patient adherence to the prescribed short-term antibiotic regimen: taking the prescribed number of daily doses and completing the prescribed duration. | Framework: None reported.<br>How used: NA. | 4.1 Instruction on how to perform a behaviour (correct administration method, timing, and what to do if a dose is missed), and 5.1 Information about health consequences (possible adverse effects and self-management of side effects). | Communication strategies: Standardised individualised verbal education tailored to the specific antibiotic prescribed; structured coverage of mechanism, administration, timing, side-effect self-management and missed-dose action; and substantially longer contact time than routine care (20-25 versus | Measurements: Standardised education content for the 10 commonest antibiotics prepared from the Lexicomp drug information database; structured face-to-face baseline interview collecting sociodemographic, clinical and antibiotic-use data; telephone follow-up adherence assessment combining a subjective method (self-reported missed doses or days) and an objective method (number of untaken or remaining pills); SPSS | Main findings: Overall, 318/589 of patients (54%) were adherent. Patients in the intervention group were significantly more likely to be adherent than controls (OR 1.445, 95% CI 1.029-2.030, $p = 0.033$ ). Other independent facilitators of adherence were being employed (OR 1.535, 95% CI 1.074-2.192, $p = 0.019$ ) and having searched for information about the prescribed antibiotic (OR 1.664, 95% CI 1.057-2.622, $p = 0.028$ ). Higher dosing frequency predicted poorer adherence relative to once-daily regimens, with three-times-daily dosing returning an OR of 0.094 (95% CI 0.018-0.497, $p = 0.005$ ) and twice-daily an OR of 0.201 |

|  |  |  |  |                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>10 minutes). The telephone follow-up served measurement rather than reinforcement. Patient engagement strategies: One-to-one tailored education addressing the patient's own prescribed antibiotic; self-management guidance equipping patients to handle side effects and missed doses independently. The authors note that patients who sought</p> | <p>v23. No patient-facing leaflets, visual aids or digital tools were used, as education was delivered verbally. Outcomes assessed: PRIMARY: adherence to the short-term antibiotic regimen, assessed two days after completion of the course, with patients classified non-adherent if they failed to follow the number of daily doses and/or the duration as prescribed. SECONDARY: pattern of antibiotic utilisation by class, gender, age group, comorbidity and indication; factors associated with adherence (multivariate logistic regression); patient-reported reasons for</p> | <p>(95% CI 0.081-0.495, <math>p \leq 0.01</math>). The most common reasons for non-adherence were already feeling better (35.3%), forgetting to take the medicine (24.2%) and carelessness (13.8%). Penicillins were the most prescribed class (38.7%), followed by fluoroquinolones (23.9%) and cephalosporins (20.9%); 48.1% of courses were for seven days and 62.7% prescribed twice daily. Barriers/facilitators: NR as a formal analysis but contextually identified to be BARRIERS: higher dosing frequency (twice or three times daily); early discontinuation once symptoms improve; forgetfulness and carelessness. The authors acknowledge that adherence was self-reported and subject to recall bias, mitigated by measuring two days after course completion, and that the single-centre tertiary</p> |
|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                         |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                               |                                                                                                                                                                                                                                            |                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                     |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                               | information about their antibiotic were significantly more adherent, and recommend that patient education become a regular element of dispensing. No shared decision-making, goal setting, action planning or problem-solving is reported. | missing doses or not completing treatment; and use of other sources of antibiotic information.                                                                                                                               | hospital setting limits generalisability. FACILITATORS identified in the regression: pharmacist-led education; employment; patient information-seeking about the prescribed antibiotic; and simpler once-daily regimens.                                            |
| Angoulvant et al., 2013 | PAEDIATRIC CAREGIVERS: Parents' adherence to their child's prescribed antibiotic course including completing the course, avoiding skipped doses, correct preparation, | Framework: None reported as a behavioural theory but the session design followed 1998 WHO and 2007 French National Authority for Health (HAS) recommendations for therapeutic patient education, and the sessions were characterised using the educational/behavioural/organisational component classification of Wu et al. | 1.1 Goal setting – behaviour (mutual determination of session objectives, educational contract), 1.2 Problem solving (maximising adherence in | Communication strategies: Interactive, learner-centred counselling with the educator acting as a resource and guide rather than                                                                                                            | Measurements: Barrows cards (drawing tools created for the sessions); illustrated information sheets given to parents; samples of different oral solution forms of the prescribed antibiotics and antipyretics for practical | Main findings: At day 14, satisfaction with the information on antibiotics was significantly higher in the intervention group [96.9% (125/129) vs 83.0% (108/130); p = 0.002, exact Fisher]. In a conservative intention-to-treat analysis imputing missing data as |

|                                                                                                          |                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| administration and storage of the oral liquid; and avoidance of saving and reusing leftover antibiotics. | (2008).<br><br>How used: The WHO/HAS therapeutic patient education framework was used to develop the intervention, providing its four-stage structure (educational diagnosis, educational contract, education and evaluation). The Wu et al., 2018 classification was used to describe and characterise the intervention's components. | everyday situations, solutions to avoid spitting and mask flavour), 1.4 Action planning (joint identification of the best dosing times during the day), 4.1 Instruction on how to perform a behaviour (preparation, administration, storage and dosing), 5.1 Information about health consequences (treatment effects, side effects, germs surviving if the course is not completed), 6.1 Demonstration of the behaviour (practice demonstration with | a lecturer; well-defined open questions; an educational diagnosis eliciting existing knowledge, beliefs and behaviours before teaching; a standardised interview grid; drawings, Barrows cards and illustrated information sheets as visual communication aids; role-play; and a comprehension check via an open question at the end (a teach-back style approach). | demonstration; a standardised interview grid; a day-14 telephone questionnaire of 11 standardised structured items (satisfaction, agreement and difficulty Likert scales, with attitude items derived from Pechere et al. 2007), checked for reliability in 10 individuals before the study; a month-6 attitude questionnaire; and SAS v9.12. Outcomes assessed: PRIMARY: proportion of parents satisfied with the information on antibiotics received at the hospital, at day 14. SECONDARY: parent satisfaction with information on fever control; parent attitudes about judicious antibiotic | unfavourable, the difference persisted [82.7% (124/150) vs 72.0% (108/150); $p = 0.018$ ]. As expected, satisfaction with fever-control information was higher in the control arm (96.9% vs 89.1%, $p = 0.01$ ). Intervention parents gave significantly more correct answers on attitudes to judicious antibiotic use at day 14 [5 correct answers 44% (57/129) vs 37% (48/130) and 6 correct 36% (46/129) vs 28% (36/130); $p = 0.017$ , Mann-Whitney U]. The difference was driven chiefly by two items; leftover antibiotics can be saved and used again ( $p = 0.04$ ) and if my child doesn't finish all of the antibiotics, some of the germs may survive ( $p = 0.02$ ). No difference was seen for taking a few antibiotic doses is better than taking none at all, which had the lowest proportion of correct answers (about 50%) in |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>different oral solution forms), 8.1</p> <p>Behavioural practice/rehearsal (role-playing and the Barrows cards exercise), and 12.5</p> <p>Adding objects to the environment (illustrated information sheets given to parents).</p> | <p>Sessions were delivered in French only.</p> <p>Patient engagement strategies: Mutual determination of the session objectives with the parents (educational contract); active elicitation of parents' knowledge, beliefs and behaviours as the starting point; explicitly encouraged interactivity; role-playing and problem-solving exercises about real everyday</p> | <p>use (6 of the 11 items) at day 14 and month 6; reported difficulty giving the antibiotic on schedule; and resolution of the acute infection.</p> | <p>both groups. There were no significant differences in reported difficulty giving the antibiotic on schedule (72.1% vs 74.6% easy, <math>p = 0.65</math>) or in infection resolution.</p> <p>At month 6 there was no significant between-group difference in attitudes (<math>p = 0.73</math>), indicating the effect was not sustained.</p> <p>Barriers/facilitators: NR as a formal analysis but the authors' feasibility observations and limitations suggested</p> <p>BARRIERS: the 30-minute pharmacist-delivered session demands financial and human resources unlikely to be available everywhere and extended the emergency-department stay; a pharmacist was not available every day or around the clock; parents with poor French were excluded, as the team could not deliver sessions in other</p> |
|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                    |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                   |                                                                                                                                                           |                                                                                                                                                                                                            |                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    |                                                                                                                                                                 |                                                                                                                                                                                                                                                                                   |                                                                                                                                                           | <p>adherence situations; joint identification of the best dosing times; and freedom to ask any questions, including on the other arm's topic.</p> <p>No shared decision-making about treatment choice.</p> |                                                                                                                                                                                    | <p>languages, limiting reach in a linguistically diverse population; and the day-14 effect was lost by 6 months, suggesting a need for reinforcement. FACILITATORS: high acceptability and feasibility as 298 of 300 families (99.3%) completed the full session; the multi-component design was more effective than single-component approaches; the session can be segmented and delivered by therapeutic-education-trained nurses or moved to the pharmacy at dispensing to ease resourcing.</p> |
| <p>Ashiru-Oredope et al., 2020</p> | <p>PHARMACY STAFF: providing self-care advice and written information for self-limiting RTIs, appropriate referral to a GP, referral to the pharmacist, and</p> | <p>Framework: COM-B model. The study also builds on prior BCW-informed qualitative work (Jones et al. 2018). How used: Prior BCW qualitative work informed the rationale and COM-B model was used to design the 25-item behavioural assessment questionnaire (7 capability, 3</p> | <p>4.1 Instruction on how to perform a behaviour (webinar training on AMS and leaflet use; self-care instructions to patients), 5.1 Information about</p> | <p>Communication strategies: Self-care conversations structured and cued by the leaflet; provision of plain-language written patient</p>                                                                   | <p>Measurements: TARGET TYI-RTI community pharmacy leaflet; AMS training webinar; control webinar; briefing notes; printed consultation data input sheet; PharmOutcomes online</p> | <p>Main findings: The intervention reduced the likelihood of GP referral (adjusted OR 0.91 overall), significantly so for middle ear infection (aOR 0.18) and sinusitis (aOR 0.20), with the effect greatest in the first two weeks; self-care advice was given</p>                                                                                                                                                                                                                                 |

|  |                                                                                                                                                          |                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>signposting to over-the-counter medicines.</p> <p>PATIENTS: self-care for self-limiting RTIs rather than seeking a GP appointment or antibiotics.</p> | <p>opportunity, 6 motivation and 9 behaviour items) and to evaluate and interpret influences on pharmacy staff behaviour and the intervention's likely mechanisms of action. The questionnaire was reviewed by the Centre for Behaviour Change, UCL.</p> | <p>health consequences (expected illness duration, when to seek help, antibiotic resistance), 12.5 Adding objects to the environment (50 printed leaflets supplied per pharmacy), 7.1 Prompts/cues (leaflet triggering and structuring self-care conversations), 1.9 Commitment (signposting patients to the Antibiotic Guardian pledge) - uncertain, and 9.1 Credible source (PHE/TARGET-branded materials).</p> | <p>information on expected illness duration; safety-netting advice on when to seek further help; explaining why antibiotics are not needed for self-limiting infections; signposting to over-the-counter medicines and to the Antibiotic Guardian campaign; and referral communication to pharmacists and GPs. Patient engagement strategies: The leaflet was used</p> | <p>data recording portal; 25-item COM-B behavioural assessment questionnaire; process evaluation questionnaire; GBP 50 participation incentive per pharmacy; and Microsoft Excel and STATA v13. Outcomes assessed: PRIMARY: self-reported referrals to GPs. SECONDARY: provision of self-care advice; provision of written information; referrals to a pharmacist by other pharmacy staff; signposting to non-prescription medicines; uptake of resources. Also, COM-B, barriers and facilitators to advice-giving, and process evaluation (ease of participation, data</p> | <p>provided more frequently in the intervention arm (<math>p = 0.06</math>), with the effect increasing in the later two weeks. COM-B (both arms): 95% knew what advice to give but 25% found it hard to explain why antibiotics weren't needed, and 41% lacked time. Staff reported a mean of 7.2 self-care conversations and 6.4 occasions of giving resources per person per day, and 3.3 daily missed opportunities. Only 14% had done AMR training in the past year and staff found the leaflet a useful tool that integrated into standard practice. Barriers/facilitators: BARRIERS: lack of time and competing pressures (40.8% of staff; 63.3% cited being too busy and 11.9% other things more important for incomplete data collection); forgetfulness (54.8%); difficulty explaining antimicrobial</p> |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                                                                                                                                                                                                                                                               |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>interactively during the consultation as a shared resource and given to the patient to take home; patients were signposted to the Antibiotic Guardian pledge. No shared decision-making, goal setting, action planning or problem-solving is reported.</p> | <p>completeness, acceptability).</p> | <p>resistance in lay terms (25.3%); patients in a hurry to leave; the winter RTI season being an exceptionally busy period with reported under-staffing; and low levels of prior AMR training. FACILITATORS: the printed leaflet triggering conversations and facilitating a short consultation, and supporting integration into standard pharmacy practice; a take-home resource for patients; the webinar training; feeling supported to give self-care advice (79.1%); Local Pharmaceutical Committee support in study design and recruitment; and the GBP 50 participation incentive. A suggestion was to shorten and simplify the leaflet.</p> |
|--|--|--|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Attar et al., 2025 | <p><b>PRESCRIBERS:</b></p> <p>selecting empirical antibiotics per policy, using culture-based or targeted therapy, prescribing the correct dose and duration, appropriate choice and timing of surgical prophylaxis, de-escalation and IV-to-oral switch, and avoiding irrational fixed-dose combinations and dual antibiotics with overlapping or dual anaerobic cover.</p> | <p>Framework: None reported.</p> <p>How used: NA but the CDC core elements framework was used to structure the design and implementation of the programme.</p> | <p>2.2 Feedback on behaviour (case-level feedback during rounds, structured feedback forms, quarterly indicator data), 2.7 Feedback on outcome(s) of behaviour (quarterly AMS metrics), 7.1 Prompts/cues (day 7/10 review reminders; antibiotic justification form attached to the file), 4.1 Instruction on how to perform a behaviour (antibiotic policy booklet, MIC guiding table, lectures, diagnostic stewardship training), 12.5 Adding objects to</p> | <p>Communication strategies: Regular case-by-case communication and discussion with consultants during daily rounds; counselling for antibiotic modification by senior medicine and paediatrics consultants; structured feedback forms; weekly case discussions and quarterly meetings; a WhatsApp group linking the AMS team with consultants and</p> | <p>Measurements: Hospital antibiotic policy booklet with antibiogram annexure; antibiotic justification form; structured feedback forms; MIC guiding table and VITEK AST interpretation guidance; WhatsApp group; quarterly AMS indicator reports; guest lectures, quizzes and poster competitions; PCR respiratory panels; VITEK 2 identification system; Microsoft Excel and IBM SPSS v29.</p> <p>Outcomes assessed: Antibiotic utilisation overall and by agent (DDD/100 bed days); antimicrobial resistance patterns for six organism groups over five years; correlation between</p> | <p>Main findings: Overall antibiotic consumption fell 15% (1681.0 to 1420.0 DDD/100 bed days), with large reductions for ceftriaxone (23.36 to 6.75, about 71%) and amikacin (9.03 to 5.15, about 42%), and irrational fixed-dose combination use fell 28% (98.1 to 70.3 DDD/100 bed days). Quality indicators improved markedly with empirical antibiotics per policy changing from 73% to 96%; surgical prophylaxis per policy 58% to 96%; correct dose and duration 83% to 93%; culture-based therapy 61% to 90%; surgical prophylaxis timing 79% to 98%. Resistance fell for gentamicin, amikacin and teicoplanin but rose for several others, with a significant positive utilisation-resistance correlation for ceftriaxone in <i>Klebsiella</i> and <i>Acinetobacter</i> and meropenem in <i>Acinetobacter</i> (<math>R = 0.9</math>, <math>p =</math></p> |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                            |                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>the environment (policy booklets, justification forms, PCR panels), 1.2 Problem solving (weekly meetings discussing unjustified antibiotic use), 2.3 Self-monitoring of behaviour (prescriber-completed justification forms), 6.2 Social comparison (shared indicator data, quizzes and poster competitions), and 9.1 Credible source (counselling by senior consultants).</p> | <p>residents; and sensitisation through guest lectures, quizzes and poster competitions. Patient engagement strategies: None reported. Patients were not participants.</p> | <p>utilisation and resistance (Spearman); AMS quality indicators; irrational fixed-dose combination use; and AWaRe classification distribution.</p> | <p>0.037). Watch-group antibiotics dominated consumption (64-79%), with an Access:Watch ratio of 0.2-0.4, far below the WHO-recommended 1.5. Barriers/facilitators: BARRIERS: de-escalation was difficult in critical care because most patients had already received higher antibiotics and were colonised or infected with MDRO; low baseline compliance with culture-based therapy in medicine, surgery, orthopaedics and ENT; preauthorisation was not feasible in this setup; a high MDRO burden as a referral centre receiving antibiotic-exposed patients; high prevalence of ESBL, AmpC co-producers and carbapenem-resistant organisms limiting Access-group use. FACILITATORS: hospital leadership commitment with human, financial and IT</p> |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                             |                                                                                                                                                     |                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                             |                                                                                                                                                     |                                                                                                                                                                                                                               | resources; a multidisciplinary AMS team; regular case-by-case communication rather than restrictive measures; structured feedback; accessible antibiotic policy booklets; the WhatsApp group; year-round sensitisation activities; provision of PCR diagnostics that reassured physicians; growing prescriber reliance on clinical pharmacists and microbiologists over time; and particularly strong compliance among paediatricians. |
| Collazo et al., 2025 | PATIENTS: non-prescription antibiotic use (using leftover, shared or non-medically sourced antibiotics), inappropriate expectations and demand for antibiotics, completing | Framework: None reported for this study but the Kilbourne Framework of Health Disparities research was used in an earlier quantitative phase of the wider five-year project. How used: The Kilbourne framework was applied in a prior phase of the project to examine the relationship between patient, clinical encounter and healthcare system factors and non- | 5.1 Information about health consequences (potential antibiotic harms, dangers of non-prescription use, resistance), 4.1 Instruction on how to perform a behaviour (how and | Communication strategies: Written patient education in plain, concise language, bilingual in English and Spanish, designed with health literacy and | Measurements: Trifold bilingual brochure Antibiotics - What You and Your Family Should Know with an insert on managing symptoms with OTC alternatives (reproduced as a figure in the paper); focus group and interview guides | Main findings: DEVELOPMENT PHASE (three themes): On what to say, the tool had to correct common misconceptions, patients from holding onto leftover antibiotics or sharing them, cover completing the course, recognising reactions and knowing when to seek help, and help manage patients'                                                                                                                                           |

|  |                                                                                                                                                                                                                          |                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>prescribed courses, and managing symptoms with OTC alternatives instead of antibiotics.</p> <p><b>PROVIDERS:</b> communicating about appropriate antibiotic use and resisting inappropriate prescribing pressure.</p> | <p>prescription use; findings from that phase and from subsequent qualitative interviews informed the content of the tool even though no direct behavioural theory was applied within this study.</p> | <p>when to take antibiotics, completing the course, which OTC medicines to use for specific symptoms, when to seek help), 12.5 Adding objects to the environment (brochure available in clinics and taken home), 9.1 Credible source (providers reported the tool legitimised their message and gave them credibility), and 8.2 Behaviour substitution (OTC alternatives offered in place of antibiotics).</p> | <p>cultural/linguistic competency input and a deliberately uncrowded layout; the brochure used as a conversation prompt and communication bridge to open patient-provider discussion; providers used it to reframe expectations and to explain why antibiotics were not indicated in conversations they described as otherwise uncomfortable; and patients were encouraged to ask questions.</p> | <p>developed by team members with expertise in AMS, qualitative research, health literacy and Hispanic cultural and linguistic competency; Atlas.ti v25; and incentives including 25 USD prepaid card for patient advisory board members per meeting, focus group participants and pilot patients, and 50 USD for providers.</p> <p>Outcomes assessed: Qualitative content and design priorities for the tool; feasibility, acceptability and communication impact of the brochure; integration into clinical workflows; effect on patient-provider communication; and</p> | <p>expectations of receiving antibiotics. Healthcare professionals acknowledged that providers sometimes prescribe antibiotics to save time or avoid an uncomfortable conversation. On how to say it, the language had to be clear and short, with a simple, uncrowded layout, since too much text puts patients off. On where to say it, distribution needed to be consistent and accessible, systematically built into busy clinic workflows so the information was available before, during and after appointments.</p> <p><b>PILOT PHASE (three themes):</b></p> <p>On integration into clinical workflows, providers said the tool fit existing routines and save time during patient education, and used it responsively when patients disclosed non-prescription use. On supporting patient-provider communication,</p> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                            |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>Patient engagement strategies: A patient advisory board of six bilingual patient representatives across four clinics met four times to identify educational needs, recommend strategies for patient engagement, review previous quantitative and qualitative findings and advise on reducing non-prescription use, and patients were also involved in pilot-testing</p> | <p>reframing of patient antibiotic expectations.</p> | <p>the tool worked as a bridge prompting questions from both sides and improved shared understanding; patients intended to keep it and share it with family and community, extending its reach beyond the counter. On reframing expectations, providers used the tool to support conversations when antibiotics were not indicated, explaining that it legitimised their message and lent them credibility, and noted that patient expectations were shaped by cultural norms and prior healthcare experiences, including in countries where antibiotics are readily available. Patients particularly valued the OTC alternatives for symptom relief.</p> <p>Barriers/facilitators: BARRIERS: busy clinic environments and time constraints making consistent distribution difficult</p> |
|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                    |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>(formal patient and public involvement statement). At the point of care, patients were given the brochure before the visit and encouraged to discuss it with their provider and ask questions, supporting shared understanding, and reported intending to keep it and share it with family and community. No formal shared decision-making, goal setting or</p> |  | <p>without systematic workflow integration; provider pressure from patient expectations, compounded by value-based care contracts in which patient satisfaction scores affect reimbursement; patient disappointment and concern when antibiotics are declined; cultural norms and prior healthcare experiences favouring antibiotics; and patient refusal to participate due to lack of interest, time or feasibility.</p> <p>FACILITATORS: stakeholder co-design with both patients and healthcare professionals; simple, bilingual, health literacy-appropriate design; the tool perceived as saving consultation time; a tangible artefact that legitimised the provider's message in difficult conversations; the take-home format enabling onward sharing</p> |
|--|--|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                        | action planning is reported.                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                | with family and community; and participant incentives.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Hayes et al., 2023 | PHARMACY STAFF: checking the safety and appropriateness of antibiotic prescriptions, contacting prescribers, and providing tailored self-care, adherence and safety-netting advice. PATIENTS: appropriate antibiotic use, adherence and understanding of their antibiotics. | Framework: COM-B (capability, opportunity, motivation - behaviour) model.<br><br>How used: Foundation for the development of pharmacy antimicrobial stewardship intervention (PAMSI). | 1.4 Action planning (pharmacy AMS action plan), 1.9 Commitment (Antibiotic Guardian pledge), 4.1 Instruction on how to perform a behaviour (e-Learning module, counselling on how to take antibiotics), 5.1 Information about health consequences (AMR and self-care/safety-netting messages in the TARGET leaflets and counselling), 7.1 Prompts/cues | Communication strategies: Structured, personalised verbal counselling tailored to the patient's self-reported knowledge gaps; self-care and safety-netting advice for common infections; written patient information leaflets; PQS criteria explicitly required adopting principles of | Measurements: TARGET Antibiotic Checklist (paper and digital versions); TARGET patient information leaflets (respiratory, urinary, dental, children's - self-care and safety-netting); UKHSA 'AMS for Community Pharmacy' e-Learning module (hosted on e-Learning for Healthcare); Antibiotic Guardian pledge website; pharmacy AMS action plan; UKHSA SnapSurvey (Snap11) online data collection platform; online follow-up questionnaire; QSR NVivo 2020 and | Main findings: 8374/11232 pharmacies (74.5%) submitted 213105 checklists; 86% met and 44% exceeded the 25-checklist requirement. Safety checks were recorded in 81-95% of checklists and 83% were fully completed. Prescriber contacted for 2741 (1.3%) most common reasons being strength, dose, duration, quantity, and formulation (845; 30%) which changed in 34% of the 900 with recorded outcomes. Another 21% resulted in an alternative antibiotic and 3% were cancelled. Antibiotic Guardian pledges from pharmacy teams rose from 2211 (2019) to approximately 28000 (2020-21). According to the follow-up |

|  |  |  |                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>(Antibiotic Checklist prompting the series of checks), 12.5 Adding objects to the environment (Checklist, patient leaflets), and adding objects to the environment (Checklist, patient leaflets), and 10.1 Material incentive (PQS remuneration specifically targeted at contractors).</p> | <p>shared decision-making; and pharmacist-prescriber communication to discuss prescription concerns. Patient engagement strategies: Patients complete the self-report section of the Checklist which directs the one-on-one consultation although 75% of respondents reported that staff read the questions aloud and entered answers themselves. PQS</p> | <p>Microsoft Excel for analysis.</p> <p>Outcomes assessed: PAMSI Uptake; proportion of antibiotic safety and appropriateness checks completed; frequency, reasons for and outcomes of prescriber contacts; checklist completion/completeness; staff-reported value, feasibility, confidence, continued use of resources; barriers to implementation.</p> | <p>questionnaire (n = 105) 95% personally used the Checklist, 85% had updated their AMS action plan, 40% had embedded the principles into daily practice, 68% agreed the time was justified by the benefits, but only 34% agreed it was feasible in terms of time (44% disagreed).</p> <p>Barriers/facilitators: BARRIERS: time commitment and counselling each patient individually; lack of staff and resources; difficulty contacting prescribers in a timely way; patient expectations, unwillingness to wait and disengagement; patients not physically present; lack of access to patient medical records; belief among a minority that AMS is the prescriber's role.</p> <p>FACILITATORS: the PQS financial incentive driving uptake at scale; the Checklist providing a structure and overcoming not</p> |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                                                                                                                                              |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                                                                                                                              |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                             | criteria also specifies shared decision-making principles.                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                 | knowing the indication; staff development and improved confidence; perceived patient benefit from one-to-one discussion; requests for more printed and digital resources integrated into the dispensing workflow.                                                                                                                                                                                                                                                                                                     |
| Hayes et al., 2022 | PHARMACY STAFF: checking antibiotic appropriateness, providing tailored antibiotic and infection self-care advice, and querying prescribers. | Framework: BCW and COM-B model. How used: PAMSI was designed using the Behaviour Change Wheel, with the e-Learning targeting staff capability and motivation and the Checklist providing opportunity and cues to action. The interview questions and thematic analysis followed the COM-B model. | 4.1 Instruction on how to perform a behaviour (e-Learning; counselling), 5.1 Information about health consequences (AMR and self-care messages in leaflets and advice), 7.1 Prompts/cues (Checklist prompting the appropriateness checks), 1.2 Problem solving / 3.1 Social | Communication strategies: Verbal advice (in person or by phone); hard-copy leaflets; posters and counter or screen displays; and signposting to websites or apps by text message. Nine communication methods were measured pre/post; the | Measurements: TARGET Antibiotic Checklist; AMS for Community Pharmacy e-Learning; TARGET TYI leaflets, an NHS dental leaflet and an Antibiotic Research UK leaflet; posters; pre/post staff questionnaires; interview schedule; NVivo 11; and Stata 17 (GLLAMM). Outcomes assessed: Staff-reported checking of antibiotic appropriateness; provision of advice across seven topics, use of nine | Main findings: Appropriateness checking rose significantly from 41% to 79% post-intervention ( $p < 0.001$ ), as did advice provision across 6 of 7 topics ( $p \leq 0.01$ ), the exception being how/when to take the antibiotic which was already high at baseline. 7 of 9 communication methods improved, notably leaflets and text signposting ( $p < 0.001$ ). There was no significant increase in querying prescribers, though interviewees felt more empowered to do so. Of 2043 checklists, 95% recorded the |

|  |  |  |                                                                                                                                                       |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | support where staff tailor advice to knowledge gaps, and 12.5 Adding objects to the environment (Checklist, leaflets, posters placed on the counter). | Checklist's knowledge-assessment section was used to structure and tailor the advice given. Patient engagement strategies: Patient self-completion of the Checklist used to surface knowledge gaps and tailor counselling; provision of infection self-care leaflets; and safety-netting advice. | communication methods, and queries to prescribers; plus estimated extra time and its perceived feasibility and justification; qualitative facilitators and barriers; and descriptive Checklist and patient follow-up data. | infection and 90% self-assessed knowledge; the main advice needs were symptom duration (20%), side effects (13%), food (13%), alcohol (8%) and returning unused antibiotics (8%); 62% received a self-care leaflet. Safety checks were completed for 73-86% prescriptions. Extra time (about 5 minutes per patient) was rated feasible (71% agree) and justified (85% agree). Three qualitative themes arose, namely; enablers for embedding into practice, perceived benefits, and COVID-19 and other contextual barriers. Barriers/facilitators: BARRIERS: COVID-19 disruption; time pressure; prescriptions collected by representatives or delivered to the home with no follow-up; incomplete checklists; lack of AMS continuity across the primary care pathway; and |
|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                                                                       |                                                                                                       |                                                           |                                                            |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                                                       |                                                                                                       |                                                           |                                                            |                                                                                        | <p>language barriers which were partly mitigated by multilingual staff and resources. Authors also note self-reported outcomes and probable acquiescence bias in patient knowledge ratings.</p> <p>FACILITATORS: whole-team involvement; embedding materials into the everyday environment (leaflets on the counter); fit with wider priorities including the 2020/21 PQS; e-Learning improving staff knowledge and motivation; the Checklist enabling both prescriber and patient conversations that would not otherwise have occurred; and materials giving staff confidence to query prescriptions.</p> |
| Jones et al., 2018 | PHARMACY STAFF: giving self-care advice for common infections; giving | Framework: Theoretical Domains Framework (TDF); Behaviour Change Wheel (BCW); COM-B; BCT Taxonomy v1. | Coded by the authors for RECOMMENDED interventions, using | Communication strategies: No strategies were delivered but | Measurements: TDF-based question schedule; audio recording and verbatim transcription; | Main findings: Advice-giving was shaped by staff grade, and some pharmacists were unaware of the link between giving self-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|  |                                                                           |                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | antibiotic compliance/adherence advice; participating in AMS initiatives. | How used: Used at multiple stages to develop the questioning schedule; to analyse and interpret the findings; and to derive intervention recommendations i.e., key TDF domains mapped through the BCW to COM-B components, intervention functions, policy categories and BCTs. | <p>BCTTv1: 12.1 Restructuring the physical environment, 3.1 Social support (unspecified), 12.5 Adding objects to the environment, 4.1 Instruction on how to perform a behaviour, 5.1 Information about health consequences (for patients), 9.1 Credible source, 7.1 Prompts/cues, 2.2 Feedback on behaviour, 2.3 Self-monitoring of behaviour, 1.1 Goal setting (behaviour), 1.4 Action planning, 2.7 Feedback on outcome(s) of behaviour, and 6.1</p> | <p>participants' current practice included verbal self-care advice structured by the WWHAM mnemonic (who, what symptoms, how long, action taken, medication taken); routine verbal compliance advice with every antibiotic prescription; referral to GP or urgent care; and opportunistic conversations about resistance when repeat prescriptions are noticed. Recommended practice was</p> | <p>QSR NVivo v10; GBP 40 gift voucher for participants. Materials recommended by authors: TARGET patient information leaflets, pictorial compliance stickers, and electronic or hard-copy audit templates. Outcomes assessed: A set of theory-based intervention recommendations drawn from TDF domains through the Behaviour Change Wheel to intervention functions, policy categories and BCTs; barriers, facilitators and behavioural determinants for giving self-care advice, giving antibiotic compliance advice and participating in</p> | <p>care and compliance advice and controlling AMR until prompted by the interviewer. Many had never heard of AMS or intended to adopt AMS activities and were unaware of any local AMS initiatives, although all were concerned about AMR. The pharmacy environment created barriers of time, space, and well-qualified staff with advice given over the counter and AMS activity was limited by the absence of an indication/diagnosis on prescriptions. Staff felt patient examinations, questioning prescriptions and audits would enable more tailored AMS advice while pharmacists in Wales reported that self-care audits had raised AMR awareness and improved practice. Barriers/facilitators: BARRIERS: lack of time; underskilled or</p> |
|--|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |                                 |                                                                                                                                                                                                                                                                      |                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--|--|--|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | Demonstration of the behaviour. | <p>TARGET</p> <p>'Treating Your Infection' leaflets to cue infection-related self-care conversations, simple or pictorial leaflets and stickers to reinforce compliance advice.</p> <p>Patient engagement strategies: None reported. Patients were not involved.</p> | AMS initiatives, mapped to the 14 TDF domains.. | <p>inexperienced counter staff giving misinformation; lack of space and reliance on over-the-counter conversations at busy times; no indication/diagnosis on prescriptions; uncertainty about whether querying prescriptions is within the pharmacist's role; inability to examine patients; no formal feedback on advice given; lack of awareness of AMS and of the link between advice and AMR; belief that patients do not understand or care about compliance advice and want an instant cure; belief that the public find AMR hard to understand; and poor communication with Clinical Commissioning Groups in England. FACILITATORS: pharmacists' knowledge, skills and confidence in giving self-care and compliance advice; walk-in access to a healthcare professional without an</p> |
|--|--|--|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                  |                                                       |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------|------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |                                                                  |                                                       |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                   | <p>appointment; GPs' confidence in pharmacists' competence for minor RTIs; audits (Wales)</p> <p>raising AMR awareness and changing practice; proactive Welsh Health Boards; TARGET leaflets as a cue for consultations; and the GBP 40 incentive aiding recruitment of non-enthusiasts.</p>                                                                                                                                                                      |
| Kristina et al., 2021 | Appropriate antibiotic use and self-medication with antibiotics. | <p>Framework: None reported.</p> <p>How used: NA.</p> | <p>5.1 Information about health consequences (overuse causes resistance, consequences of stopping early), 4.1 Instruction on how to perform a behaviour (take the full prescribed course, obtain antibiotics only with a prescription). Case presentation and</p> | <p>Communication strategies: Didactic lecture-based education combined with case presentation and group discussion, delivered by pharmacists in a community group setting. No individualised or tailored counselling</p> | <p>Measurements: Two validated self-administered questionnaires (11 true/false knowledge items across four domains; 4 practice statements), developed from previous published studies, face-validated by expert pharmacists and assessed with a content validity index, and piloted with 10 non-sample respondents; educational course module</p> | <p>Main findings: Knowledge categories shifted from poor 34.22% to 12.21%, adequate 28.23% to 38.28% and high 37.43% to 49.25%. Appropriate practice rose from 55% to 75.24%. Domain-level correct responses (pre to post, all <math>p &lt; 0.001</math>, Wilcoxon) changed from indication 41.75% to 64.46%, access 60.00% to 78.17%, administration 43.55% to 74.63%, resistance 29.00% to 55.22%, and practice 53.55% to 92.26%. Notable item-level shifts</p> |

|  |  |  |                                                        |                                                            |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--|--|--|--------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | discussion are not described in enough detail to code. | reported.<br>Patient engagement strategies: None reported. | (content face-validated).<br>Outcomes assessed: Knowledge of antibiotic use and resistance, by domain (indication, access, administration, resistance) and overall (categorised as poor, adequate, high); self-reported practice of antibiotic use. | were antibiotics work on most colds and coughs answered correctly 24.36% changed to 73.88%, antibiotics can be purchased without prescription 76.88% changed to 98.88%, if you feel better you can stop taking antibiotics 54.10% changed to 95.15%, and antibiotics can be used to treat viral infections 21.55% changed to 66.04%. The resistance domain showed the smallest improvement.<br>Barriers/facilitators: NR. The authors note limitations including incomplete demographic data and limited generalisability beyond this local area, and recommend multifaceted interventions involving other healthcare professionals. |
|--|--|--|--------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lakha et al.,<br>2024 | <p>PHARMACY TECHNICIANS: undertaking structured clinical reviews of patients on repeated or long-term antibiotics for acne, stepping down antibiotic treatment, giving self-care advice, onward referral, and running clinical-system searches for quality improvement with the ultimate aim of reducing inappropriate long-term antibiotic prescribing for acne.</p> | <p>Framework: COM-B model; BCW is cited as its source.</p> <p>How used: Used to develop the data collection instrument (21 predefined statements themed on the COM-B components) and to structure the analysis and interpretation of the findings.</p> | <p>4.1 Instruction on how to perform a behaviour ('How to...' guide and review flowchart), 12.5 Adding objects to the environment (toolkit and clinical scenarios), 5.1 Information about health consequences (risks of long-term antibiotic treatment; AMR), 1.4 Action planning ('develop implementation plan' section), and 2.2/2.7 Feedback on behaviour/outcomes (baseline and post-review searches and analysis, sharing key themes).</p> | <p>Communication strategies: None delivered but recommended to include self-care advice to patients with acne; structured guidance for the patient consultation; education on non-antimicrobial interventions; onward referral communication; and sharing of quality improvement themes with colleagues. Patient engagement strategies: None reported. Patients</p> | <p>Measurements: Qualtrics XM survey platform; TARGET acne 'How to...' toolkit and clinical scenarios hosted on the RCGP e-learning site; audit templates and patient information leaflets on respiratory tract infections and UTIs; and other AMR resources including CPPE, PrescQIPP, e-Learning for Health, and organisational prescribing guidance. Outcomes assessed: Self-reported capability, opportunity and motivation; perceived usefulness of each section of the acne 'How to...' toolkit; awareness of and engagement with AMS initiatives; awareness of the PCN DES requirement and national antibiotic</p> | <p>Main findings: Capability was significantly higher among technicians familiar with TARGET than those not familiar resources [3.01 (SD 0.84) vs 2.25 (SD 0.82); <math>p &lt; 0.01</math>], as was opportunity [3.84 (SD 0.31) vs 3.26 (SD 0.27); <math>p &lt; 0.01</math>]. Motivation was high in both groups and did not differ significantly [4.15 (SD 0.31) vs 3.85 (SD 0.74); <math>p &lt; 0.5</math>]. Highest capability items were skills to run clinical-system searches and understanding the risks of long-term antibiotic treatment, the lowest was confidence undertaking clinical review for patients on repeated or long-term antibiotics for acne. The lowest opportunity item was availability of support staff to run searches. Overall usefulness of the acne toolkit was 3.85 (SD 0.20), with the highest-rated sections being</p> |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                               |                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--|--|--|--|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>were not participants.</p> | <p>prescribing targets; self-reported acne reviews and interventions made in the previous three months; and willingness to join an AMS community of practice.</p> | <p>information on acne, self-care measures, and treatment of acne vulgaris. Of 23 respondents, 18 were aware that AMS forms part of the PCN DES and of national prescribing targets, 14 were willing to join an AMS community of practice, 4 had reviewed acne patients in the past three months but only 1 had used the acne 'How to...' resource to structure the review.</p> <p>Barriers/facilitators: BARRIERS: lack of awareness of the acne 'How to...' resource; the AMS pharmacy technician role is not a regulated title and has no agreed definition of the required knowledge, skills and level of practice; Initial Education and Training Standards make no reference to AMS-specific activities; lack of support staff to run clinical searches; and low confidence in undertaking clinical</p> |
|--|--|--|--|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                  |                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                         |                                                                                                                                                                  |                                                                                                                                                                                                                       | <p>reviews for long-term antibiotic use in acne. FACILITATORS: familiarity with TARGET resources; consistently high motivation regardless of familiarity; existing skills and opportunity to run clinical-system searches and undertake quality improvement; the PCN DES contractual requirement; proposed community of practice model, targeted campaigns and network dissemination; and expanding scope of practice.</p> |
| Lambert et al., 2025 | <p>PHARMACY STAFF: Dispensing behaviour including safety checks (allergies, contraindications, interactions), providing appropriate advice to patients (particularly treatment duration and dose),</p> | <p>Framework: None reported as a behavioural theory but the Audit Project Odense (APO) methodology was used as the quality improvement method.</p> <p>How used: APO was used to develop and structure both the intervention and the data collection in the form of a self-recording questionnaire completed by healthcare professionals and the</p> | <p>2.2 Feedback on behaviour (confidential individual and country level audit feedback on dispensing practice),</p> <p>2.3 Self-monitoring of behaviour (staff self-registration of</p> | <p>Communication strategies: Formal communication training in basic patient-professional communication techniques with role-play practice on clinical cases;</p> | <p>Measurements: An optimised self-registration form based on pharmacists' suggestions with an accompanying instruction document; a demographic questionnaire on each pharmacy; collective country-level feedback</p> | <p>Main findings: Overall safety checks performed improved by 18% and the proportion of dispensings with no checks fell by 17% (both <math>p &lt; 0.001</math>). Correct advice rose by 17% (<math>p &lt; 0.001</math>) and dispensings with no advice fell by 35% (<math>p = 0.006</math>), but the risk of giving at least 1 inappropriate advice rose by 44%</p>                                                        |

|                                                                                                                                                                                                                                            |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>obtaining prescription information (location of infection and treatment duration), judging the appropriateness of prescriptions, and contacting prescribers where needed.</p> <p>PATIENTS (indirectly): appropriate antibiotic use.</p> | <p>intervention to improve practice.</p> <p>According to the authors this was the first application of APO in a multinational community pharmacy setting.</p> | <p>their own dispensing episodes), 6.2 Social comparison (country's average results presented alongside individual results, and peer discussion), 4.1 Instruction on how to perform a behaviour (communication training, EU prudent-use guidelines, instruction on using the patient materials), 8.1 Behavioural practice/rehearsal (role-playing clinical cases and practising with the patient materials), 1.2 Problem solving</p> | <p>tailored patient information at the point of dispensing using the patient leaflet; verbal advice on treatment duration, dose and safety; display of a poster distinguishing viral from bacterial infection; information cards on antimicrobial resistance; facilitated peer-to-peer discussion using open-ended questions at staff level; and pharmacist-prescriber contact. Patient</p> | <p>reports and confidential individual pharmacy reports; an e-learning platform with intervention materials, first-audit results, EU guidelines and a quiz; a poster on viral versus bacterial infections; a patient information leaflet; cards on antimicrobial resistance and antibiotic use (all in local languages and freely available online); and Stata for analysis. Outcomes assessed: Ten quality indicators were assessed across following 4 themes; SAFETY CHECKS (proportion of dispensings with no safety checks, and mean percentage of possible safety checks performed), ADVICE TO PATIENTS</p> | <p>(<math>p &lt; 0.001</math>). Improvements in prescription information were not significant, and prescription judgement were also mostly nonsignificant 2% except with France worsening significantly (133%, <math>p &lt; 0.001</math>) and Lithuania improving significantly (60%, <math>p = 0.001</math>). At baseline, no safety checks were performed in 29% of dispensings and only 47% of possible safety checks were performed (lowest Poland 29%, highest Greece 71%); no advice was given in 4% of dispensings and unnecessary advice in 18%; pharmacists had no information on the diagnosis in 23% and on treatment duration in 3% of dispensings. Notably, safety checks worsened in Greece (13%, <math>p = 0.004</math>) and improved substantially in Spain (72%, <math>p &lt; 0.001</math>); in France duration and dose were already discussed in</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>(small-group discussion identifying areas for improvement and ways to enhance practice), 12.5 Adding objects to the environment (posters, leaflets, and cards supplied to pharmacies), 5.1 Information about health consequences (patient materials on AMR and on viral versus bacterial infection), 3.1 Social support (unspecified) via peer-to-peer discussion, and 7.1 Prompts/cues (poster displayed in the pharmacy).</p> | <p>engagement strategies: Engagement was limited but patient education materials were co-designed using a modified Delphi technique across the five countries, and the patient information leaflet was designed to allow the pharmacist to tailor information to the individual patient at the point of dispensing. No further shared decision-making, goal setting, action planning or problem-solving</p> | <p>(correct advice, at least one inappropriate advice, and no advice provided), PRESCRIPTION INFORMATION (unknown location of infection, and unknown treatment duration), and PRESCRIPTION JUDGEMENT (assessing whether staff judged prescriptions on the basis of the right prescription information). Descriptive data were also collected on antibiotics dispensed, dispenser type and prescriber contact.</p> | <p>97% and 98% of dispensings at baseline with no further improvement, whereas in Spain these rose from 66% and 51% to 80% and 64%. Staff clinical judgement aligned with the prescriber's for about 70% of prescriptions, and in about 25% they lacked sufficient information to judge. Prescribers were contacted for only 3% of dispensings while improvements were larger among pharmacists who actively participated (24% vs 18%).<br/>Barriers/facilitators: BARRIERS: lack of access to patient information (32% overall, 49% in Lithuania and 59% in Spain had none) and no contact with prescribers (31% overall; 73% in Spain, 54% in Poland); limited prior antibiotic-specific training; COVID-19 pandemic workload, including COVID-19 vaccination</p> |
|--|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                            |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--|--|--|--|----------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | with patients is reported. |  | <p>duties in France, hampering recruitment and forcing online rather than the originally planned in-person delivery; drug shortages that were time-consuming to resolve and altered dispensing patterns; differences in healthcare systems and social norms between countries; variation in the content and intensity of the intervention between countries; and pharmacy dropout. FACILITATORS: face-to-face delivery; active participation in the; a lower baseline standard of practice, leaving more room to improve; peer-to-peer discussion; purpose-designed materials in local languages; and the structured APO audit and feedback methodology.</p> |
|--|--|--|--|----------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                       |                                                                                                                                                                       |                                                |                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Muñoz et al.,<br>2014 | Patient adherence to the prescribed antibiotic course: taking the correct dose at the correct intervals and completing the prescribed duration without missing doses. | Framework: None reported.<br><br>How used: NA. | 4.1 Instruction on how to perform a behaviour (duration, dose, dosing regimen and how to use the antibiotic), and 5.1 Information about health consequences (correct use and the importance of adherence). | Communication strategies: Individualised verbal counselling delivered privately; knowledge assessed first using a validated questionnaire, with information tailored to the specific gaps identified; deliberately spoken-only delivery, with written information withheld by design. Patient engagement strategies: Pre-intervention | Measurements: Pharmacist-authored Dispensing Guideline containing the most important pharmacological data for each antibiotic, compiled from two reference texts; the validated knowledge questionnaire of Garcia et al., 2019; the Morisky-Green test combined with a self-reported pill count for adherence; and SPSS v18.0. All written information excluded by design. Outcomes assessed: PRIMARY: adherence to antibiotic treatment at seven days, assessed by combined Morisky-Green test and self-reported pill count, with non-adherence graded mild (one dose | Main findings: Adherence was significantly higher in the intervention group (67.2%, 95% CI 55.0-77.4) than in controls (48.4%, 95% CI 36.4-60.6), a difference of 18.8% ( $p < 0.05$ ), confirmed on logistic regression (OR 2.23, 95% CI 1.01-4.93, $p < 0.05$ ). Moderate non-compliance occurred in 38.1% of the intervention group versus 81.2% of controls ( $p = 0.001$ ). Patient-perceived health did not differ significantly, with 54.7% of the intervention group and 46.8% of controls reporting themselves totally cured. Independent predictors of adherence were prior knowledge of the antibiotic treatment (OR 3.06, 95% CI 1.34-6.99) and agreement between the treatment duration stated orally by the physician and the duration of the package written on the prescription (OR 2.84, 95% CI |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                         |                                                                                                 |                                                |                                                                                                    |                                                                                                                                                                                                                                                                      |                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                                                                                                 |                                                |                                                                                                    | knowledge assessment used to personalise the discussion to the individual patient; two-way verbal exchange addressing the patient's or carer's specific knowledge deficits. No shared decision-making, goal setting, action planning or problem-solving is reported. | missed) or moderate (more than one dose missed). SECONDARY: patient-perceived; and predictors of adherence by binary logistic regression. | 1.16-6.99), while beta-lactam use predicted poorer adherence (OR 0.32, 95% CI 0.14-0.72).<br><br>Barriers/facilitators: BARRIERS: beta-lactam regimens associated with poorer adherence; mismatch between prescribed and dispensed duration; single-pharmacy design and the absence of true randomisation limit generalisability.<br><br>FACILITATORS: prior patient knowledge of the antibiotic; agreement between the physician-stated treatment duration and the duration of the dispensed package; and availability of a private counselling area and a dedicated 20-minute session. |
| Paravattil et al., 2021 | Patient adherence to the prescribed antibiotic course and appropriate antibiotic use, including | Framework: None reported.<br><br>How used: NA. | 4.1 Instruction on how to perform a behaviour (how to take the antibiotic),<br><br>5.1 Information | Communication strategies:<br><br>Intensive structured face-to-face counselling                                                                                                                                                                                       | Measurements:<br><br>Standardised pharmacist training and instructions by arm; a structured telephone call-back                           | Main findings: Antibiotic adherence was 64% under standard care, 86.2% with structured counselling and 88.5% with the call-back service, a                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                                                          |  |                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| avoiding as-needed use and early discontinuation on symptom improvement. |  | about health consequences (side effects and appropriate antibiotic use), 3.1 Social support (practical) (side-effect management and adherence support provided during the call-back), and 2.3 Self-monitoring of behaviour (prompted review of adherence during the call). | covering administration and possible side effects; proactive pharmacist-initiated telephone follow-up as a two-way check-in during treatment; and verbal referral to the physician where symptoms were worsening. Patients rated pharmacist instruction on how to take the antibiotic as excellent across all three arms, and explanation of side effects as excellent in both active arms but only average | protocol; patient-reported adherence with self-reported remaining pills; a three-point symptom severity rating scale (1 poor, 2 average, 3 excellent); patient feedback questionnaire on counselling and on the call-back service; pharmacist feedback questionnaire. Outcomes assessed: Antibiotic adherence rates by arm; symptom severity scores before and after antibiotic treatment; appropriateness of the antibiotic prescriptions reviewed; content and duration of the call-back contacts; patient-perceived usefulness of and experience with the call-back service and the | borderline difference ( $X^2 = 5.862$ , $p = 0.053$ ). Twenty-five percent of patients reported having antibiotics remaining; the most common reasons for non-adherence were forgetfulness (35%), delayed start (20%) and symptom improvement (15%). All patients who used antibiotics on an as-needed basis or stopped after symptoms improved were in the standard care arm. Post-treatment symptom severity was rated excellent (median 3) in all arms. Of the prescriptions reviewed, 29.1% were judged inappropriate, but the community pharmacists did not intervene on any of them. The call-back service was rated useful by 84.6% of patients, with 80.8% rating their experience as excellent and 76.9% saying they would use it again; all four pharmacists agreed it added value for patients |
|--------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>under standard care.</p> <p>Patient engagement strategies:</p> <p>Proactive post-dispensing outreach rather than waiting for patient-initiated questions;</p> <p>responsive side-effect and adherence support tailored to what the patient reported during the call; patient-reported experience, usefulness and willingness to reuse the service were collected.</p> <p>No shared</p> | <p>counselling received; and pharmacist-reported acceptability, value, workload impact and job satisfaction.</p> | <p>without significantly increasing workload. Counselling was reported as helpful by 69.6% (standard care), 100% (structured counselling) and 92.3% (call-back) of patients (<math>X^2 = 10.71</math>, <math>p = 0.002</math>).</p> <p>Barriers/facilitators: BARRIERS: community pharmacists' limited knowledge and confidence in assessing prescription appropriateness, with no intervention made on any of the 29.1% inappropriate prescriptions; no access to patient health records or clinical data, restricting assessment to subjective patient report; absence of a reimbursement model; limited pharmacist-prescriber collaboration; and pressure to dispense without prescription from patient demand, revenue needs and long waits at physician offices. Small sample size and</p> |
|--|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                     |                                                                                                                                                                                                                                            |                                                                                                                                                                      |                                                                                                                                                                                                                                        |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     |                                                                                                                                                                                                                                            |                                                                                                                                                                      |                                                                                                                                                                                                                                        | decision-making, goal setting or action planning is reported.                                                                                                                                |                                                                                                                                                                                                                                                                                                               | self-reported adherence limit the findings. FACILITATORS: the call-back is simple, inexpensive and brief (mean 3.3 minutes); high patient acceptability and willingness to reuse; unanimous pharmacist agreement that it added value and increased job satisfaction without significantly increasing workload; and standardised training by arm.                                                                                       |
| Pierce et al., 2021 | <p><b>PRESCRIBERS:</b><br/>Appropriately matching antibiotic therapy to culture and susceptibility results.</p> <p><b>PATIENTS:</b><br/>Adherence to the revised regimen (taking the medication as directed for the correct duration).</p> | <p>Framework: None reported as a behavioural theory but IDSA/SHEA antimicrobial stewardship guidelines were used as the practice framework.</p> <p>How used: NA.</p> | <p>The patient-facing components are described only in generic terms but tentatively, 4.1 Instruction on how to perform a behaviour (educating the patient on the antibiotic change and how to take it) and 2.3 Self-monitoring of</p> | <p>Communication strategies: Telephone counselling and patient education about the antibiotic change; telephone symptom assessment before deciding whether to modify therapy; structured</p> | <p>Measurements: Purpose-built CPRS antimicrobial dashboard; pharmacist protocol for antimicrobial modification by culture type based on guidelines, commonly isolated organisms and local resistance patterns; CPRS note templates for interventions and for patient follow-up; provider education flyer</p> | <p>Main findings: Of 675 veterans with pending cultures, 320 had a positive culture on empiric antibiotics and 10 required pharmacist intervention. 7/10 had their antibiotic changed for non-susceptibility and 3 asymptomatic mismatches were left unchanged but were first discussed with the provider to prevent initiation of unwarranted antibiotics. 4 additional untreated patients with positive cultures were identified</p> |

|  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>behaviour (follow-up call asking the patient to report days of therapy and tablets taken per day), both uncertain. The pharmacist and provider facing components were more clearly codable as 12.1</p> <p>Restructuring the social environment (antimicrobial stewardship care coordination agreement permitting pharmacists to modify regimens without prior provider contact),</p> <p>12.5 Adding objects to the environment (purpose-built CPRS</p> | <p>telephone follow-up after therapy completion to check medication was taken as directed, discuss adverse effects, answer questions and assess symptom resolution; certified letter if unreachable; pharmacist-provider communication via electronic notes with the provider added as a co-signer; and provider education by email and flyer. Patient engagement</p> | <p>and email; the antimicrobial stewardship care coordination agreement; the facility antibiogram; and certified letters for uncontactable patients.</p> <p>Outcomes assessed: Number and type of pharmacist interventions and antibiotic changes were assessed for therapy mismatch. Also assessed were the most common culture types and isolated organisms; adverse effects and symptom resolution at follow-up; and provider burden and awareness which was described qualitatively. Time to culture review and to notification were stated as</p> | <p>incidentally and contacted, with antibiotics initiated for symptomatic patients after provider consultation. Urine was the culture type in 12 of 14 cases (86%), with oropharynx and stool accounting for one case each. The most common organisms were Escherichia coli (5 cases, 36%) and Pseudomonas aeruginosa (4, 29%). Of the 7 requiring a change, 4 had been prescribed fluoroquinolones empirically (2 levofloxacin, 2 ciprofloxacin), and 3/4 had urinary tract infections caused by P. mirabilis or E. coli which have documented local fluoroquinolone resistance. The service reduced the time patients spent on inappropriate antibiotics and decreased provider burden, since pharmacists could act without interrupting providers' clinical work, and revised regimens could</p> |
|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                |                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | <p>antimicrobial dashboard, CPRS note templates, and provider flyer), 7.1 Prompts/cues (dashboard flagging pending and completed cultures and mismatched antibiotic-organism combinations), 4.1 Instruction on how to perform a behaviour (guideline, organism and antibiogram-based modification protocol; provider education by email and flyer), and 4.2 Information about antecedents (facility resistance patterns informing the protocol, e.g. local</p> | <p>strategies: Engagement was limited but patients were contacted, their symptoms assessed, and their self-reported symptom status determined whether therapy was changed, so patient-reported information directly shaped the clinical decision. Patients' questions were also answered during follow-up calls. No further shared decision-making, goal setting or action</p> | <p>aims but were not formally measured.</p> | <p>often be mailed without patients returning to the facility.</p> <p>Barriers/facilitators: BARRIERS: a very small number of interventions relative to the screening burden; a daily time commitment of 60-90 minutes navigating the dashboard; dashboard inefficiency, displaying all antibiotics and all available cultures rather than only mismatches; incomplete provider education because staff worked different shifts and could not attend educational sessions; provider views and satisfaction were never formally assessed; the service scope was limited to patients already receiving an antibiotic; and difficulty contacting some veterans, requiring up to three attempts then a certified letter.</p> <p>FACILITATORS: the care coordination agreement enabling</p> |
|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                            |                                                                                                                                                                                                                              |                                                                                                                                                           |                                                                                                                                                                                  |                                                                                                                                                           |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |                                                                                                                                                                                                                              |                                                                                                                                                           | fluoroquinolone resistance).                                                                                                                                                     | planning is reported.                                                                                                                                     |                                                                                                                                                                                                                                             | pharmacists to act independently; the purpose-built CPRS dashboard and note templates; a guideline- and antibiogram-based protocol; support from a lead physician who had identified the problem; positive provider reception because the service reduced their burden; the existing facility AMS programme and established clinical pharmacist role; and the ability to mail antibiotics overnight. |
| Radhakrishnan et al., 2023 | GENERAL PUBLIC:<br>Appropriate antibiotic use including not taking antibiotics for the common cold, sore throat, persistent cough, coloured mucus or mild infections; not reusing or sharing leftover antibiotics; returning | Framework: None reported the discussion refers to participants observing a behaviour performed in the video and its impact on cognition.<br>How used: NA. | 5.1 Information about health consequences (reasons for antibiotic resistance and consequences of unnecessary use),<br>4.1 Instruction on how to perform a behaviour (appropriate | Communication strategies:<br>Individual counselling by a clinical pharmacist; audiovisual or video based education in the intervention arm versus printed | Measurements:<br>Educational video; educational pamphlet; a structured self-administered knowledge, attitude and practice questionnaire adapted from Bhardwaj et al. 2021 and translated into Tamil with three sections (sociodemographics; | Main findings: Knowledge, attitude and practice improved significantly in both arms, with the video group improving significantly more at three months ( $p < 0.001$ ) and no significant baseline difference. Several misconceptions were substantially corrected in both arms, with the video arm reaching higher endpoints for example                                                            |

|  |                                                                                                                                                                                                                                                   |  |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>leftover antibiotics to the pharmacy for proper disposal; obtaining antibiotics only with a prescription and not online or from friends or relatives; completing courses; and resting and waiting for self-limiting infections to subside.</p> |  | <p>antibiotic use, adherence to prescription, returning leftovers for disposal), 6.1 Demonstration of the behaviour (supported for the video arm only), and 12.5 Adding objects to the environment (pamphlet given to the usual care group) .</p> | <p>pamphlet in the comparator arm; content simplified into plain language and translated into the local language, with participant choice of Tamil or English. Patient engagement strategies: None reported. Participants were recipients of the education; no shared decision-making, goal setting, action planning or problem-solving is described.</p> | <p>previous antibiotic history including course duration, frequency and sources; and 18 dichotomous KAP items, six each on knowledge, attitude and practice); SPSS v20; randomization.com and sealed envelopes for allocation. Outcomes assessed: Change in knowledge, attitude and practice of antibiotic use was measured as domain mean scores and item-level correct responses at baseline and at three months, and compared between the two groups.</p> | <p>with antibiotics can kill viruses answered correctly 37.03% to 85.1% in the pamphlet group versus 92.5% in video and leftover antibiotics can be used again or given to someone else 30.8% to 85.1% pamphlet versus 29.6% to 92.5% video. Two attitude items showed no significant change in either arm, needing a doctor's prescription to buy antibiotics and taking antibiotics from friends or relatives, and both were already high at baseline ( about 85-90%). Barriers/facilitators: NR as these were not investigated but the authors note limitations that the findings reflect a small rural population rather than the whole country and that the study period was short, so long-term effects are unknown. Contextual BARRIERS: lack of strict regulation of over-the-counter</p> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  |  |  | <p>antibiotics; limited access to sophisticated healthcare in rural areas; healthcare cost as a considerable burden for low- and middle-income participants; reliance on untrained providers for 68% of healthcare in rural India; and the observation that many people lack the interest and time to read a pamphlet.</p> <p>FACILITATORS: visual demonstration of behaviour in the video allowing observation of the modelled behaviour; translation of materials into local language with a choice; content sourced from WHO and ICMR then simplified and reviewed by a clinical pharmacist and microbiologist team; in-person one-to-one delivery by a lead clinical pharmacist; lower literacy demand of the video format; and prior family or friend connection to the health sector, which was</p> |
|--|--|--|--|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | associated with more positive baseline attitudes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Sneddon et al., 2022 | <p><b>PRESCRIBERS</b><br/>(Dentists, Dental surgery assistants, Physician assistants): Prudent and appropriate prescription of antibiotics.</p> <p><b>DISPENSERS</b><br/>(pharmacists, pharmacy technicians): Good practice in dispensing antibiotic prescriptions.</p> | <p>Framework: AACTT framework (Actor, Action, Context, Target, Time) for behavioural specification and the Behaviour Change Wheel cited in the discussion portion.</p> <p>How used: AACTT was used to analyse the interview data and specify the target behaviours by professional group (behavioural analysis alongside thematic analysis). The Behaviour Change Wheel is only cited to interpret the findings and frame future recommendations.</p> | NA. | <p>Communication strategies: NA delivered but counselling was described as part of the prescriber's role in tackling AMR and authors recommend behaviourally informed public awareness campaigns but caution against unintended consequences of posters and leaflets..</p> <p>Patient engagement</p> | <p>Measurements: Semi-structured interview schedule and topic guide, developed from previous research and piloted with two members of the dental teams at each hospital; participant information sheet; audio recording and professional transcription with independent quality checking; remuneration of GHS 41 as lunch or mobile data.</p> <p>Outcomes assessed: Qualitative themes on knowledge and beliefs about AMR and AMS, and on people and places; and behavioural specification</p> | <p>Main findings: 2 themes and 10 subthemes were identified.</p> <p>Antibiotics were prescribed daily for both therapeutic and prophylactic indications, most commonly amoxicillin and metronidazole. Prescribing was influenced by organisational context (senior hierarchy and drug availability), clinical factors (limited diagnostics and concern over reused non-sterile instruments driving prophylaxis) and patient factors (home hygiene, help-seeking behaviour, expectations, over-the-counter access without prescription, and cost affecting adherence).</p> <p>Knowledge of AMR consequences was good, but</p> |

|  |  |  |  |                                                            |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--|--|--|--|------------------------------------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | strategies: None reported. Patients were not participants. | of prescribing and dispensing. | <p>knowledge of causes was inconsistent, with many attributing resistance mainly to patients not completing courses. AMR/AMS training had been received by senior staff but not the wider clinical team.</p> <p>Barriers/facilitators: BARRIERS: restricted availability of some antibiotics within the hospital; patients' inability to afford the full prescription and lack of National Health Insurance Scheme cover; limited access to diagnostic tests; non-sterile or reused instruments and poor environmental hygiene prompting prophylactic prescribing; hierarchical prescribing culture and habitual P drugs; patient delays in presenting and expectations/demands for antibiotics; over-the-counter availability of antibiotics from community pharmacies and</p> |
|--|--|--|--|------------------------------------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                    |                                                                                                                                                                                                                                                     |                                                       |                                                                                                                                                                                                                                |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                                                                                                                                                                                                                                     |                                                       |                                                                                                                                                                                                                                |                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                    | <p>chemical sellers; and uneven distribution of AMR/AMS training across staff grades.</p> <p>FACILITATORS: existence of national standard treatment guidelines; established AMS programmes at both hospitals; prescribers' stated willingness to counsel patients against buying antibiotics without a prescription; and good general awareness of AMR as a global issue.</p>   |
| Vilić et al., 2025 | <p>PATIENT: adherence to the prescribed oral antibiotic regimen after discharge; collecting the prescription, taking the correct dose at the correct interval, and completing the prescribed duration without shortening or prolonging therapy.</p> | <p>Framework: None reported.</p> <p>How used: NA.</p> | <p>4.1 Instruction on how to perform a behaviour (clarifying the dose, interval, duration and method of administration),</p> <p>5.1 Information about health consequences (consequences of inappropriate use; reinfection,</p> | <p>Communication strategies:</p> <p>Individualised, patient-specific counselling and education at discharge; clarification of the treatment plan against the discharge summary;</p> | <p>Measurements: Author-developed pre-discharge questionnaire (23 questions covering sociodemographics, comorbidities, chronic therapy, antibiotic details, and attitudes and opinions towards antibiotics); MARS-5 (Medication Adherence Report Scale, used with the author's</p> | <p>Main findings: Non-adherence was significantly lower in the intervention group than in the non-intervention group [2.1% (1/47) vs 36.2% (17/47); chi-square 17.591, <math>p &lt; 0.001</math>].</p> <p>Among the 17 non-adherent participants in the non-intervention group, 6 (35.3%) prolonged therapy beyond the recommended duration, 4 (23.5%) took a lower dose, 4</p> |

|  |  |  |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  | rehospitalisation and resistance and possible side effects), 5.3 Information about social and environmental consequences (antimicrobial resistance as a population-level consequence of inappropriate use), 9.1 Credible source (advice delivered by a clinical pharmacist as an identified expert) is uncertain. | explanation of the consequences of misuse; opportunity for the patient to ask questions about their therapy; and structured telephone follow-up after treatment completion. Patient engagement strategies: Engagement was limited but the patients could ask questions about their therapy during the counselling session. No shared decision-making, goal setting, action | permission) for chronic therapy adherence; author-developed post-discharge follow-up adherence questionnaire designed specifically for short-term antibiotic therapy; hospital information system (BIS); Study Randomizer software; and IBM SPSS. Both questionnaires are reproduced in the paper. Outcomes assessed: Adherence to the prescribed oral antibiotic regimen after discharge, defined strictly as participants being adherent only if they fully complied and non-adherent if they missed any dose, extended or shortened the duration, altered the dose or otherwise deviated from | (23.5%) shortened therapy, 2 (11.8%) took a higher dose and 1 (5.9%) both reduced the dose and prolonged the duration. 8 (47.1%) could not specify a cause for this but 4 (23.5%) reported the reason to be misunderstanding the physician's instructions, 2 (11.8%) prolonged therapy by consuming the entire package, 2 (11.8%) did not collect a new prescription from the pharmacy, and 1 (5.9%) stopped early believing the course was complete. The single non-adherent participant in the intervention group had missed one dose through forgetfulness. Urinary tract infection was the most common indication (63.3%), and ciprofloxacin (50%) and amoxicillin-clavulanic acid (36.7%) were the most frequently prescribed agents. 84.7% of regimens were prescribed twice |
|--|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                                                 |                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--|--|--|--|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | <p>planning or problem-solving is reported.</p> | <p>the discharge instructions; reasons for non-adherence; baseline sociodemographics, comorbidities, polypharmacy, attitudes towards antibiotics and MARS-5 chronic therapy adherence; and descriptive data on antibiotic indications, agents, duration and dosing frequency.</p> | <p>daily and 40.8% lasted 7-10 days.</p> <p>Barriers/facilitators: NR as a formal analysis but contextually identified to be BARRIERS: insufficient patient understanding of the prescribed regimen; misunderstanding the physician's instructions; believing the course was complete; consuming the whole package; failing to collect a new prescription; and forgetfulness. There were also some methodological factors limiting the findings including a single-department small sample pilot, unvalidated author-developed adherence questionnaire, and self-reported adherence subject to recall and reporting bias. FACILITATORS: embedding pharmacist counselling into routine discharge workflow, delivered by a single pharmacist for uniform delivery, which directly addressed the</p> |
|--|--|--|--|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                      |                                                                                                                               |                                                                                                                                                                                                                       |                                                                                                                  |                                                                                       |                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                                                                                                               |                                                                                                                                                                                                                       |                                                                                                                  |                                                                                       |                                                                                                                                                    | <p>understanding gap; a single regional hospital with a small, closely monitored population allowing frequent patient-provider interaction and individualised discharge instructions; a predominantly older, comorbid population accustomed to regular medication use; strict institutional adherence to ISKRA national guidelines giving clear, standardised dosage and duration instructions; and structured telephone follow-up within ten days of completion, which may have encouraged a sense of accountability in both groups.</p> |
| Warrier et al., 2025 | <p>PRESCRIBERS: selecting empirical antibiotics in line with the hospital antibiotic policy, sending appropriate cultures</p> | <p>Framework: None reported. The programme drew on published hospital antibiotic policies developed for NABH accreditation, and the authors cite a Cochrane review of enabling interventions with feedback as the</p> | <p>2.2 Feedback on behaviour (same-day individual feedback on prescription compliance; six-monthly aggregate</p> | <p>Communication strategies: The study explicitly included enhancing pharmacists'</p> | <p>Measurements: Published hospital antibiotic policies (NABH accreditation requirement); predefined criteria for syndrome-based assessment of</p> | <p>Main findings: Compliance with antibiotic selection according to hospital policy improved significantly from 53.7% at baseline to 69.7% during the intervention and 76% after</p>                                                                                                                                                                                                                                                                                                                                                      |

|  |                                                                                                                                               |                                     |                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>before initiating restricted antimicrobials, prescribing the correct dose, and limiting the duration of restricted antibiotic therapy.</p> | <p>rationale.<br/>How used: NA.</p> | <p>feedback presentations), 2.7<br/>Feedback on outcome(s) of behaviour (presentation of aggregated AMS indicators), 1.2<br/>Problem solving (discussion of common deviations and possible improvements, with suggestions sought from prescribers), and 4.1 Instruction on how to perform a behaviour (training of pharmacists by the ID champion; guidance to prescribers on policy).</p> | <p>communication abilities for delivering proactive feedback. Real-time interpersonal communication from the clinical pharmacist to the prescriber on the same day as the prescription review; and group presentation of aggregated audit findings to prescribers by an infectious disease physician champion. Patient engagement strategies: None reported. Patients</p> | <p>indication; WHO AWaRe classification; training delivered through ward rounds and lectures; Microsoft Excel for data capture and SPSS v20 for analysis.<br/>Outcomes assessed:<br/>PRIMARY: days of therapy for restricted antibiotics.<br/>SECONDARY: compliance with the hospital antibiotic policy, acceptance of AMS advice, dose/dosing errors, and gross 30-day mortality as a balancing measure. Also, number of new prescriptions for restricted antibiotics and proportion of patients with appropriate cultures sent before initiation.</p> | <p>consolidation (<math>p &lt; 0.001</math>). Days of therapy for restricted antibiotics fell 5.8% (<math>p &lt; 0.001</math>) and monthly restricted prescriptions fell from approximately 445 to 396 per month (<math>p &lt; 0.001</math>). Changes in culture sampling, AMS advice acceptance and dosing errors were non-significant. Gross 30-day mortality was unchanged (17.2% to 18% to 17.1%, <math>p = 0.885</math>), supporting safety. The most common deviations from policy were the empirical choice of antibiotics for lower respiratory tract infection and the duration of antibiotic use.<br/>Barriers/facilitators: NR but contextual factors suggest the following BARRIERS: absence of established AMSP and infectious disease physician at any of the three sites; prescribers not documenting antimicrobial</p> |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|  |  |  |  |                        |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--|--|--|--|------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  | were not participants. |  | <p>indication and requiring the pharmacist to assess it against predefined criteria; persistent limits to prescriber uptake; and resource constraints in the low- and middle-income setting.</p> <p>FACILITATORS: dedicated clinical pharmacist recruited at each site; structured training of the pharmacist by the Project Champion (an experienced ID consultant); ongoing weekly review and feedback by the Champion; same-day, individual-level feedback to prescribers; aggregate feedback presented to prescribers; and two-way consultation in which prescribers were invited to suggest improvements and policy changes.</p> |
|--|--|--|--|------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### **3.3 Main findings**

#### **3.3.1 Behavioral Theories and Frameworks**

Seven of the 20 studies 35% explicitly referenced and applied a behavioral theory or framework to the intervention or as part of the analysis in their research (Ari Kristina et al., 2021; Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023; Jones et al., 2018; Lakha et al., 2023; Sneddon et al., 2022). The remaining thirteen studies (65%) reported no behavioral theory. Although several of these did reference other (non behavioral) frameworks such as the CDCC core elements framework (Attar et al., 2025), IDSA/ SHEA antimicrobial stewardship guidelines (Pierce et al., 2021), and the WHO/French National Authority for Health therapeutic patient education framework (Pierce et al., 2021), frameworks for therapeutic patient education (Angoulvant et al., 2013). None of which are behavior change theories per se.

The COM-B model (Capability, Opportunity, Motivation - Behaviour) was the most common model mentioned in the seven studies that used an explicit behavioral approach, and this framework was featured in six of the studies (30%) (Allison et al., 2020; Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023; Jones et al., 2018; Lakha et al., 2023). Of the five studies cited (25%) (Allison et al., 2020; Hayes et al., 2022; Jones et al., 2018; Lakha et al., 2023; Sneddon et al., 2022), the Behaviour Change Wheel (BCW) was used, most often as the source framework from which COM-B was derived, or cited to interpret findings, not as an independent program. The BCW, on the other hand, only appeared in the discussion section of (Sneddon et al., 2022) to aid interpretation of findings and make recommendations, but appeared neither in the study design nor in analysis.

In (Allison et al., 2020; Jones et al., 2018) the Theoretical Domains Framework (TDF) was employed to gain insight into behavioral determinants that guided the research design of the

interventions. In (Sneddon et al., 2022), Experts used the AACTT framework (Actor, Action, Context, Target, Time) to define a specific target behaviour.

Two studies (10%) (Allison et al., 2020; Jones et al., 2018) included a Theoretical Domains Framework (TDF). In both researches, the same qualitative study was conducted without any modification and was directly applied to the analysis of the interview and focus group data and translated into an intervention.

(Jones et al., 2018) also applied BCT Taxonomy v1 as an explicit analytic tool in its own right, by taking the recommended interventions and coding them against BCT Taxonomy v1, which was separate from its use of TDF/BCW/COM-B as theories of behaviour.

The three COM-B studies (15%) (Allison et al., 2020; Hayes et al., 2022; Lakha et al., 2023), explicitly build on the same earlier qualitative study (Jones et al., 2018) which involved conducting interviews based on the TDF model and identifying behavioral determinants that were then translated into COM-B/BCW-based intervention designs.

### **3.3.2 Behaviour Change Techniques (BCTs)**

19 of the 20 studies (95%) were coded for BCTs. The one exception (5%) was (Sneddon et al., 2022) as it was not an intervention study, but rather an exploratory qualitative study of prescribing behaviour and therefore there was no intervention delivered or tested, meaning there was nothing to code. Both the most prevalent BCTs were informational/instructional:

#### **3.3.2.1 Instruction on how to perform a behaviour**

Recounted in 19 studies (95%), except (5%) (Sneddon et al., 2022). Most frequent BCT found in the corpus. The practical application was in many different forms, such as, depending on the study: verbal instructions to patients. These were used to explain how and when to take an

antibiotic (Almomani et al., 2023; Vilić et al., 2025) e-Learning modules for pharmacy staff, explaining how to carry out safety checks (Hayes et al., 2023); or instructions for experts who prepare antibiotic suspensions for children, on how to prepare and store them (Aika & Enato, 2023).

#### **3.3.2.2 Information about health consequences**

These were described in 16 studies (80%) (Aika & Enato, 2023; Allison et al., 2020; Almomani et al., 2023; Angoulvant et al., 2013; Ari Kristina et al., 2021; Ashiru-Oredope et al., 2020; Collazo et al., 2025; Hayes et al., 2022, 2023; Jones et al., 2018; Lakha et al., 2023; Lambert, Benko, et al., 2025; Muñoz et al., 2014; Paravattil et al., 2021; Radhakrishnan et al., 2023; Vilić et al., 2025) and others. The 2nd most common BCT in the corpus. Indicating the implications of antimicrobial resistance, the dangers of inappropriate antibiotic use, or side effects of prescribed medication.

#### **3.3.2.3 Adding objects to the environment:**

These were addressed in 13 studies (65%) (Aika & Enato, 2023; Allison et al., 2020; Angoulvant et al., 2013; Ashiru-Oredope et al., 2020; Attar et al., 2025; Collazo et al., 2025; Hayes et al., 2022, 2023; Jones et al., 2018; Lakha et al., 2023; Lambert, Benko, et al., 2025; Pierce et al., 2021; Radhakrishnan et al., 2023). This included physical checklists, printed leaflets, posters, illustrated information sheets and policy booklets inserted in the pharmacy, ward or clinic setting as part of the intervention.

#### **3.3.2.4 Prompts/cues**

They were reported in 8 studies (40%) (Allison et al., 2020; Ashiru-Oredope et al., 2020; Attar et al., 2025; Hayes et al., 2022, 2023; Jones et al., 2018; Lambert, Benko, et al., 2025; Pierce et al., 2021) often in the form of checklists or leaflets that structured or triggered a conversation

#### **3.3.2.5 Feedback on behaviour**

Feedback was observed in 6 studies (30%) (Allison et al., 2020; Attar et al., 2025; Jones et al., 2018; Lakha et al., 2023; Lambert, Benko, et al., 2025; Warriar et al., 2025). Most often involved feedback to pharmacy staff on the rate of completion of checklists, and/or feedback to prescribers on compliance with stewardship guidelines.

#### **3.3.2.6 Credible source**

This point is addressed in 6 studies (30%) (Allison et al., 2020; Ashiru-Oredope et al., 2020; Attar et al., 2025; Collazo et al., 2025; Jones et al., 2018; Vilić et al., 2025). This records instances when the credibility of the messenger was specified as a mode of delivery for the message, such as delivery from NHS/PHE material, a clinical pharmacist, or a senior consultant who counsels

#### **3.3.2.7 Problem solving**

This was addressed in 5 studies (25%) (Angoulvant et al., 2013; Attar et al., 2025; Hayes et al., 2022; Lambert, Benko, et al., 2025; Warriar et al., 2025). It reflected a range of staff-level problem solving around deviations from antibiotic policy (Attar et al., 2025; Warriar et al., 2025), to problem solving with patients/caregivers around fitting a dose schedule into daily routine (Angoulvant et al., 2013).

#### **3.3.2.8 Self-monitoring of behaviour**

Observed in studies (Attar et al., 2025; Lambert, Benko, et al., 2025; Paravattil et al., 2021) (25%) . Patients or staff self-monitoring their behaviour or symptoms over time, e.g., a patient's self-reported symptom status influencing follow-up (Paravattil et al., 2021; Pierce et al., 2021) or staff completion tracking (Attar et al., 2025; Lambert, Benko, et al., 2025).

### **3.3.2.9 Action planning**

Implemented in 4 studies (20%) (Angoulvant et al., 2013; Hayes et al., 2023; Jones et al., 2018; Lakha et al., 2023). Explicitly planned specifics of when and how a behavior would be implemented, such as providing explicit plans for dosing times around a family's daily routine, (Angoulvant et al., 2013).

### **3.3.2.10 Demonstration of the behavior**

Involved physically demonstrating correct behaviour, not just verbalising it, e.g. demonstrating a liquid antibiotic dose (Aika & Enato, 2023; Jones et al., 2018; Radhakrishnan et al., 2023) (15%).

### **3.3.2.11 Social support (unspecified)**

Involved in providing practical or emotional support around the target behaviour, for example by ensuring the pharmacist is available to answer questions and to follow up on the initial contact (Hayes et al., 2022; Jones et al., 2018; Lambert, Benko, et al., 2025; Paravattil et al., 2021) (20% of the total sample).

### **3.3.2.12 Feedback on outcome(s) of behaviour**

This was separate from (feedback on the behaviour itself), and concerned feedback on consequences of the behaviour in the downstream parts of the system, e.g. clinical outcomes after a change in prescription practice (Attar et al., 2025; Jones et al., 2018; Lakha et al., 2023; Warriar et al., 2025) (20% of the total sample).

#### **3.3.2.13 Goal setting (behaviour)**

Involved in the setting of a specific and agreed goal associated with a target behaviour in (Jones et al., 2018) most clearly demonstrated in the "educational contract" in (Angoulvant et al., 2013) (10% of the total sample) whereby the session goals were agreed to with parents.

#### **3.3.2.14 Behavioural practice/rehearsal**

Participated in the target behaviour in a structured manner, for example, role-play scenarios with clinical situations (Lambert, Benko, et al., 2025) or practice dosing with parents (Angoulvant et al., 2013) (10% of the total sample) .

#### **3.3.2.15 Social comparison**

Involved comparing the behaviour/performance of a person or site to others, including comparing the prescribing of one site to another, or comparing checklist performance in one site to another (Attar et al., 2025; Lambert, Benko, et al., 2025) .

#### **3.3.2.16 Commitment**

Involved inducing some sort of commitment to the behavior (Hayes et al., 2023), for example, by getting patients to sign a public antibiotic guardian pledge (Ashiru-Oredope et al., 2020) (10% of the total sample) .

#### **3.3.2.17 Restructuring of the physical/social environment**

Involved in changing an aspect of the physical or social environment to support behavior for example, changing an aspect of a workflow or referral pathway, rather than simply adding an object (Jones et al., 2018; Pierce et al., 2021) (10% of the total sample) .

### **3.3.2.18 Information about social and environmental consequences**

Included other people/environmental consequences of behaviour rather than health of the individual (Vilić et al., 2025) (5% of the total sample) .

### **3.3.2.19 Behaviour substitution**

Encouraged an alternative behavior that replaced the target behavior, such as asking their provider about antibiotic requests rather than getting them themselves or self-prescribing antibiotics (Collazo et al., 2025) (5% of the total sample) .

### **3.3.2.20 Material incentive (behaviour)**

Involved a physical incentive linked to performing the behavior (Hayes et al., 2023) (5% of the total sample) .

### **3.3.2.21 Information about Patients**

Involved in giving information regarding what triggers and/or precedes the target behavior; helps the person realize when the behavior is likely to take place (Pierce et al., 2021).

The predominant BCTs are those related to instruction and information provision; these are employed in the great majority of studies. BCTs associated with more active behavioral engagement were each found in fewer than 25% of studies; only a small number of studies included more than one of the rare. More active BCTs, including (Jones et al., 2018) in which 13 BCTs were coded as recommended interventions based on stakeholder interviews, but were not delivered to patients as behavioral items.

### 3.3.3 Communication Strategies

The communication strategies in the data sets addressed the diversity in both the information presented and the medium through which the message was conveyed, even when the content of the BCT was the same (i.e., instruction, consequences) across studies.

Studies describing patient-facing counselling were typically based on self-reported patient knowledge gaps, with individualized, face-to-face verbal counselling being the most common format (Aika & Enato, 2023; Almomani et al., 2023; Hayes et al., 2022, 2023; Muñoz et al., 2014) (30% of the total sample) . In some of these researches, the tailoring of the counselling was deliberately designed to be based on a prior assessment of patient knowledge e.g in (Muñoz et al., 2014) a validated patient knowledge questionnaire was administered prior to the counselling, and written materials were intentionally not provided based on the outcomes of the prior knowledge questionnaire.

In patient-facing studies, written or visual materials that accompanied verbal counselling were common, including leaflets (Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023) (15% of the total sample) , posters/counter displays (Hayes et al., 2022, 2023), illustrated information sheets (Angoulvant et al., 2013), and a purpose-designed bilingual brochure that included plain language and cultural and linguistic competency input (Collazo et al., 2025).

Formal, theory-driven communication strategies were observed in fewer studies, such as (Angoulvant et al., 2013) observed open-ended questions, an educational diagnosis phase asking the parent about their existing knowledge and beliefs before teaching, an educational interview grid and a teach-back style comprehension check at the end.

(Collazo et al., 2025) Used a brochure that acted as a ‘communication bridge’, a tool used by providers to break into conversations they found uncomfortable, and it gave their messages credibility.

Prior to the start of the intervention, a formal training program in communication skills was provided to the pharmacy staff in (Lambert, Benko, et al., 2025) that included role-play practice with clinical scenarios, and was structured around open-ended questioning skills.

Six studies (30%) (Almomani et al., 2023; Angoulvant et al., 2013; Muñoz et al., 2014; Paravattil et al., 2021; Pierce et al., 2021; Vilić et al., 2025) used telephone communication as the primary delivery method or as a follow-up method following a face-to-face interaction. In (Paravattil et al., 2021), this was specifically a proactive call-back from the pharmacist 3-5 days after the beginning of an antibiotic course.

Researchers in (Attar et al., 2025; Sneddon et al., 2022; Warriar et al., 2025) (15% of the total sample) reported pharmacist-to-prescriber communications as the main or only communication channel; that is, pharmacists provided feedback on the same day as ward rounds, used a structured feedback form or engaged in case discussions during regular meetings, but did not communicate directly with the patient.

### **3.3.4 Patient Engagement Strategies**

The dataset highlighted the difference between research that provided information for patients and studies that engaged patients in aspects of the research design or provision of the intervention. No patient engagement was reported in (Ari Kristina et al., 2021; Attar et al., 2025; Jones et al., 2018; Lakha et al., 2023; Radhakrishnan et al., 2023; Sneddon et al., 2022; Warriar et al., 2025) (35% of the total sample) .

In five of these (Attar et al., 2025; Jones et al., 2018; Lakha et al., 2023; Sneddon et al., 2022; Warriar et al., 2025), the patients were not included as study participants, but rather the target behaviour and the population were solely the pharmacy staff or the prescriber.

Patients were the participants in the other two researches (Ari Kristina et al., 2021; Radhakrishnan et al., 2023) (10% of the total sample) but no other engagement strategy was reported other than them being recipient of education.

Limited or tailored engagement was reported in 9 studies (45%) (Aika & Enato, 2023; Almomani et al., 2023; Ashiru-Oredope et al., 2020; Collazo et al., 2025; Hayes et al., 2022, 2023; Paravattil et al., 2021; Pierce et al., 2021; Vilić et al., 2025). These studies indicated that patients were not treated as "passive recipients," but rather could ask questions, and the patients' self-reported symptoms or gaps in knowledge influenced what the pharmacist is going to respond with. In research (Paravattil et al., 2021; Pierce et al., 2021), the patient was reached after the first visit and patient input directly affected the next steps in the decision-making process such as in (Collazo et al., 2025), for instance, patient-reported symptom status determined the next steps. However, none of these 9 studies reported that they engaged in formal shared decision-making, goal setting, and/or action planning with the patient.

Four studies reported active or co-design engagement in various forms:

In (Allison et al., 2020) patient representatives were directly involved in the co-design of the intervention itself in three workshops, prior to the delivery to the overall population of patients.

(Angoulvant et al., 2013) integrated the goal-setting process into each of the individual counselling sessions (called the “educational contract”), integrated role-playing and problem-

solving activities into the daily life of the parent, and included collaborative identification of optimal dosing times.

(Collazo et al., 2025) also created a patient advisory board of 6 bilingual patient representatives who were asked to meet four times in the development of the intervention to identify educational needs of patients and recommend engagement strategies; patients were also asked to participate in pilot testing intervention materials.

The development of the patient education materials was a co-construction process that was achieved using a modified Delphi technique in five countries as indicated in (Lambert, Benko, et al., 2025).

In the entire corpus, only 11 of 20 (55%) (Aika & Enato, 2023; Allison et al., 2020; Almomani et al., 2023; Angoulvant et al., 2013; Ashiru-Oredope et al., 2020; Collazo et al., 2025; Lambert, Benko, et al., 2025; Muñoz et al., 2014; Paravattil et al., 2021; Pierce et al., 2021; Vilić et al., 2025) studies explicitly mention that no formal shared decision-making was used. This means that in some areas, joint decision-making for the treatment or antibiotic was rarely, if ever, included in the described intervention.

### **3.3.5 Target Behaviours**

Corpus indicated consistent split between interventions directed at patients/caregivers and interventions directed at pharmacy staff or prescribers.

Among the 20 studies, 15 studies (75%) directly targeted a patient/caregiver facing behavior like (Aika & Enato, 2023; Allison et al., 2020; Almomani et al., 2023; Angoulvant et al., 2013; Ari Kristina et al., 2021; Ashiru-Oredope et al., 2020; Collazo et al., 2025; Hayes et al., 2022, 2023; Lambert, Benko, et al., 2025; Muñoz et al., 2014; Paravattil et al., 2021; Pierce et al., 2021;

Radhakrishnan et al., 2023; Vilić et al., 2025). The behaviours targeted in patients were variable, but included the following, with a constricted theme around which these behaviours evolved. This include completing the course of antibiotics, taking the right dose, taking them at the right time, not re-using or sharing another person's antibiotics, returning unused antibiotics to the pharmacy, understanding when antibiotics are specified and when not (e.g., not for viral infections, not for the common cold).

Five of the 20 studies (25% of the total sample) focused solely on either the pharmacy staff or pharmacy technician or the prescriber with no direct interaction of the staff or technician with the patient in the intervention (Attar et al., 2025; Jones et al., 2018; Lakha et al., 2023; Sneddon et al., 2022; Warriar et al., 2025). The behaviors being scrutinized in these studies has involved elements such as checking antibiotic appropriateness, contacting prescriber if necessary, engaging in AMS initiatives, or choosing antibiotics consistent with hospital policy behaviors done by the healthcare professional, not the patient.

In a subset of the studies with patients, the behavior of the staff such as checking the safety of prescriptions, contacting prescribers, providing individualized information was measured as a secondary target behavior, in addition to the behavior of the patient in taking the antibiotic (Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023; Lambert, Benko, et al., 2025; Pierce et al., 2021) (25% of the total sample) .

### **3.3.6 Integration of behavioural frameworks and patient engagement**

The question that this review aims to answer is not whether theory is being used in pharmacist-led AMS interventions, but rather how do pharmacist-led AMS interventions combine behavioral frameworks and patient engagement tactics. Following this query, the 7 studies (35% of the total sample) (Allison et al., 2020; Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023; Jones et al.,

2018; Lakha et al., 2023; Sneddon et al., 2022) that applied a named behavioral theory were cross-checked with level of patient engagement.

Of the 7 studies that were theory-informed, patient involvement was always limited. Three studies (15%) (Jones et al., 2018; Lakha et al., 2023; Sneddon et al., 2022) reported no patient engagement at all, as these were staff/prescriber-based studies and no contact with patients.

Other 3 studies (Ashiru-Oredope et al., 2020; Hayes et al., 2022, 2023), included patients as a component of tailored counselling, but not as part of a formal process of shared decision making, goal setting, or action planning. Only (Allison et al., 2020) engaged patients more actively, as co-designers during the development of the intervention. Six studies (30%) (Aika & Enato, 2023; Almomani et al., 2023; Muñoz et al., 2014; Paravattil et al., 2021; Pierce et al., 2021; Vilić et al., 2025), involved patients only in tailoring; three studies (Angoulvant et al., 2013; Collazo et al., 2025; Lambert, Benko, et al., 2025), involved more active forms of patient engagement, proportionally more than the theory-informed studies.

This suggests that the application of the behavioral theory and the active involvement of the patient were not found as complementary aspects of the same interventions in this body of literature. They did not find that a named behavioral framework was associated with increased likelihood of active patient engagement, and in fact, the studies with the most explicit patient involvement (Angoulvant et al., 2013; Collazo et al., 2025; Lambert, Benko, et al., 2025) (20% of the total sample) did not involve a theory.

Data indicate that active involvement with patients was achieved in other ways, such as the development of an advisory board, an educational contract, or a multinational co-design process.

The theory-driven research studies, on the other hand, tended to focus on designing interventions and specifying BCTs, rather than structuring patient involvement itself.

The interventions included in this review did not consistently incorporate behavioral frameworks or patient involvement mechanisms, and most of the behavioral components were used without the patient involvement components. The presence of a formal behavioral theory impacted the design of the intervention and its behavioral change techniques but not active involvement or involvement of patients. When patient involvement was most progressive, it usually emerged in the form of practical decisions about the interventions, rather than a formal theory of behavior change. The literature reviewed did not include any study that integrated the most prevalent modes of patient participation found in the body of literature with a named behavioral model.

### **3.3.7 Barriers and facilitators**

In the 20 studies, 19 (95%) reported barriers and/or facilitators to implementation, delivery, or acceptability, while one study (5%) (Ari Kristina et al., 2021) did not report on barriers and facilitators.

Time pressure/Work load was the most frequently reported barrier mentioned in 7 studies (35%) (Hayes et al., 2023; Allison et al., 2020; Hayes et al., 2022; Ashiru-Oredope et al., 2020; Paravattil et al., 2021; Collazo et al., 2025; Pierce et al., 2021). Lack of training, confidence, or awareness of stewardship was cited as a barrier in 4 studies (20%) (Lakha et al., 2024; Sneddon et al., 2022; Warriar et al., 2025; Paravattil et al., 2021). Limited or no access to patient records or clinical information was reported in 3 studies (15%) (Hayes et al., 2023; Paravattil et al., 2021; Lambert et al., 2025). In 4 studies (20%) (Muñoz et al., 2014; Almomani et al., 2023; Aika & Enato, 2023; Vilić et al., 2025), patient-side factors, such as forgetfulness, misunderstanding,

or early discontinuation of medication after symptoms resolved, were reported as barriers to adherence.

The most frequently mentioned facilitator was the use of a structured tool, e.g., a checklist or leaflet, to give a cue or framework for the interaction 5 studies; (25%) (Hayes et al., 2023; Allison et al., 2020; Hayes et al., 2022; Ashiru-Oredope et al., 2020; Lambert et al., 2025). In 5 studies (25%) (Muñoz et al., 2014; Almomani et al., 2023; Aika & Enato, 2023; Vilić et al., 2025; Radhakrishnan et al., 2023), the same pharmacist was reported as a facilitative individual delivery factor for the intervention. Four studies (20%) (Hayes et al., 2023; Allison et al., 2020; Lakha et al., 2024; Ashiru-Oredope et al., 2020) reported a financial or material incentive for participation or uptake. Putting the intervention into the current workflow (rather than a new stage) was reported as a facilitator in 4 studies (20%) (Hayes et al., 2023; Allison et al., 2020; Hayes et al., 2022; Lambert et al., 2025).

## **CHAPTER 4**

### **DISCUSSION**

#### **4.1 Overview**

This review aimed to gain insight into the extent to which the antibiotic stewardship efforts of pharmacists have been based on behaviour studies. Theories of behaviour and behaviour change techniques go hand in hand and they complement one another in well-designed behaviour change interventions.

The use of behavioural theory, identification of behaviour change techniques, and patient involvement in antimicrobial stewardship interventions were evaluated in this review, along with the linkage between these three components.

The literature reviewed in Chapter 3 shows that the theories of behavioural change (theories of behaviour) were used but inconsistently, that the methods used to try to change behaviours were mainly instructional instead of participative, and that where patient involvement was used in an attempt to change behaviour, it was not generally extended to include shared decision making. Combined, the findings suggest a territory on which research has shown the form thoughtfully designed in theory might take and where it is not the standard in the larger body of research.

The results identify a larger problem of behavioural theory translation for intervention design.

The literature shows that theory-informed practices can be applied, and that these practices differ in their application. At the same time, while contemporary behaviour change literature has sought to differentiate knowledge into the ability, motivation, opportunity, environment, and skills to engage in a given behaviour, the prevalence of information-based approaches in the literature suggests that awareness and knowledge are critical factors in behaviour change.

Overall, these results lead to the possibility that there is a lack of alignment between the availability of behavioural science frameworks and intervention implementation. Theory, behaviour change techniques and patient involvement can be found as distinct elements in the literature, but are not always combined in the same intervention.

#### **4.2 The use of Behavioural Theory**

Behavioural theory was not universally applied in all of the literature included, but in those studies that explicitly utilized theory in the development of interventions, the results indicate the potential utility of theory-based intervention development. Structured qualitative work in these studies was used to identify behavioural determinants and to relate these to intervention components using known frameworks and taxonomies of behaviour. This is because it takes intervention development beyond the mere recognition that there is a need to change the behaviour. A theory-informed approach may offer a framework for the explanation of the behaviour, and thus, the factors to target.

This is significant in AMS, as a single research gap will not invariably lead to inappropriate antibiotic use. Antibiotic use-related behaviours can be shaped by norms of health care providers, perceived expectations, confidence, habits, social influences, environmental constraints, perceived risk, and the interaction between the health care provider and the patient.

There have been a number of frameworks created specifically to help structure these different determinants and link them with possible interventions, including: the Theoretical Domains Framework (TDF), the COM-B model, and the Behaviour Change Wheel (Richardson et al., 2019).

The results of this review hence do not endorse the notion that behavioural theory is not applicable to AMS in the context of the Pharmacy profession. Rather, the theory-grounded research shows that behavioral conceptualizations can be translated into intervention development. What is more important is why this approach has yet to become a standard in the wider literature.

#### **4.2.1 The theory-practice gap**

One of these explanations is that the secondary use of the behavioral theory is an indication of a general theory-practice gap in applied health research. Behavioral theories and frameworks may be available generally, but may not be utilized systematically in the development of interventions. There is also a similar lack of specification of theoretical mechanisms underlying the interventions and inconsistent reporting in the previous studies on the behavior change interventions. (Adlan et al., 2025)

This differentiation is important because it is possible to implement a behaviour change technique in the intervention without it being theory-informed. For instance, education and/or advice can be a recognized behaviour change technique, but that does not mean that the intervention was chosen to address a specific behavioural determinant. Theory is more worthy when it provides the linkage between behavioural diagnosis, the design of intervention, selecting intervention techniques, and the expected mechanism of change.

In this light, it is possible that 'theory' was not being used, but rather that there was not a great deal of formalization of behavioural thinking. Researchers and practitioners may identify behavioral issues intuitively, but not specifically describe the problems in terms of constructs of behavior or theoretical domains.

However, there were several studies which did not make an explicit mention of the behavioral theory but employed experimental or mixed methods designs. This indicates that having a method does not guarantee the use of theory.

The literature on implementation science has consistently pointed to the importance of the intervention itself, as well as the context, resources, professional roles, organizational structures, and/or processes of implementation that shape the success of intervention. (Adlan et al., 2025)

#### **4.3 Selection of Behaviour Change Techniques.**

A second key finding was the dominance of instruction and information-provision techniques. This suggests that this review's findings reflect a historical assumption that providing people with better information is likely to improve their health behaviours.

This is especially important where AMS is concerned. Patients and practitioners should be informed about antibiotics, resistance, and proper use of antibiotics, what they can expect and potential side effects. However, knowledge is just one part of behaviour; and there are well recognised issues in the behaviour change literature that changing what people know is not enough to change their behaviour, especially when the behaviour is influenced by environmental, social, motivational or habit factors (A. Simpson et al., 2025).

When instruction becomes the dominant intervention strategy, the intervention may address what people know, but not whether they have the capability, opportunity, motivation, confidence, or environment required to do something differently.

This is particularly relevant to AMS, where antibiotic-related behaviours take place in complex interactions rather than isolated events. The patient's expectations, the pharmacist's style,

prescribing norms, consultation structure, workflow, and perceived clinical risks may each play a role in antibiotic-related behaviours. Information may therefore be insufficient when the driver of the behaviour is not perceived to be a lack of knowledge.

An explanation for the dominance of instructional techniques relates to community pharmacy practice itself. Community pharmacy interactions can be brief and task-focused, and intervention techniques such as information and instruction may be easier to include in an existing consultation than techniques requiring repeated contact, monitoring, rehearsal, or structured follow-up.

This interpretation reflects implementation research, which shows that interventions are influenced by feasibility, available resources, workload, professional roles, and the characteristics of the setting in which they are implemented. (Klaic et al., 2022)

The few studies that have employed methods like setting goals and self-monitoring are important for this reason. These interventions demonstrate that more active behaviour change techniques can be incorporated into pharmacy workflows without requiring an entirely new service model.

This challenges the assumption that information provision is the inevitable consequence of limited time in pharmacy practice, and suggests that intervention design choices may actually contribute to the observed patterns.

This interpretation reflects behaviour change theory, which emphasises that intervention techniques should be selected according to the behavioural mechanism that needs to change, rather than what is easiest to implement (Kok et al., 2016).

The implication is not that instruction should be abandoned from AMS interventions, but rather that information may be productively utilized as part of a broader behaviour change intervention, as opposed to being considered an intervention in its own right. The concern is with distinguishing between information as a mechanism for behaviour change, and information as an assumed behaviour change in its own right.

#### **4.4 Patient Engagement and Shared Decision-Making**

Another key finding of this review is that the distinction between patient engagement and shared decision-making is not blurred. Patients were engaged in some capacity across all interventions, but this mainly comprised tailoring of communication to patients' knowledge, understanding, or preferred style of communication. In some cases, patients contributed to the setting of goals or intervention content. However, rarely did interventions go beyond communicating information to patients in order to persuade them towards concordant behaviour.

This finding highlights the difference between patient-centred communication and shared decision-making, as concepts pertinent to improving healthcare practice. Whereas patient-centred communication focuses on understanding patients' needs and communicating accordingly, shared decision-making involves exchanging information and deliberating upon values and trade-offs to reach agreement on a specific management choice (Bae, 2017).

It emerges from the findings that current interventions in AMS primarily operate at the level of communication and engagement and do not aim to involve patients in decision-making.

One reason for this might be that in the case of antibiotics, shared decision-making may often be inappropriate or not feasible. In some consultations, the clinical indication for an antibiotic may be evident, whereas in others, the need for an antibiotic may be doubtful. In cases where the

evidence is clear, shared decision-making would not be necessary. In cases where the evidence is inconclusive, shared decision-making may be appropriate (Stiggelbout et al., 2012)

On the other hand, even when there is strong evidence for a particular course of action, such as withholding an antibiotic, shared decision-making may be beneficial to address decision-specific uncertainties and patients' preferences and values. The issue of uncertainty and scope for patient choice cuts across several of the included studies. For example, patients may wish to receive antibiotics anyway due to expectations of benefit, concerns about side effects, uncertainty about symptoms, or negative experiences with previous treatment. In such cases, shared decision-making could be helpful.

Another possible explanation for the lack of shared decision-making interventions in AMS is that they are not as established in the design of pharmacy-led interventions as they are in other areas of medicine. Shared decision-making is a dialogic process that goes beyond simply consulting patients, engaging them in the discussion of options and trade-offs, and deliberating upon these to reach an agreement that considers both parties' views (Montori et al., 2023).

The findings of this review demonstrate that a distinction should be made between consultation- and communication-focused interventions and shared decision-making interventions. Patient involvement cannot be assumed synonymous with shared decision-making. A study can engage patients in co-developing materials or strategies without aiming to involve them in decisions regarding their own treatment.

The implication of this finding is that future AMS studies should explicitly differentiate between consultation and communication interventions and shared decision-making interventions.

#### **4.5 Two Different Intervention Logics: Patients and Professionals**

Another characteristic identified during the review is the separation between patient-facing interventions and interventions targeted towards pharmacists, technicians, or prescribers. These should not necessarily be regarded as different manifestations of the same intervention typology.

A patient-facing intervention may aim to change antibiotic expectations, adherence, understanding, confidence, or communication with healthcare professionals. A professional-facing intervention, on the other hand, may target prescribing, checking, dispensing, counselling, or antimicrobial stewardship practices. These occur in various domains and have respective set of determinants.

This distinction is based on the theory of behaviour change, which emphasizes the need to identify the behaviour to be changed, the individual or group(s) that engage in the behaviour, and the situation that the behaviour takes place (Davis et al., 2015).

Changing the behaviour of a pharmacist could be aided by their workflow, professional norms, organisational expectations, confidence, skills, habits, feedback and access to decision support systems. Changing a patient's behaviour, on the other hand, may be more influenced by their understanding, perceived necessity, and concerns about medicines, social influences, prior experiences, and day-to-day routines.

This distinction highlights the basis for some of the overall patterns seen in the review. An intervention aimed at professionals may require an environmental restructuring, prompting, feedback, audit, workflow modification, or professional training to be effective. A patient-facing intervention, meanwhile, may need communication strategies, action planning, self-monitoring, goal setting, or support for adherence to succeed.

Consequently, pooling both groups' evidence into one dataset obscures the fact that the dominance of instructional methods and the limited use of behavioural theory may not apply equally to both intervention types.

The current review is unable to say whether such a difference is present due to the way the two groups' literature was combined, but the distinction is an important basis for future research.

Subsequent reviews could look separately at patient-facing and professional-facing interventions and examine whether theories, behaviour change techniques, and implementation contexts differ systematically between them.

The findings therefore suggest that AMS research may benefit from moving away from a single conception of the behaviour that needs to be changed. Antibiotic stewardship involves multiple actors at multiple stages in the prescribing and medicine-use pathway. Seeing these as one general problem leads to interventions that are too broad to address the mechanisms leading to particular problematic behaviours.

A more behaviourally-specific approach would highlight first the actor, the target behaviour, the context, and the determinants of the behaviour before selecting intervention techniques. Such an approach would also offer a more tangible evaluation basis – examining whether an intervention changed the intended behavioural mechanism rather than just an overall outcome.

## **4.6 Limitations**

### **4.6.1 Limitations of the Review Methodology**

The title, abstract and full-text screening, as well as decisions, were made mainly by one reviewer and verified and discussed with the supervisor, as opposed to the dual-reviewer process with arbitration by a third reviewer.

This review did not use a pre-registered protocol, such as on Open Science Framework. As mentioned previously, potential registration is good practice when conducting an evidence-based synthesis, but it was not observed in this review, which moderately restricts transparency and reliability of the review process.

Only five databases PubMed, Scopus, Web of Science, CINAHL, and PsycINFO were searched; English-language literature was included, and only literature that was peer-reviewed was included; grey literature and literature in other languages were not captured.

### **4.6.2 Evidence Base Limitations**

The 20 studies included were geographically focused, with more than a quarter from the United Kingdom, two from India, and the remaining studies each being from a different country. This concentration was directly related to the application of behavioral theory, as discussed in Chapter 4, which is why the results of the review on the use of behavioral theory can only be generalized to the context of the studies reviewed.

The research design of the studies varied widely, from randomized controlled to qualitative interview studies, with some studies being conducted on small samples. This diversity is suitable for a scoping review but also poses a problem when analysing and interpreting the data presented

in the review: i-e the included evidence in the review cannot be pooled or weighted only on the basis of methodological strength; as review points some strong and weak evidences in the data pool.

Only a small number of the studies studied interventions to the behavior of the pharmacist or prescriber compared to the majority of studies that revolved around patient contact.

#### **4.6.3 Conceptual and Synthetic Limitations**

The review was conducted in the form of a structured narrative synthesis, instead of a formal quantitative or thematic analysis. Findings were tabulated into categories based on the extraction table and summarized with counts, which cannot be statistically pooled and do not allow for effect-size calculations. In addition, the patterns found are not the result of a standardized analytic procedure but rather the result of the reviewers' organization of the findings. (Popay et al., 2006)

Some coding of Behaviour Change Techniques (BCT) v1 (Michie et al., 2013) required some interpretation, particularly when interventions were described generally (e.g. counselling or education) but not sufficiently in detail to provide confidence in coding. In the extraction table, cases were marked as uncertain, but this does not imply that the process of marking cases as such was entirely objective.

Lastly, this review did not formally synthesize or compare intervention effectiveness or quantitative outcomes. The results therefore do not illustrate if any intervention was more clinically and behaviorally effective than others as far as AMS is concerned, but only show how the pharmacist-led AMS interventions have applied behavioral theory, BCTs, and communication strategies.

## **4.7 Implications for Practice, Design, and Future Research**

### **4.7.1 Implications for practice and future research.**

The model highlighted in (Jones et al., 2018) is a working model that can be used as a template by teams in their future interventions as pharmacist-led AMS. It can identify behavioral factors using TDF, translate into a design using the BCW and COM-B, and code the design against the BCT Taxonomy v1.

Active-engagement techniques were found in only a few studies, so there is a need for more in the literature, not to replace the instruction and information giving that is already in place. This is feasible because, as mentioned earlier in this chapter, neither (Angoulvant et al., 2013) nor (Lambert, Benko, et al., 2025) had special requirements for additional infrastructure to accomplish the task.

### **4.7.2 For Pharmacy Practice**

Pharmacists who offer AMS interventions in very different settings make extensive use of tailored and individualized counselling. It is one of the positive indicators that it is effective as a practical transferable approach.

However, the literature available in general, and the AMS led by the pharmacist in particular, has little value for the transition from the one-way information flow to the two-way patient-information flow. Additionally, in health care communication, there are more widely used tools of shared decision-making that may be transferable to this practice.

### **4.7.3 For Future Research**

Based on this review, the following three areas of future study are identified. There is a potential for a research culture effect on theory-based work and a structural effect, and it would be interesting to see whether the COM-B/BCW/TDF approach to community pharmacy work is also effective in hospital, primary care and non-UK community settings to help distinguish between the two explanations.

The second is that this review does not look at outcomes or effectiveness, and a next step would be to confirm that the more active BCTs and more active engagement did not have different outcomes to the majority of studies, which used instruction.

Third, there is a lack of alignment between patient engagement and shared decision making, and research testing the application of shared decision-making tools for the context of AMS work by pharmacists would give insight into whether or not shared decision-making is indeed a problem in antibiotic-related decision-making or simply has not been developed.

## **CHAPTER 5 – CONCLUSION**

This scoping review aimed to explore the research methods used to incorporate behavior modification frameworks and patient engagement strategies into antimicrobial stewardship programs run by pharmacists, and their impact on antibiotic use. Twenty studies were included and synthesized to answer the research questions based around Behavioral theories used and how well they were applied; range and distribution of BCTs used; structure of communication and counselling strategies; and settings, populations and contexts in which interventions have been implemented.

Reviewing the behavioral theory, it was identified that a well-established framework, typically COM-B was used in seven of the 20 studies. These seven studies were not uniformly distributed, but were all within fairly close boundaries and some were follow-up studies. The 13 remaining studies did not mention a named behavioral theory. This suggests that theory informed research design is possible and effective in this domain and is beginning to gain acceptance, but not yet a common practice in this domain.

The review identified a significant difference in the use of BCTs in terms of instructions and information about health consequences, as majority of the dataset contained BCTs related to the health consequences. Additionally, the remaining techniques included more active behavioral involvement were each represented in only a few studies and studied only with some of the interventions. Communication strategies were primarily about individualized tailored counselling usually delivered with written information and shared decision making was rarely mentioned even in studies that had the most advanced aspects of patient engagement.

With regard to setting and context, evidence was focused geographically; more than a quarter of the studies included were from the United Kingdom and most were based in community pharmacy. This focus coincided closely with that of theory-informed design, which led to open questions raised about the transferability of the current evidence on theory-informed AMS communication to hospital settings, primary care or non-UK community settings.

Combined, the findings indicate that research in the area of antimicrobial stewardship led by pharmacists has shown, in a few selected studies, the applicability of behavioral theory and a wider spectrum of BCTs to patient and staff-directed communication around AMS. What is not well developed is the uniformity of this approach in the broader literature, the degree to which patient involvement in this way includes actual shared decision making, and the extent to which the findings in the literature can be extrapolated beyond the contexts in which they are generated.

This review has certain limitations, behavioural theory and BCTs were only mainly reviewed by one author; the protocol was not registered in advance; there was not a prospective synthesis of outcomes or effectiveness data, therefore it cannot comment on whether a particular behavioural theory and BCT approach is more effective or more clinically effective than another. The following should be considered when drawing conclusions from the above summary

While these limits are respected, this review can provide a structured description of the progress and gaps in the integration of behavioural science with pharmacist-led antimicrobial stewardship communication and a reasonably specific guide for future research like testing theory informed intervention design in community pharmacy outside the UK, investigation of the differential effects of more active BCTs compared to the dominant instruction heavy BCTs, and further research to clarify whether shared decision making is truly constrained in antibiotic-related decisions, or it is an issue for further exploration in intervention design. These gaps could inform

if the theory informed method shown in a few studies in this review can be expanded to a more uniform method of pharmacist-led AMS in the broader context.

## REFERENCES

- Acampora, M., Guasconi, M., Schioli, C., Coschignano, C., Cassinari, N., Cipolla, R., Artioli, G., Bonacaro, A., Sarli, L., & Barelli, S. (2023). Uncovering doctors' perceived barriers and facilitators of antibiotic prescribing behaviours: A qualitative study using the theoretical domains framework. *Acta Biomedica Atenei Parmensis*, 94(6), e2023265. <https://doi.org/10.23750/abm.v94i6.15232>
- Adam, K. E., & Bruce, A. (2023). Consumer Preferences and Attitudes towards Antibiotic Use in Food Animals. *Antibiotics*, 12(10), 1545. <https://doi.org/10.3390/antibiotics12101545>
- Adlan, O., Stewart, D., Ahmed, Y., Al-Ismael, M., Al-Omary, H., & Nazar, Z. (2025). A scoping review of the use of behavioral theories in health professionals' continuing professional development research. *BMC Medical Education*, 25(1), 1721. <https://doi.org/10.1186/s12909-025-08276-3>
- Aika, I. N., & Enato, E. (2023). Bridging the gap in knowledge and use of antibiotics among pediatric caregivers: Comparing two educational interventions. *Journal of Pharmaceutical Policy and Practice*, 16(1), 76. <https://doi.org/10.1186/s40545-023-00578-5>
- Allison, R., Chapman, S., Howard, P., Thornley, T., Ashiru-Oredope, D., Walker, S., Jones, L. F., & McNulty, C. A. M. (2020). Feasibility of a community pharmacy antimicrobial stewardship intervention (PAMSI): An innovative approach to improve patients' understanding of their antibiotics. *JAC-Antimicrobial Resistance*, 2(4), dlaa089. <https://doi.org/10.1093/jacamr/dlaa089>
- Almomani, B. A., Hijazi, B. M., Al-Husein, B. A., Oqal, M., & Al-Natour, L. M. (2023). Adherence and utilization of short-term antibiotics: Randomized controlled study. *PloS One*, 18(9), e0291050. <https://doi.org/10.1371/journal.pone.0291050>
- Angoulvant, F., Rouault, A., Prot-Labarthé, S., Boizeau, P., Skurnik, D., Morin, L., Mercier, J.-C., Alberti, C., & Bourdon, O. (2013). Randomized Controlled Trial of Parent Therapeutic Education on Antibiotics to Improve Parent Satisfaction and Attitudes in a Pediatric Emergency Department. *PLoS ONE*, 8(9), e75590. <https://doi.org/10.1371/journal.pone.0075590>
- Ari Kristina, S., Nisrina Salsabila, N., Yulianto, Y., & Fortwengel, G. (2021). Effect of didactic educational intervention on improving knowledge of antibiotics use and resistance in Yogyakarta Community. *Pharmaceutical Sciences Asia*, 48(4), 346–353. <https://doi.org/10.29090/psa.2021.04.20.075>
- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. <https://doi.org/10.1080/1364557032000119616>

- Ashiru-Oredope, D., Doble, A., Thornley, T., Saei, A., Gold, N., Sallis, A., McNulty, C. A. M., Lecky, D., Umoh, E., & Klinger, C. (2020). Improving Management of Respiratory Tract Infections in Community Pharmacies and Promoting Antimicrobial Stewardship: A Cluster Randomised Control Trial with a Self-Report Behavioural Questionnaire and Process Evaluation. *Pharmacy*, 8(1), 44. <https://doi.org/10.3390/pharmacy8010044>
- Attar, N. R., Dhanawade, S. S., Yadav, D., & Nikam, J. (2025). Impact of Antimicrobial Stewardship on Antimicrobial Utilization and Resistance Patterns in a Tertiary Care Hospital in Western Maharashtra. *Cureus*, 17(3), e80012. <https://doi.org/10.7759/cureus.80012>
- Bae, J.-M. (2017). Shared decision making: Relevant concepts and facilitating strategies. *Epidemiology and Health*, 39, e2017048. <https://doi.org/10.4178/epih.e2017048>
- Bardet, J.-D., Vo, T.-H., Bedouch, P., & Allenet, B. (2015). Physicians and community pharmacists collaboration in primary care: A review of specific models. *Research in Social and Administrative Pharmacy*, 11(5), 602–622. <https://doi.org/10.1016/j.sapharm.2014.12.003>
- Barsola, B., Saklani, S., Pathania, D., Kumari, P., Sonu, S., Rustagi, S., Singh, P., Raizada, P., Moon, T. S., Kaushik, A., & Chaudhary, V. (2024). Exploring bio-nanomaterials as antibiotic allies to combat antimicrobial resistance. *Biofabrication*, 16(4), 042007. <https://doi.org/10.1088/1758-5090/ad6b45>
- Beck, A. P., Baubie, K., Knobloch, M. J., & Safdar, N. (2018). Promoting Antimicrobial Stewardship by Incorporating it in Undergraduate Medical Education Curricula. *WMJ: Official Publication of the State Medical Society of Wisconsin*, 117(5), 224–228.
- Boiko, O., Gulliford, M. C., & Burgess, C. (2020). Revisiting patient expectations and experiences of antibiotics in an era of antimicrobial resistance: Qualitative study. *Health Expectations*, 23(5), 1250–1258. <https://doi.org/10.1111/hex.13102>
- Borek, A. J., Wanat, M., Atkins, L., Sallis, A., Ashiru-Oredope, D., Beech, E., Butler, C. C., Chadborn, T., Hopkins, S., Jones, L., McNulty, C. A. M., Roberts, N., Shaw, K., Taborn, E., & Tonkin-Crine, S. (2020). Optimising antimicrobial stewardship interventions in English primary care: A behavioural analysis of qualitative and intervention studies. *BMJ Open*, 10(12), e039284. <https://doi.org/10.1136/bmjopen-2020-039284>
- Borek, A. J., Wanat, M., Sallis, A., Ashiru-Oredope, D., Atkins, L., Beech, E., Hopkins, S., Jones, L., McNulty, C., Shaw, K., Taborn, E., Butler, C., Chadborn, T., & Tonkin-Crine, S. (2019). How Can National Antimicrobial Stewardship Interventions in Primary Care Be Improved? A Stakeholder Consultation. *Antibiotics*, 8(4), 207. <https://doi.org/10.3390/antibiotics8040207>
- British Society for Antimicrobial Chemotherapy. (2018). *Antimicrobial stewardship: From principles to practice*. <https://www.bsac.org.uk/antimicrobialstewardshipebook/BSAC-AntimicrobialStewardship-FromPrinciplestoPractice-eBook.pdf>

- Brookes-Howell, L., Elwyn, G., Hood, K., Wood, F., Cooper, L., Goossens, H., Ieven, M., & Butler, C. C. (2012). 'The Body Gets Used to Them': Patients' Interpretations of Antibiotic Resistance and the Implications for Containment Strategies. *Journal of General Internal Medicine*, 27(7), 766–772. <https://doi.org/10.1007/s11606-011-1916-1>
- Browne, A. J., Chipeta, M. G., Haines-Woodhouse, G., Kumaran, E. P. A., Hamadani, B. H. K., Zarea, S., Henry, N. J., Deshpande, A., Reiner, R. C., Jr, Day, N. P. J., Lopez, A. D., Dunachie, S., Moore, C. E., Stergachis, A., Hay, S. I., & Dolecek, C. (2021). Global antibiotic consumption and usage in humans, 2000–18: A spatial modelling study. *The Lancet Planetary Health*, 5(12), e893–e904. [https://doi.org/10.1016/S2542-5196\(21\)00280-1](https://doi.org/10.1016/S2542-5196(21)00280-1)
- Burgess, A., & MacGowan, A. (2026). Antibiotic resistance. *Medicine*, 54(1), 40–46. <https://doi.org/10.1016/j.mpmed.2025.10.013>
- Butler, C. C., Simpson, S. A., Dunstan, F., Rollnick, S., Cohen, D., Gillespie, D., Evans, M. R., Health, S. L. I. E. A. P., Alam, M. F., Bekkers, M.-J., Evans, J., Moore, L., Howe, R., Hayes, J., Hare, M., & Hood, K. (2012). Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: Practice based randomised controlled trial. *BMJ*, 344(feb02 1), d8173–d8173. <https://doi.org/10.1136/bmj.d8173>
- Byrne-Davis, L. M. T., Turner, R. R., Amatya, S., Ashton, C., Bull, E. R., Chater, A. M., Lewis, L. J. M., Shorter, G. W., Whittaker, E., & Hart, J. K. (2022). Using behavioural science in public health settings during the COVID-19 pandemic: The experience of public health practitioners and behavioural scientists. *Acta Psychologica*, 224, 103527. <https://doi.org/10.1016/j.actpsy.2022.103527>
- Caneschi, A., Bardhi, A., Barbarossa, A., & Zaghini, A. (2023). The Use of Antibiotics and Antimicrobial Resistance in Veterinary Medicine, a Complex Phenomenon: A Narrative Review. *Antibiotics*, 12(3), 487. <https://doi.org/10.3390/antibiotics12030487>
- Centers for Disease Control and Prevention. (2014). *Core Elements of Hospital Antibiotic Stewardship Programs*. US Department of Health and Human Services, CDC. <http://www.cdc.gov/getsmart/healthcare/implementation/core-elements.html>
- Champion, V. L., & Skinner, C. S. (2008). The health belief model. In *Health behavior and health education: Theory, research, and practice*, 4th ed. (pp. 45–65). Jossey-Bass/Wiley.
- Charani, E., Castro-Sánchez, E., & Holmes, A. (2014). The Role of Behavior Change in Antimicrobial Stewardship. *Infectious Disease Clinics of North America*, 28(2), 169–175. <https://doi.org/10.1016/j.idc.2014.01.004>
- Chavada, J., Muneshwar, K. N., Ghulaxe, Y., Wani, M., Sarda, P. P., & Huse, S. (2023). Antibiotic Resistance: Challenges and Strategies in Combating Infections. *Cureus*. <https://doi.org/10.7759/cureus.46013>

- Chokshi, A., Sifri, Z., Cennimo, D., & Horng, H. (2019). Global Contributors to Antibiotic Resistance. *Journal of Global Infectious Diseases*, 11(1), 36–42. [https://doi.org/10.4103/jgid.jgid\\_110\\_18](https://doi.org/10.4103/jgid.jgid_110_18)
- Cole, S. A., Sannidhi, D., Jadotte, Y. T., & Rozanski, A. (2023). Using motivational interviewing and brief action planning for adopting and maintaining positive health behaviors. *Progress in Cardiovascular Diseases*, 77, 86–94. <https://doi.org/10.1016/j.pcad.2023.02.003>
- Collazo, A., Wermuth, P., Luna Rodriguez, J., Olmeda, K., Mancera, A., Faustinella, F., Paasche-Orlow, M. K., Zoorob, R., Trautner, B. W., & Grigoryan, L. (2025). ‘In Texas, everybody wants antibiotics’: Reducing inappropriate antibiotic expectations and use with a provider–patient communication tool in primary care. *Family Medicine and Community Health*, 13(4), e003628. <https://doi.org/10.1136/fmch-2025-003628>
- Davis, R., Campbell, R., Hildon, Z., Hobbs, L., & Michie, S. (2015). Theories of behaviour and behaviour change across the social and behavioural sciences: A scoping review. *Health Psychology Review*, 9(3), 323–344. <https://doi.org/10.1080/17437199.2014.941722>
- Dellit, T. H., Owens, R. C., McGowan, J. E., Gerding, D. N., Weinstein, R. A., Burke, J. P., Huskins, W. C., Paterson, D. L., Fishman, N. O., Carpenter, C. F., Brennan, P. J., Billeter, M., & Hooton, T. M. (2007). Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. *Clinical Infectious Diseases*, 44(2), 159–177. <https://doi.org/10.1086/510393>
- Dennison Himmelfarb, C. R., Beckie, T. M., Allen, L. A., Commodore-Mensah, Y., Davidson, P. M., Lin, G., Lutz, B., Spatz, E. S., on behalf of the American Heart Association Council on Cardiovascular and Stroke Nursing, & on behalf of the American Heart Association Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; Council on Quality of Care and Outcomes Research; Council on Hypertension; Council on the Kidney in Cardiovascular Disease; Council on Lifelong Congenital Heart Disease and Heart Health in the Young; Council on Lifestyle and Cardiometabolic Health; Council on Peripheral Vascular Disease; Council on Epidemiology and Prevention; and Stroke Council. (2023). Shared Decision-Making and Cardiovascular Health: A Scientific Statement From the American Heart Association. *Circulation*, 148(11), 912–931. <https://doi.org/10.1161/CIR.0000000000001162>
- Dighriri, I. M., Alnomci, B. A., Aljahdali, M. M., Althagafi, H. S., Almatrafi, R. M., Altwairqi, W. G., Almagati, A. A., Shunaymir, A. M., Haidarah, G. A., Alanzi, M. H., Hadadi, A. A., Suwaydi, H. M., Aqdi, M. J., Alharthi, H. N., & Alshahrani, A. F. (2023). The Role of Clinical Pharmacists in Antimicrobial Stewardship Programs (ASPs): A Systematic Review. *Cureus*. <https://doi.org/10.7759/cureus.50151>
- Dik, J.-W. H., Hendrix, R., Poelman, R., Niesters, H. G., Postma, M. J., Sinha, B., & Friedrich, A. W. (2016). Measuring the impact of antimicrobial stewardship programs. *Expert Review of Anti-Infective Therapy*, 14(6), 569–575. <https://doi.org/10.1080/14787210.2016.1178064>

- Do, N. T. T., Vu, H. T. L., Nguyen, C. T. K., Punpuing, S., Khan, W. A., Gyapong, M., Asante, K. P., Munguambe, K., Gómez-Olivé, F. X., John-Langba, J., Tran, T. K., Sunpuwan, M., Sevene, E., Nguyen, H. H., Ho, P. D., Matin, M. A., Ahmed, S., Karim, M. M., Cambaco, O., ... Wertheim, H. F. L. (2021). Community-based antibiotic access and use in six low-income and middle-income countries: A mixed-method approach. *The Lancet Global Health*, 9(5), e610–e619. [https://doi.org/10.1016/S2214-109X\(21\)00024-3](https://doi.org/10.1016/S2214-109X(21)00024-3)
- Donà, D., Barbieri, E., Daverio, M., Lundin, R., Giaquinto, C., Zaoutis, T., & Sharland, M. (2020). Implementation and impact of pediatric antimicrobial stewardship programs: A systematic scoping review. *Antimicrobial Resistance & Infection Control*, 9(1), 3. <https://doi.org/10.1186/s13756-019-0659-3>
- Dyar, O. J., Huttner, B., Schouten, J., & Pulcini, C. (2017). What is antimicrobial stewardship? *Clinical Microbiology and Infection*, 23(11), 793–798. <https://doi.org/10.1016/j.cmi.2017.08.026>
- Estany-Gestal, A., Salgado-Barreira, A., & Vazquez-Lago, J. M. (2024). Antibiotic Use and Antimicrobial Resistance: A Global Public Health Crisis. *Antibiotics (Basel, Switzerland)*, 13(9). <https://doi.org/10.3390/antibiotics13090900>
- Founou, R. C., Blocker, A. J., Noubom, M., Tsayem, C., Choukem, S. P., Dongen, M. V., & Founou, L. L. (2021). The COVID-19 Pandemic: A Threat to Antimicrobial Resistance Containment. *Future Science OA*, 7(8), FSO736. <https://doi.org/10.2144/fsoa-2021-0012>
- Garau, J., & Bassetti, M. (2018). Role of pharmacists in antimicrobial stewardship programmes. *International Journal of Clinical Pharmacy*, 40(5), 948–952. <https://doi.org/10.1007/s11096-018-0675-z>
- Gezmu, A. A., Tesfaye, A. W., & Coates, A. R. M. (2026). The Role of Combination Antibiotic Therapy in Combatting Drug-Resistant *Acinetobacter baumannii* Infections: A Systematic Review of Randomised Control Trials. *Antibiotics*, 15(4), 356. <https://doi.org/10.3390/antibiotics15040356>
- Gillies, K., Brehaut, J., Coffey, T., Duncan, E. M., Francis, J. J., Hey, S. P., Presseau, J., Weijer, C., & Campbell, M. K. (2021). How can behavioural science help us design better trials? *Trials*, 22(1), 882. <https://doi.org/10.1186/s13063-021-05853-x>
- GOV.UK. (2021, November 9). UK-VARSS 2020 Highlights [Government Owned]. GOV.UK. <https://www.gov.uk/government/publications/veterinary-antimicrobial-resistance-and-sales-surveillance-2020/uk-varss-2020-highlights>
- Hayes, C. V., Lecky, D. M., Pursey, F., Thomas, A., Ashiru-Oredope, D., Saei, A., Thornley, T., Howard, P., Dickinson, A., Ingram, C., Allison, R., & McNulty, C. A. M. (2022). Mixed-Method Evaluation of a Community Pharmacy Antimicrobial Stewardship Intervention (PAMSI). *Healthcare*, 10(7), 1288. <https://doi.org/10.3390/healthcare10071288>
- Hayes, C. V., Parekh, S., Lecky, D. M., Loader, J., Triggs-Hodge, C., & Ashiru-Oredope, D. (2023). The National Implementation of a Community Pharmacy Antimicrobial Stewardship Intervention

(PAMSI) through the English Pharmacy Quality Scheme 2020 to 2022. *Antibiotics*, 12(4), 793. <https://doi.org/10.3390/antibiotics12040793>

Heid, C., Knobloch, M. J., Schulz, L. T., & Safdar, N. (2016). Use of the Health Belief Model to Study Patient Perceptions of Antimicrobial Stewardship in the Acute Care Setting. *Infection Control & Hospital Epidemiology*, 37(5), 576–582. <https://doi.org/10.1017/ice.2015.342>

Hembach, N., Schmid, F., Alexander, J., Hiller, C., Rogall, E. T., & Schwartz, T. (2017). Occurrence of the mcr-1 Colistin Resistance Gene and other Clinically Relevant Antibiotic Resistance Genes in Microbial Populations at Different Municipal Wastewater Treatment Plants in Germany. *Frontiers in Microbiology*, 8, 1282. <https://doi.org/10.3389/fmicb.2017.01282>

Hickey, E., Man, B., Helm, K. V. T., Lockhart, S., Duffecy, J., & Morris, M. A. (2024). Preferred Communication Strategies for People with Communication Disabilities in Health Care Encounters: A Qualitative Study. *Journal of General Internal Medicine*, 39(5), 790–797. <https://doi.org/10.1007/s11606-023-08526-4>

Jones, L. F., Owens, R., Sallis, A., Ashiru-Oredope, D., Thornley, T., Francis, N. A., Butler, C., & McNulty, C. A. M. (2018). Qualitative study using interviews and focus groups to explore the current and potential for antimicrobial stewardship in community pharmacy informed by the Theoretical Domains Framework. *BMJ Open*, 8(12), e025101. <https://doi.org/10.1136/bmjopen-2018-025101>

Klaic, M., Kapp, S., Hudson, P., Chapman, W., Denehy, L., Story, D., & Francis, J. J. (2022). Implementability of healthcare interventions: An overview of reviews and development of a conceptual framework. *Implementation Science*, 17(1), 10. <https://doi.org/10.1186/s13012-021-01171-7>

Kok, G., Gottlieb, N. H., Peters, G.-J. Y., Mullen, P. D., Parcel, G. S., Ruiter, R. A. C., Fernández, M. E., Markham, C., & Bartholomew, L. K. (2016). A taxonomy of behaviour change methods: An Intervention Mapping approach. *Health Psychology Review*, 10(3), 297–312. <https://doi.org/10.1080/17437199.2015.1077155>

Kraetschmer, N., Sharpe, N., Urowitz, S., & Deber, R. B. (2004). How does trust affect patient preferences for participation in decision-making? *Health Expectations*, 7(4), 317–326. <https://doi.org/10.1111/j.1369-7625.2004.00296.x>

Kumar, K. S., Saranya, S., & Rani, N. V. (2022). Community Pharmacists' Knowledge, Attitude, and Nonprescription Dispensing Practices of Antibiotics: An Explorative Study in a Selected City of South India. *Journal of Research in Pharmacy Practice*, 11(2), 51–58. [https://doi.org/10.4103/jrpp.jrpp\\_48\\_21](https://doi.org/10.4103/jrpp.jrpp_48_21)

Kusuma, I. Y., Pratiwi, H., & Pitaloka, D. A. E. (2022). Role of Pharmacists in Antimicrobial Stewardship During COVID-19 Outbreak: A Scoping Review. *Journal of Multidisciplinary Healthcare*, Volume 15, 2605–2614. <https://doi.org/10.2147/JMDH.S385170>

- Lakha, A., Fleming, N., Sonnex, K., Thornley, T., Anderson, C., Hand, K., & Ashiru-Oredope, D. (2023). Evaluating the role of primary care pharmacy technicians in antimicrobial stewardship (AMS) and acne management using TARGET resources. *JAC-Antimicrobial Resistance*, 6(1), dlae011. <https://doi.org/10.1093/jacamr/dlae011>
- Lambert, M., Benko, R., Lykkegaard, J., Søndergaard, J., Olsen, J., Garcia-Sangenis, A., Anastasaki, M., Lionis, C., Hansen, M. P., Lundgren, P. T., Bruno, P., Raynal, F., Vallejo-Torres, L., Bjerrum, L., Jaruseviciene, L., Radzeviciene, R., Kowalczyk, A., Llor, C., & Taxis, K. (2025). Community pharmacists' role in optimising antibiotic use: The HAPPY PATIENT project to improve dispensing practices in five EU countries. *Research in Social & Administrative Pharmacy: RSAP*, 21(8), 597–607. <https://doi.org/10.1016/j.sapharm.2025.03.064>
- Lambert, M., Van Dijk, L., Benko, R., Llor, C., Lykkegaard, J., Mantel-Teeuwisse, A. K., Pont, L., & Taxis, K. (2025). The role of the community pharmacist in antibiotic use – a commentary on current status and future perspectives. *Exploratory Research in Clinical and Social Pharmacy*, 20, 100652. <https://doi.org/10.1016/j.rcsop.2025.100652>
- Liaskou, M., Duggan, C., Joynes, R., & Rosado, H. (2018). Pharmacy's role in antimicrobial resistance and stewardship. *Pharmaceutical Journal*. <https://doi.org/10.1211/PJ.2018.20204885>
- Lloyd, D. H., & Page, S. W. (2018). Antimicrobial Stewardship in Veterinary Medicine. In S. Schwarz, L. M. Cavaco, & J. Shen (Eds.), *Antimicrobial Resistance in Bacteria from Livestock and Companion Animals* (pp. 675–697). ASM Press. <https://doi.org/10.1128/9781555819804.ch31>
- MacGowan, A., & Macnaughton, E. (2017). Antibiotic resistance. *Medicine*, 45(10), 622–628. <https://doi.org/10.1016/j.mpmed.2017.07.006>
- Maher, A., Roche, K., Morrissey, E., Murphy, A., Sheaf, G., Ryan, C., & Molloy, G. J. (2025). Behaviour change interventions addressing patient antibiotic treatment-seeking behaviour for respiratory tract infections in primary and community care settings: A scoping review. *BMJ Open*, 15(8), e101694. <https://doi.org/10.1136/bmjopen-2025-101694>
- Majumder, M. A. A., Rahman, S., Cohall, D., Bharatha, A., Singh, K., Haque, M., & Gittens-St Hilaire, M. (2020). Antimicrobial Stewardship: Fighting Antimicrobial Resistance and Protecting Global Public Health. *Infection and Drug Resistance*, Volume 13, 4713–4738. <https://doi.org/10.2147/IDR.S290835>
- Marques, M. M., Wright, A. J., Corker, E., Johnston, M., West, R., Hastings, J., Zhang, L., & Michie, S. (2024). The Behaviour Change Technique Ontology: Transforming the Behaviour Change Technique Taxonomy v1. *Wellcome Open Research*, 8, 308. <https://doi.org/10.12688/wellcomeopenres.19363.2>
- Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., Eccles, M. P., Cane, J., & Wood, C. E. (2013). The Behavior Change Technique Taxonomy (v1) of 93 Hierarchically Clustered Techniques: Building an International Consensus for the Reporting of

Behavior Change Interventions. *Annals of Behavioral Medicine*, 46(1), 81–95.  
<https://doi.org/10.1007/s12160-013-9486-6>

Miller, W. R., Rollnick, S., Butler, C. C., & Aloia, M. S. (2008). Motivational Interviewing in Health Care: Helping Patients Change Behavior. *COPD: Journal of Chronic Obstructive Pulmonary Disease*, 5(3), 203–203. <https://doi.org/10.1080/15412550802093108>

Montori, V. M., Ruissen, M. M., Hargraves, I. G., Brito, J. P., & Kunneman, M. (2023). Shared decision-making as a method of care. *BMJ Evidence-Based Medicine*, 28(4), 213–217.  
<https://doi.org/10.1136/bmjebm-2022-112068>

Moore, S. A., Flynn, D., Price, C. I. M., & Avery, L. (2022). Using intervention mapping to develop and facilitate implementation of a multifaceted behavioural intervention targeting physical activity and sedentary behaviour in stroke survivors: Physical Activity Routines After Stroke (PARAS): intervention development study. *Health Psychology and Behavioral Medicine*, 10(1), 439–466. <https://doi.org/10.1080/21642850.2022.2066534>

Muflih, S. M., Al-Azzam, S., Karasneh, R. A., Conway, B. R., & Aldeyab, M. A. (2021). Public Health Literacy, Knowledge, and Awareness Regarding Antibiotic Use and Antimicrobial Resistance during the COVID-19 Pandemic: A Cross-Sectional Study. *Antibiotics*, 10(9), 1107.  
<https://doi.org/10.3390/antibiotics10091107>

Müller, E., Zill, J. M., Dirmaier, J., Härter, M., & Scholl, I. (2014). Assessment of Trust in Physician: A Systematic Review of Measures. *PLoS ONE*, 9(9), e106844.  
<https://doi.org/10.1371/journal.pone.0106844>

Muñoz, E. B., Dorado, M. F., Guerrero, J. E., & Martínez, F. M. (2014). The effect of an educational intervention to improve patient antibiotic adherence during dispensing in a community pharmacy. *Atención Primaria*, 46(7), 367–375. <https://doi.org/10.1016/j.aprim.2013.12.003>

Notarbartolo, V., Badiane, B. A., Insinga, V., & Giuffrè, M. (2024). Antimicrobial Stewardship: A Correct Management to Reduce Sepsis in NICU Settings. *Antibiotics*, 13(6), 520.  
<https://doi.org/10.3390/antibiotics13060520>

O'Neill, J. (2016). *Tackling Drug-Resistant Infections Globally: Final Report and Recommendations* [Final Report]. Review on Antimicrobial Resistance. [https://amr-review.org/sites/default/files/160525\\_Final%20paper\\_with%20cover.pdf](https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf)

Paravattil, B., Zolezzi, M., Nasr, Z., Benkhadra, M., Alasmar, M., Hussein, S., & Maklad, A. (2021). An Interventional Call-Back Service to Improve Appropriate Use of Antibiotics in Community Pharmacies. *Antibiotics (Basel, Switzerland)*, 10(8). <https://doi.org/10.3390/antibiotics10080986>

Parente, D. M., & Morton, J. (2018). Role of the Pharmacist in Antimicrobial Stewardship. *Medical Clinics of North America*, 102(5), 929–936. <https://doi.org/10.1016/j.mcna.2018.05.009>

- Patey, A. M., Fontaine, G., Francis, J. J., McCleary, N., Presseau, J., & Grimshaw, J. M. (2023). Healthcare professional behaviour: Health impact, prevalence of evidence-based behaviours, correlates and interventions. *Psychology & Health*, 38(6), 766–794. <https://doi.org/10.1080/08870446.2022.2100887>
- Peters, M. D. J., Marnie, C., Tricco, A. C., Pollock, D., Munn, Z., Alexander, L., McInerney, P., Godfrey, C. M., & Khalil, H. (2020). Updated methodological guidance for the conduct of scoping reviews. *JBI Evidence Synthesis*, 18(10), 2119–2126. <https://doi.org/10.11124/JBIES-20-00167>
- Pierce, K. N., Clarke, K., Swanson, M. M., & Hobbs, D. (2021). Implementation of a Pharmacist-Led Culture and Susceptibility Review System in Urgent Care and Outpatient Settings. *Federal Practitioner : For the Health Care Professionals of the VA, DoD, and PHS*, 38(9), 426–430. <https://doi.org/10.12788/fp.0173>
- Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., Britten, N., Roen, K., & Duffy, S. (2006). *Guidance on the conduct of narrative synthesis in systematic reviews: A product from the ESRC Methods Programme*. Lancaster University. <https://doi.org/10.13140/2.1.1018.4643>
- Prestinaci, F., Pezzotti, P., & Pantosti, A. (2015). Antimicrobial resistance: A global multifaceted phenomenon. *Pathogens and Global Health*, 109(7), 309–318. <https://doi.org/10.1179/2047773215Y.00000000030>
- Radhakrishnan, R., Maheswary, D., Leela, K. V., & Damodharan, N. (2023). Impact of clinical pharmacist’s educational intervention tools in enhancing public awareness and perception of antibiotic use: A randomized control trial. *Clinical Epidemiology and Global Health*, 19, 101191. <https://doi.org/10.1016/j.cegh.2022.101191>
- Richardson, M., Khouja, C. L., Sutcliffe, K., & Thomas, J. (2019). Using the theoretical domains framework and the behavioural change wheel in an overarching synthesis of systematic reviews. *BMJ Open*, 9(6), e024950. <https://doi.org/10.1136/bmjopen-2018-024950>
- Saha, S. K., Hawes, L., & Mazza, D. (2019). Effectiveness of interventions involving pharmacists on antibiotic prescribing by general practitioners: A systematic review and meta-analysis. *Journal of Antimicrobial Chemotherapy*, 74(5), 1173–1181. <https://doi.org/10.1093/jac/dky572>
- Salam, Md. A., Al-Amin, Md. Y., Salam, M. T., Pawar, J. S., Akhter, N., Rabaan, A. A., & Alqumber, M. A. A. (2023). Antimicrobial Resistance: A Growing Serious Threat for Global Public Health. *Healthcare*, 11(13), 1946. <https://doi.org/10.3390/healthcare11131946>
- Simpson, A., Beauchamp, M. R., Dimmock, J., Willis, C., & Jackson, B. (2025). Health behaviour change: Theories, progress, and recommendations for the next generation of physical activity research. *Psychology of Sport and Exercise*, 80, 102918. <https://doi.org/10.1016/j.psychsport.2025.102918>
- Simpson, S. A., Butler, C. C., Hood, K., Cohen, D., Dunstan, F., Evans, M. R., Rollnick, S., Moore, L., Hare, M., Bekkers, M.-J., & Evans, J. (2009). Stemming the Tide of Antibiotic Resistance (STAR): A

protocol for a trial of a complex intervention addressing the “why” and “how” of appropriate antibiotic prescribing in general practice. *BMC Family Practice*, 10(1), 20. <https://doi.org/10.1186/1471-2296-10-20>

Smith, J., Zimmerman, E., Gachiengo Nyabero, W., Nanda, P., Fasawe, O., & Roder-DeWan, S. (2025). A behavioural science framework for tackling upstream challenges in health systems. *BMJ Global Health*, 10(2), e016897. <https://doi.org/10.1136/bmjgh-2024-016897>

Sneddon, J., Thompson, W., Kpobi, L. N. A., Ade, D. A., Sefah, I. A., Afriyie, D., Goldthorpe, J., Turner, R., Nawaz, S., Wilson, S., Hart, J., & Byrne-Davis, L. (2022). Exploring the Use of Antibiotics for Dental Patients in a Middle-Income Country: Interviews with Clinicians in Two Ghanaian Hospitals. *Antibiotics*, 11(8), 1081. <https://doi.org/10.3390/antibiotics11081081>

Stiggelbout, A. M., Weijden, T. V. D., Wit, M. P. T. D., Frosch, D., Legare, F., Montori, V. M., Trevena, L., & Elwyn, G. (2012). Shared decision making: Really putting patients at the centre of healthcare. *BMJ*, 344(jan27 1), e256–e256. <https://doi.org/10.1136/bmj.e256>

Tang, K. W. K., Millar, B. C., & Moore, J. E. (2023). Antimicrobial Resistance (AMR). *British Journal of Biomedical Science*, 80, 11387. <https://doi.org/10.3389/bjbs.2023.11387>

Tiseo, K., Huber, L., Gilbert, M., Robinson, T. P., & Van Boeckel, T. P. (2020). Global Trends in Antimicrobial Use in Food Animals from 2017 to 2030. *Antibiotics*, 9(12), 918. <https://doi.org/10.3390/antibiotics9120918>

Torres, N. F., Solomon, V. P., & Middleton, L. E. (2019). Patterns of self-medication with antibiotics in Maputo City: A qualitative study. *Antimicrobial Resistance & Infection Control*, 8(1), 161. <https://doi.org/10.1186/s13756-019-0618-z>

Tricco, A. C., Lillie, E., Zarin, W., O’Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., ... Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine*, 169(7), 467–473. <https://doi.org/10.7326/M18-0850>

UK Government. (2019). *Tackling antimicrobial resistance 2019–2024: The UK’s five-year national action plan* [National Action Plan]. UK Government. [https://assets.publishing.service.gov.uk/media/6261392d8fa8f523bf22ab9e/UK\\_AMR\\_5\\_year\\_national\\_action\\_plan.pdf](https://assets.publishing.service.gov.uk/media/6261392d8fa8f523bf22ab9e/UK_AMR_5_year_national_action_plan.pdf)

Van Den Bergh, D., & Brink, A. (2021). A commitment and call to strengthen and expand qualitative research efforts to improve the impact of antimicrobial stewardship. *JAC-Antimicrobial Resistance*, 3(4), dlab151. <https://doi.org/10.1093/jacamr/dlab151>

Van Dijk, L. M., Van Eikenhorst, L., Karapinar-Çarkit, F., & Wagner, C. (2023). Patient participation during discharge medication counselling: Observing real-life communication between

healthcare professionals and patients. *Research in Social and Administrative Pharmacy*, 19(8), 1228–1235. <https://doi.org/10.1016/j.sapharm.2023.05.008>

Vilić, K., Momčilović, M., Kuruc Poje, D., Bužančić, I., Sertić, V., Zlatar, G. Š., Žabić, I., Hadžiabdić, M. O., & Turčić, P. (2025). Impact of clinical pharmacist counselling at discharge on adherence to oral antibiotics: A pilot study. *Acta Pharmaceutica*, 75(4), 643–657. <https://doi.org/10.2478/acph-2025-0039>

Warrier, A. R., Tejaswini, N., Kallarakkal, H., & Sagar, S. (2025). Enhancing antimicrobial stewardship program: Impact of clinical pharmacist-driven feedback in the absence of infectious diseases physicians—a multicenter quasi-experimental study. *Antimicrobial Stewardship & Healthcare Epidemiology*, 5(1), e176. <https://doi.org/10.1017/ash.2025.10088>

WHO. (2026, July 16). *Antimicrobial resistance* [World Forum]. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance>

WHO Regional Office for Europe & European Centre for Disease Prevention and Control. (2022). *Antimicrobial resistance surveillance in Europe 2022 – 2020 data* [Surveillance report]. WHO Regional Office for Europe. <https://www.ecdc.europa.eu/en/publications-data/antimicrobial-resistance-surveillance-europe-2022-2020-data>

World Health Organization. (2015). *Global Action Plan on Antimicrobial Resistance*. World Health Organization.