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ANTIBIOTIC PRESCRIBING IN ACUTE ENDODONTIC CONDITIONS: EVIDENCE, CLINICAL PRACTICE, AND ANTIMICROBIAL STEWARDSHIP FROM A PUBLIC HEALTH PERSPECTIVE

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ABSTRACT

Antibiotic prescribing in dentistry represents an important component of antimicrobial stewardship because dental professionals contribute substantially to community antibiotic exposure. Acute endodontic conditions are frequently encountered in urgent dental care, although systemic antibiotics have a limited role in most localized pulpal and periapical diseases. This narrative review examined evidence concerning antibiotic indications in acute endodontic conditions, international prescribing recommendations, reported prescribing practices, determinants of inappropriate prescribing, and potential stewardship interventions. The evidence was synthesized qualitatively. Current recommendations consistently prioritize definitive local treatment and source control and discourage antibiotics for symptomatic irreversible pulpitis, symptomatic apical periodontitis, and localized acute apical abscesses without systemic involvement. Antibiotics are mainly indicated when infection is spreading or accompanied by systemic manifestations such as fever, diffuse swelling, cellulitis, progressive trismus, dysphagia, or other signs of significant infection. Nevertheless, inappropriate prescribing remains common and is associated with diagnostic uncertainty, fear of complications, patient expectations, time pressure, limited access to urgent operative treatment, and organizational barriers. Evidence from stewardship programmes suggests that education alone is less effective than multimodal interventions incorporating guidelines, decision-support tools, audit and feedback, and patient communication. Antimicrobial stewardship in endodontics should therefore be considered not only a clinical issue but also a public-health and healthcare-system challenge.

KEYWORDS

Antibiotic Prescribing, Antimicrobial Stewardship, Acute Endodontic Conditions, Dental Infections, Public Health

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1. Introduction

Antibiotic resistance is one of the major public-health challenges associated with contemporary healthcare. Although antibiotic prescribing is frequently discussed in relation to hospitals and primary medical care, dentistry represents an important source of community antimicrobial exposure. Dental professionals prescribe systemic antibiotics predominantly for odontogenic infections and prophylactic indications, and therefore prescribing behaviour within dental services may influence both individual patient safety and population-level antimicrobial resistance. Rational dental prescribing has consequently become an increasingly important component of antimicrobial stewardship.

Acute endodontic conditions provide a particularly relevant example of the tension between microbiological disease, clinical urgency, patient expectations, and appropriate antimicrobial use. Symptomatic irreversible pulpitis, symptomatic apical periodontitis, and acute apical abscess are common causes of urgent dental attendance. Their clinical presentation may include severe pain, tenderness, swelling, and, in more advanced cases, systemic manifestations. Nevertheless, the presence of microorganisms within the root canal system does not automatically justify systemic antibiotic treatment. In most localized endodontic conditions, the principal therapeutic objective is elimination of the source of infection through local intervention, such as pulpotomy, pulpectomy, root canal treatment, drainage, or extraction (Lockhart et al., 2019; Segura-Egea et al., 2018).

This distinction is important from both clinical and public-health perspectives. Systemic antibiotics do not remove necrotic pulp tissue, disinfect the root canal system sufficiently to replace mechanical treatment, or establish drainage of a localized abscess. Their routine use in such circumstances may expose patients to adverse drug reactions without providing clinically meaningful additional benefit. Evidence summarized by the American Dental Association and Cochrane reviews has therefore supported restrictive antibiotic use for most pulpal and localized periapical conditions (Agnihotry et al., 2019; Cope et al., 2024; Lockhart et al., 2019; Tampi et al., 2019).

Current clinical guidelines are broadly consistent in recommending antibiotics when there is evidence of systemic involvement or spreading infection. Fever, malaise, diffuse or rapidly progressive swelling, cellulitis, significant lymphadenopathy, progressive trismus, dysphagia, and infection involving deeper anatomical spaces may indicate that local treatment alone is insufficient or that the infection poses a risk of serious complications. In these circumstances, antimicrobial therapy may be an important adjunct to urgent source control and clinical monitoring (Jevon et al., 2020; Leroy et al., 2020; Palmer, 2020; Scottish Dental Clinical Effectiveness Programme [SDCEP], 2026).

Despite this relatively consistent evidence base, antibiotic prescribing in dental practice remains variable. Surveys from different countries have documented prescribing for conditions in which antibiotics are not routinely indicated, including irreversible pulpitis, necrotic pulp without systemic involvement, symptomatic apical periodontitis, and localized abscesses. Variation also exists in antimicrobial selection, duration of treatment, use of broad-spectrum agents, and management of reported penicillin allergy (Abraham et al., 2020; Dias et al., 2022; Drobac et al., 2021; Mende et al., 2020; Sović et al., 2024).

The discrepancy between guidelines and clinical practice cannot be explained exclusively by insufficient knowledge. Antibiotic prescribing is a behavioural decision embedded within a wider healthcare environment. Dentists may prescribe because of diagnostic uncertainty, concern about progression, fear of adverse outcomes, perceived patient expectations, limited consultation time, difficulties arranging follow-up, or restricted access to definitive operative care. A prescription may therefore function as a form of risk management even when the clinician recognizes that it is not the preferred evidence-based intervention (Böhmer et al., 2021; Newlands et al., 2016; Rodríguez-Fernández et al., 2023).

The problem may become more pronounced when access to urgent dental treatment is restricted. The COVID-19 pandemic demonstrated how disruption of routine dental services can increase reliance on antibiotics when definitive procedures cannot be delivered promptly (Shah et al., 2020). Similar issues may arise in rural or underserved populations, during weekends and holidays, or in healthcare systems where emergency dental capacity is insufficient.

Patient expectations represent another relevant component. Patients experiencing severe dental pain may perceive antibiotics as a rapid solution, particularly when they associate swelling or pain with “infection.” In reality, analgesics and definitive dental treatment are usually more appropriate for localized conditions without systemic involvement. Poor public understanding of antibiotic indications can therefore contribute indirectly to inappropriate prescribing (Böhmer et al., 2021; Domínguez-Domínguez et al., 2024).

From a public-health perspective, inappropriate dental antibiotic prescribing has consequences extending beyond the individual patient. Antibiotic exposure can cause gastrointestinal symptoms, hypersensitivity reactions, drug interactions, and, in some circumstances, *Clostridioides difficile* infection. It also creates selection pressure for resistant microorganisms. Particularly concerning is the use of agents with relatively unfavorable safety profiles when narrower and safer alternatives are available (Thornhill et al., 2019; Wilson et al., 2023).

Antimicrobial stewardship therefore requires a broader approach than simply distributing prescribing guidelines. Effective interventions may include education, clinical decision-support tools, audit and feedback, prescribing surveillance, patient communication, and organizational changes that improve access to definitive dental treatment. Recent evidence suggests that multimodal interventions can reduce inappropriate prescribing, although the magnitude and sustainability of effects vary between settings (Elouafkaoui et al., 2016; Gross et al., 2019; Teoh et al., 2025). Emerging evidence from India additionally suggests that educational programmes supported by chairside prescribing resources and patient information can be feasible in primary dental care (Bhuvareghan et al., 2026).

The present review therefore approaches antibiotic use in acute endodontic conditions as a clinical, behavioural, organizational, and public-health issue. Rather than focusing exclusively on which antibiotic should be prescribed, the review examines why antibiotics continue to be prescribed when they are not indicated and how healthcare systems can support more rational prescribing.

The objectives were to: (1) summarize current evidence regarding antibiotic indications in acute endodontic conditions; (2) compare contemporary clinical recommendations; (3) describe reported prescribing patterns across different healthcare settings; (4) identify professional, patient-related, and organizational determinants of inappropriate prescribing; and (5) discuss antimicrobial stewardship strategies that may improve prescribing quality and support public-health objectives.

2. Methodology

A narrative review design was selected because the objective was to integrate evidence from different methodological traditions, including clinical guidelines, systematic reviews, clinical trials, observational studies, questionnaire-based studies, qualitative research, and stewardship interventions. The review was designed to provide an interdisciplinary synthesis rather than a quantitative estimate of treatment effect.

A literature search was conducted in PubMed/MEDLINE, Scopus, Web of Science, and the Cochrane Library for publications issued between January 2015 and July 2026. Google Scholar and the reference lists of relevant articles were used as supplementary sources. Search terms included combinations of “endodontic infection,” “irreversible pulpitis,” “symptomatic apical periodontitis,” “acute apical abscess,” “antibiotic therapy,” “antibiotic prescribing,” and “antimicrobial stewardship.”

Eligible publications included clinical guidelines, systematic reviews, randomized and non-randomized clinical studies, observational studies, qualitative studies, questionnaire-based surveys, prescribing analyses, and antimicrobial stewardship interventions relevant to systemic antibiotic use in acute dental or endodontic conditions.

The selected literature was analysed qualitatively. Data concerning clinical indications, antimicrobial selection, treatment duration, prescribing practices, adverse effects, and compliance with guidelines were extracted and grouped thematically. Due to differences in study designs, populations, diagnostic criteria, and reported outcomes, no quantitative meta-analysis was performed.

3. Results

3.1. Clinical evidence: when are antibiotics indicated?

The reviewed evidence demonstrates broad agreement that most acute endodontic conditions are primarily local diseases requiring local treatment rather than systemic antimicrobial therapy.

Symptomatic irreversible pulpitis is characterized by inflammation of a vital pulp that is unlikely to recover spontaneously. Severe spontaneous or lingering thermal pain may create a strong perception of “infection,” but pain intensity alone does not establish an indication for systemic antibiotics. The appropriate response is definitive pulp therapy, such as pulpotomy or pulpectomy, depending on the clinical circumstances. Evidence from randomized and comparative studies indicates that appropriate vital pulp therapy can provide

substantial short-term pain relief in selected cases (Agnihotry et al., 2019; Beauquis et al., 2022; Esteve-Pardo et al., 2023; Zhu et al., 2024).

Symptomatic apical periodontitis similarly does not constitute an automatic indication for systemic antibiotics. Pain on biting or percussion reflects inflammation of periapical tissues and may occur in different pulpal conditions. Management should focus on diagnosis, treatment of the affected tooth, and analgesia. Antibiotics are unlikely to provide meaningful benefit in the absence of spreading infection or systemic involvement (Lockhart et al., 2019; Segura-Egea et al., 2018).

Localized acute apical abscess represents a more complex clinical situation because it involves purulent infection. Nevertheless, the presence of pus alone does not necessarily justify systemic antibiotic therapy when effective drainage and source control can be achieved. Root canal access, incision and drainage, or extraction may be sufficient in an otherwise healthy patient without systemic signs. Antibiotics become more relevant when the infection is spreading, systemic manifestations are present, or immediate source control cannot be achieved (Cope et al., 2024; Jevon et al., 2020).

The distinction between localized and spreading infection is therefore central to rational prescribing. Diffuse swelling, cellulitis, fever, malaise, progressive trismus, dysphagia, dyspnoea, or involvement of deeper anatomical spaces should trigger urgent escalation. Such manifestations may indicate a potentially serious odontogenic infection requiring multidisciplinary or hospital-based care (Jevon et al., 2020).

Table 1. Clinical indications for systemic antibiotics in acute endodontic conditions

Clinical condition	Routine systemic antibiotics	Preferred management	Circumstances supporting antibiotic use
Symptomatic irreversible pulpitis	No	Definitive pulp therapy and analgesia	Rare exceptional circumstances when definitive care cannot be provided and clinical reassessment is possible
Symptomatic apical periodontitis	No	Definitive endodontic treatment and analgesia	Evidence of spreading/systemic infection
Localized acute apical abscess without systemic signs	Generally no	Drainage plus root canal treatment or extraction	Inability to achieve source control, selected high-risk patients
Acute apical abscess with systemic involvement	Yes, as adjunct	Urgent drainage/source control plus antibiotics	Fever, malaise, diffuse swelling, cellulitis, lymphadenopathy, spreading infection
Infection with trismus/dysphagia/airway symptoms	Yes, urgent assessment required	Emergency source control and specialist/hospital assessment	Deep-space infection or potential airway compromise
Endodontic flare-up without systemic involvement	Generally no	Reassessment, drainage if required, analgesia and local treatment	Systemic involvement or progressive infection

The evidence therefore supports a principle of source control before systemic therapy whenever clinically feasible. Antibiotics should not be regarded as a substitute for operative treatment.

3.2. Comparison of international clinical guidelines

The major clinical recommendations reviewed demonstrate substantial agreement regarding the limited role of antibiotics in localized endodontic disease.

The American Dental Association guideline recommends against routine systemic antibiotics for most pulpal and periapical conditions and emphasizes definitive conservative dental treatment. Antibiotics are primarily considered when there is systemic involvement or a substantial risk of disease progression (Lockhart et al., 2019).

The European Society of Endodontology similarly emphasizes that antibiotics should not be used routinely for symptomatic irreversible pulpitis, symptomatic apical periodontitis, or localized acute apical abscesses when appropriate local treatment can be delivered (Segura-Egea et al., 2018).

The Belgian KCE guideline also recommends restrictive prescribing. Antibiotics are not routinely recommended for uncomplicated endodontic conditions but may be considered when systemic signs or clinically significant spread are present (Leroy et al., 2020).

British guidance emphasizes drainage and removal of the source of infection and recommends antibiotics when there is evidence of spreading infection or systemic involvement. The guidance also promotes narrow-spectrum antimicrobial agents and short treatment courses when antibiotics are required (Palmer, 2020).

The Singaporean guidance follows a similar approach, discouraging antibiotics for otherwise healthy patients with irreversible pulpitis, symptomatic apical periodontitis, or localized abscesses without systemic symptoms (College of Dental Surgeons, Academy of Medicine, Singapore, 2024).

The updated Scottish guidance places particular emphasis on practical stewardship. It prioritizes treatment of the underlying cause, drainage, and review of clinical response and recommends narrow-spectrum agents when systemic antimicrobial therapy is indicated (SDCEP, 2026).

Table 2. Comparison of selected guidelines

Guideline	Antibiotics for uncomplicated endodontic pain	Antibiotics for localized abscess	Main indications	Stewardship emphasis
ADA, United States	Not routinely recommended	Not routinely recommended	Systemic involvement or high risk of progression	Definitive dental treatment
ESE	Not routinely recommended	Not routinely recommended	Spreading/systemic infection	Antibiotics as adjunct
Belgian KCE	Not recommended	Generally not recommended	Fever, cellulitis, lymphadenopathy, spread	Prudent prescribing
UK guidance	Not recommended	Generally not recommended	Local spread or systemic involvement	Narrow-spectrum agents
Singapore	Not routinely recommended	Not routinely recommended	Systemic symptoms, spreading infection, relevant immunosuppression	Antibiotic stewardship
SDCEP, Scotland	Not routinely recommended	Not routinely recommended when drainage possible	Spreading/systemic infection	Source control, review, short courses

Although there is strong agreement on the decision to prescribe, guidelines differ in antimicrobial selection, treatment duration, allergy management, and review procedures. These differences may reflect national formularies, antimicrobial resistance patterns, healthcare-system organization, and national stewardship policies rather than fundamentally different interpretations of endodontic disease.

The most consistent principle across guidelines is therefore not the selection of a particular antimicrobial agent but the decision not to prescribe when antibiotics provide no additional clinical benefit.

3.3. Antibiotic selection and duration

When systemic antibiotics are clinically indicated, guidelines generally favor narrow-spectrum β -lactam agents such as amoxicillin or phenoxymethylpenicillin, subject to local recommendations and individual patient factors. Broad-spectrum antibiotics should not be selected simply because the infection is dental in origin.

Metronidazole may have a role in selected odontogenic infections, particularly where anaerobic coverage is clinically relevant, but routine combination therapy is not justified for uncomplicated cases. A systematic review found that evidence supporting routine empirical use of metronidazole in non-periodontal dental infections is limited and should be interpreted within the broader principles of antimicrobial stewardship (Cooper et al., 2022).

Clindamycin deserves particular caution. Although historically used as an alternative for patients reporting penicillin allergy, evidence indicates a relatively unfavorable safety profile, including an increased risk of *C. difficile* infection. Dental prescribing data have demonstrated a higher risk of adverse reactions associated with clindamycin compared with several alternative agents (Thornhill et al., 2019; Wilson et al., 2023).

Reported penicillin allergy should therefore be assessed carefully. Incorrect allergy labels may lead clinicians to select broader-spectrum or less appropriate alternatives. Verification of the nature and severity of previous reactions can support safer antimicrobial selection.

Treatment duration should be individualized according to severity and clinical response. Recent evidence suggests that short courses, commonly approximately three to five days when clinically appropriate, may be effective when combined with adequate source control (Ribeiro et al., 2025). The precise duration should nevertheless follow current national guidance rather than a universal fixed rule.

An important stewardship principle is that lack of improvement should not automatically result in extension or escalation of antibiotic treatment. Persistent symptoms may indicate inadequate drainage, incorrect diagnosis, retained infection, treatment failure, or spread to another anatomical space. Clinical reassessment should therefore precede any decision to modify therapy.

3.4. Prescribing patterns in clinical practice

The evidence indicates that antibiotic prescribing in dentistry remains heterogeneous internationally.

Abraham et al. (2020), in a survey of dentists in the United Arab Emirates, reported that prescribing was broadly compatible with international recommendations but that antibiotics were still used in some scenarios where they were not routinely indicated, including irreversible pulpitis and necrotic pulp without systemic manifestations.

Mende et al. (2020) reported that antibiotics were prescribed in fewer than one-fifth of endodontic cases among Lithuanian dentists, but a substantial proportion of practitioners selected broad-spectrum antibiotics for abscesses without systemic involvement. This finding illustrates an important distinction between prescribing frequency and prescribing appropriateness.

Similar variation has been documented in Serbia, Colombia, Croatia, and other settings (Dias et al., 2022; Drobac et al., 2021; Sović et al., 2024). The persistence of inappropriate prescribing despite awareness of guidelines indicates that knowledge alone is insufficient to explain prescribing behaviour.

A systematic review and meta-analysis published in 2024 confirmed that antibiotic overprescription remains a substantial problem in apical periodontitis (Méndez-Millán et al., 2024). International comparisons further indicate considerable differences in dental antibiotic use between healthcare systems, suggesting that prescribing behaviour is influenced by contextual factors rather than solely by individual clinical knowledge (Ramanathan et al., 2023; Thompson et al., 2022).

A particularly high level of inappropriate prescribing was reported in a study from northern Ethiopia, where antibiotics were prescribed to a large majority of patients receiving treatment for dental diseases and many prescriptions were classified as inappropriate (Teklay & Tefera, 2024). Such findings should not be interpreted simply as evidence of poor professional knowledge. Limited access to urgent dental treatment, differences in healthcare infrastructure, and the availability of alternative treatment pathways may substantially influence prescribing.

Table 3. Selected evidence concerning dental antibiotic prescribing

Study	Country/setting	Main finding	Public-health relevance
Abraham et al. (2020)	United Arab Emirates	Some prescribing remained inappropriate in pulpitis and localized conditions	Knowledge does not fully determine behaviour
Mende et al. (2020)	Lithuania	Relatively low overall use but frequent selection of broad-spectrum therapy in some scenarios	Frequency and appropriateness are different outcomes
Drobac et al. (2021)	Serbia	Considerable variation in antibiotic prescribing	Need for standardized stewardship
Dias et al. (2022)	Colombia	Prescribing differed according to training and clinical scenario	Professional education may influence decisions
Rodríguez-Fernández et al. (2023)	Spain	Inappropriate prescribing associated with several behavioural and organizational factors	Behavioural interventions are needed
Sović et al. (2024)	Croatia	Antibiotics generally prescribed infrequently, but inappropriate use persisted in some circumstances	Reduced prescribing does not automatically mean appropriate prescribing
Teklay & Tefera (2024)	Ethiopia	High prevalence of antibiotic prescribing and inappropriate use	Healthcare-system context is important
Bhuvaraghan et al. (2026)	India	Stewardship education and practical resources were feasible and acceptable	Multimodal interventions may be transferable

3.5. Determinants of inappropriate prescribing

The reviewed evidence indicates that inappropriate prescribing is a multifactorial behavioural phenomenon.

3.5.1. Diagnostic uncertainty

Acute dental pain can be difficult to localize, and symptoms may overlap between pulpal and periapical conditions. Dentists may therefore prescribe antibiotics when uncertain whether an infection is present or likely to progress.

Diagnostic uncertainty is particularly relevant when clinical examination is performed under time constraints or when follow-up is difficult. A prescription may be perceived as a relatively low-cost method of reducing perceived risk, even when its clinical benefit is uncertain.

3.5.2. Fear of complications

Fear is a significant behavioural driver. Dentists may be concerned about progression to cellulitis, deep-space infection, hospitalization, or medicolegal consequences. Rodríguez-Fernández et al. (2023) identified fear as one of the factors associated with poorer prescribing quality.

This suggests that stewardship interventions should address not only what clinicians know but also how they perceive clinical risk. Practical algorithms distinguishing localized from spreading infection may reduce uncertainty and provide reassurance when antibiotics are not indicated.

3.5.3. Time pressure

Definitive dental treatment requires clinical time, equipment, and appropriate patient availability. Prescribing an antibiotic is usually faster than performing drainage, pulp therapy, extraction, or comprehensive endodontic treatment.

Newlands et al. (2016) identified time and organizational constraints among important barriers to evidence-based management. This means that inappropriate prescribing may sometimes reflect a structural problem rather than a purely individual failure.

3.5.4. Limited access to urgent dental treatment

The availability of same-day operative care is a critical determinant of prescribing. When patients cannot obtain definitive treatment promptly, antibiotics may be perceived as a temporary measure.

This issue is particularly relevant in underserved areas, during weekends and holidays, and in healthcare systems with limited emergency dental capacity. During the COVID-19 pandemic, restrictions on dental procedures were accompanied by changes in antibiotic prescribing, illustrating how service availability can directly affect antimicrobial use (Shah et al., 2020).

3.5.5. Patient expectations

Patients may associate dental pain and swelling with a need for antibiotics. Some may believe that antibiotics are stronger or faster than analgesics and dental treatment. This perception may create explicit or implicit pressure on clinicians.

Patient communication should therefore explain that antibiotics do not remove the diseased pulp or drain a localized abscess. A clear explanation of the treatment plan, expected symptom course, warning signs, and reasons for not prescribing antibiotics may improve acceptance of evidence-based care (Böhmer et al., 2021; Domínguez-Domínguez et al., 2024).

3.5.6. Professional culture and habits

Prescribing patterns can become habitual. Clinicians may continue using familiar antibiotics and treatment durations even when recommendations have changed. The existence of national guidelines does not guarantee implementation at the chairside.

Differences between general dental practitioners and specialists may also reflect differences in training, exposure to complex infections, confidence in diagnosis, and access to referral pathways.

3.5.7. Knowledge and continuing professional development

Education remains important but should not be considered sufficient. Clinicians require accessible information that can be applied rapidly during consultations. Bhuvavaraghan et al. (2026) provide recent evidence that a combined intervention incorporating a chairside antibiotic guide, antimicrobial resistance education, and patient information can be feasible in dental primary care.

The implication is that continuing professional development should move from passive dissemination of information toward practical behavioural support.

3.6. Consequences for patient safety and public health

Inappropriate prescribing exposes patients to risk without necessarily improving clinical outcomes.

Adverse effects may include gastrointestinal disturbances, hypersensitivity reactions, drug interactions, and more serious complications. Dental antibiotic prescribing has also been associated with *C. difficile* infection, reinforcing the importance of avoiding unnecessary exposure (Thornhill et al., 2019; Wilson et al., 2023).

From a population perspective, repeated unnecessary exposure contributes to selection pressure for antimicrobial resistance. The consequences may be delayed: a patient who receives an unnecessary antibiotic today may not develop a resistant infection until a later episode of care. Nevertheless, antimicrobial prescribing is cumulative at the population level.

Dental antibiotic stewardship should therefore be viewed as part of broader public-health policy. Even modest reductions in unnecessary prescriptions can be meaningful when multiplied across large numbers of dental consultations.

The issue also has an equity dimension. Patients with limited access to definitive dental treatment may be more likely to receive antibiotics as substitutes for operative care. Consequently, antimicrobial stewardship policies should avoid simply restricting prescriptions without improving access to appropriate treatment. Otherwise, stewardship could unintentionally shift the burden onto vulnerable populations.

3.7. Antimicrobial stewardship interventions

The evidence supports a multimodal approach.

The RAPiD cluster randomized trial demonstrated that audit and feedback can reduce antibiotic prescribing in general dental practice (Elouafkaoui et al., 2016). Audit provides clinicians with information about their prescribing relative to peers or standards and can make otherwise invisible prescribing patterns visible.

Gross et al. (2019) reported a reduction in antibiotic prescriptions after implementation of an academic dental stewardship programme incorporating education, institutional guidance, patient information, and prescribing surveillance. The intervention illustrates the importance of combining multiple components rather than relying exclusively on educational lectures.

A systematic review of dental antibiotic stewardship interventions also concluded that interventions can reduce prescribing, although their effectiveness varies and the evidence base remains heterogeneous (Teoh et al., 2025).

Recent work from India provides an important contemporary example. Bhuvaraghan et al. (2026) evaluated a feasibility intervention involving a chairside antibiotic guide, training focused on antimicrobial resistance and prescribing, and a patient information sheet. The intervention was designed around the practical conditions of primary dental care and demonstrates how stewardship resources can be adapted to local contexts.

Table 4. Potential components of a dental antimicrobial stewardship programme

Intervention	Target	Expected mechanism	Implementation consideration
Clinical guideline	Dentists	Standardizes prescribing decisions	Must be concise and accessible
Chairside decision-support tool	Dentists	Reduces diagnostic uncertainty	Should distinguish localized from spreading infection
Audit and feedback	Dentists/practices	Makes prescribing behaviour visible	Requires reliable prescribing data
Continuing professional development	Dentists	Updates knowledge and confidence	More effective when case-based
Patient information materials	Patients	Reduces expectation for antibiotics	Should explain alternative treatment
Communication training	Dentists	Improves acceptance of non-prescribing	Particularly useful in urgent care
Prescription surveillance	Organizations	Identifies trends and outliers	Requires standardized indicators
Improved urgent-care access	Healthcare system	Reduces antibiotic substitution for operative care	May require organizational investment
Digital decision support	Dentists	Provides real-time recommendations	Requires integration with workflow
Feedback linked to peer comparison	Dentists	Uses behavioural and social mechanisms	Must be non-punitive and educational

The optimal stewardship programme is therefore likely to be multilevel. Individual education should be combined with organizational changes and patient communication.

4. Discussion

The findings of this review demonstrate a consistent paradox: clinical guidelines increasingly restrict systemic antibiotic use in acute endodontic conditions, while inappropriate prescribing continues in routine practice. The discrepancy is not primarily a disagreement about the microbiology of endodontic disease. Rather, it reflects the complexity of clinical decision-making within real-world healthcare systems.

4.1. From clinical recommendation to prescribing behaviour

The central clinical principle is relatively straightforward: localized endodontic disease should be managed through local source control, while antibiotics are reserved for systemic involvement or spreading infection. Yet translating this principle into routine practice is more complicated.

Dentists make prescribing decisions under uncertainty. A patient may present with severe pain, swelling, limited information about previous treatment, and a requirement for immediate symptom relief. The clinician must simultaneously consider diagnosis, treatment availability, patient expectations, potential complications, and follow-up.

This explains why guideline dissemination alone may have limited impact. A guideline can tell clinicians what they should prescribe, but it cannot by itself eliminate the time pressure or uncertainty that drives precautionary prescribing.

4.2. Antibiotic prescribing as a behavioural and organizational problem

The evidence suggests that antibiotic prescribing should be conceptualized as a behavioural outcome influenced by multiple levels of the healthcare environment.

At the individual level, knowledge, attitudes, confidence, fear, and previous experience influence decisions. At the interpersonal level, communication with patients and colleagues affects prescribing. At the organizational level, appointment systems, staffing, access to emergency procedures, referral pathways, and follow-up determine what treatment is realistically available. At the policy level, national guidelines, reimbursement systems, stewardship programmes, and surveillance influence the environment in which clinicians work.

This multilevel perspective is particularly relevant to public health. If inappropriate prescribing is caused partly by inadequate access to operative care, simply instructing clinicians to “prescribe less” is unlikely to be sufficient.

4.3. The importance of source control

One of the strongest recurring principles across the evidence is that antibiotic treatment cannot replace definitive dental treatment.

In a localized endodontic infection, the source of infection is located within or around the affected tooth. Antibiotics may reach surrounding tissues but cannot reliably remove necrotic tissue or establish mechanical drainage. Consequently, even when an antibiotic is clinically indicated, source control remains essential.

This principle should be central to patient communication. Rather than presenting antibiotic avoidance as withholding treatment, clinicians can explain that the most effective treatment is the intervention that removes the cause of infection.

4.4. Patient communication as a stewardship intervention

Patient expectations should not be framed simply as a problem caused by “demanding patients.” Expectations are shaped by prior healthcare experiences, cultural beliefs, health literacy, media messages, and understanding of antibiotics.

Communication can therefore be used as a positive intervention. A clinician may acknowledge the severity of the patient's symptoms, explain the diagnosis, describe why antibiotics are not beneficial for the current condition, provide an active treatment plan, and identify clear safety-netting instructions.

This approach transforms antibiotic non-prescribing from a passive decision into an active therapeutic recommendation.

Patient information materials can reinforce the message. Written or digital information can explain why antibiotics are not necessary, what treatment will address the cause, which analgesics may be appropriate, how long symptoms may persist and which warning signs require urgent reassessment.

Such communication is especially important where patients have limited knowledge about antibiotic indications (Domínguez-Domínguez et al., 2024).

4.5. Access to care and health equity

Antimicrobial stewardship should also be considered within the framework of health equity.

Patients who cannot obtain urgent operative care may have fewer alternatives to antibiotic treatment. Restrictive prescribing policies without corresponding investment in emergency dental capacity could therefore create an inequitable situation.

Healthcare planners should consider the availability of same-day dental treatment, emergency referral pathways, weekend services, and access for rural and socioeconomically disadvantaged populations.

The COVID-19 experience provides a useful illustration. When definitive dental procedures became difficult or impossible to access, antibiotics could be used as a temporary substitute. This does not mean that antibiotics were clinically appropriate for all patients; rather, it demonstrates how service organization can influence prescribing behaviour (Shah et al., 2020).

4.6. Digital health and decision support

Digital technologies provide an opportunity to strengthen antimicrobial stewardship.

Electronic decision-support systems could integrate patient symptoms, clinical findings, allergy history, diagnosis, and national guidelines to provide real-time prescribing recommendations. Such tools may be particularly useful during urgent consultations when clinicians have limited time to consult lengthy guidelines.

Digital systems could also support audit by collecting anonymized prescribing indicators and providing feedback to individual practices or professional groups.

However, technology should not be regarded as a substitute for clinical judgment. Poorly designed decision-support systems may increase alert fatigue or encourage algorithmic prescribing. Effective digital stewardship should therefore be integrated into clinical workflow and designed around the needs of clinicians.

This area is particularly relevant to the broader scope of interdisciplinary health and technology research because it links antimicrobial stewardship with digital healthcare delivery, professional behaviour, and health-system design.

4.7. Antibiotic choice and stewardship quality

Reducing the number of prescriptions is only one component of stewardship. The quality of prescriptions that remain is equally important.

When antibiotics are clinically justified, selection should be based on the narrowest appropriate spectrum, patient-specific contraindications, allergy status, local recommendations, and expected pathogens. Unnecessary broad-spectrum therapy and inappropriate combinations should be avoided.

Clindamycin is a particularly relevant example because its historical role in patients labelled as penicillin-allergic may persist despite concerns regarding adverse effects. Improving allergy assessment and documentation may therefore be an important stewardship strategy (Thornhill et al., 2019; Wilson et al., 2023).

Similarly, treatment duration should not be unnecessarily prolonged. Evidence from odontogenic infection research supports the use of shorter courses when combined with effective source control, although national guidance should remain the primary reference for individual prescribing decisions (Ribeiro et al., 2025).

4.8. Implications for healthcare policy

The findings suggest several priorities for healthcare policy.

First, dental antibiotic guidelines should be concise, current, and easily accessible. Long documents are unlikely to be consulted routinely during emergency care.

Second, stewardship indicators should evaluate not only prescription volume but also appropriateness. A reduction in the total number of prescriptions could theoretically occur alongside continued inappropriate use in high-risk situations.

Third, prescribing data should be monitored at practice and system levels. Feedback can identify unusually high prescribing and provide opportunities for targeted interventions.

Fourth, professional education should incorporate communication skills and clinical decision-making rather than focusing exclusively on pharmacology.

Fifth, policymakers should consider the availability of definitive dental care when interpreting prescribing data. High antibiotic use may partly signal inadequate service capacity.

Finally, digital health technologies could facilitate both decision support and surveillance, creating a bridge between individual clinical practice and population-level stewardship.

4.9. Strengths and limitations of the evidence

The major strength of the evidence base is the consistency of the clinical message across guidelines and systematic reviews. Different professional organizations and healthcare systems broadly agree that antibiotics should not routinely be used for uncomplicated endodontic pain or localized infection.

However, the evidence concerning prescribing behaviour is more heterogeneous. Many studies use questionnaires or hypothetical scenarios, which may overestimate or underestimate actual prescribing. Self-reported behaviour is particularly susceptible to social desirability bias.

Cross-country comparisons are also difficult because healthcare systems differ in access to dental care, prescribing regulation, reimbursement, professional education, and antimicrobial resistance patterns.

The present review itself has limitations. It is a narrative review rather than a systematic review and therefore does not provide a formal quantitative synthesis or comprehensive risk-of-bias assessment. The literature search was conducted through several major databases and supplemented by additional sources, but it was not prospectively registered. The review also focused primarily on English-language accessible literature, which may have introduced language and publication bias.

The inclusion of literature through July 2026 strengthens the contemporary relevance of the review but also means that some very recent studies may not yet have accumulated sufficient evidence for firm conclusions.

5. Practical Framework for Antimicrobial Stewardship in Acute Endodontic Care

Based on the evidence synthesized in this review, a practical stewardship framework can be organized around five sequential questions.

Question 1: Is there a clear diagnosis?

Antibiotic prescribing should not be used to compensate for diagnostic uncertainty. A structured assessment should include medical history, pain characteristics, clinical examination, pulp sensibility testing where appropriate, percussion and palpation, periodontal assessment, and radiographic evaluation when indicated.

Question 2: Can the source of infection be controlled locally?

If definitive treatment or drainage can be performed, it should generally take priority over systemic antibiotics. Depending on the diagnosis, this may involve pulp therapy, root canal treatment, drainage, or extraction.

Question 3: Is there evidence of systemic involvement or spreading infection?

The presence of fever, malaise, diffuse swelling, cellulitis, progressive trismus, dysphagia, dyspnoea, or involvement of deeper anatomical spaces should prompt urgent escalation and consideration of systemic antimicrobial therapy.

Question 4: If antibiotics are indicated, is the prescription optimized?

The clinician should select the narrowest appropriate agent according to current national guidance, verify allergy history, avoid unnecessary broad-spectrum therapy, and prescribe for the shortest clinically appropriate duration.

Question 5: Is follow-up arranged?

The patient should receive clear safety-netting instructions. Worsening symptoms, persistent fever, increasing swelling, difficulty swallowing, breathing problems, or deterioration in general condition should prompt urgent reassessment.

This framework emphasizes that antimicrobial stewardship is not simply the act of refusing an antibiotic. It is a structured clinical process combining diagnosis, source control, risk assessment, appropriate prescribing, and follow-up.

6. Future Research Directions

Several research priorities emerge from the literature.

First, future studies should use objective prescribing data whenever possible rather than relying solely on questionnaires. Electronic prescription databases and clinical records can provide more reliable estimates of real-world behaviour.

Second, interventions should be evaluated using robust comparative designs and longer follow-up periods. Short-term reductions in prescribing do not necessarily demonstrate sustained behavioural change.

Third, more research is needed concerning the effect of digital decision-support tools. Artificial intelligence and electronic clinical decision systems may offer new opportunities for individualized prescribing support, but their effectiveness and unintended consequences require rigorous evaluation.

Fourth, patient-focused interventions deserve greater attention. Studies should evaluate whether structured communication, digital patient information, and health-literacy interventions reduce expectations for antibiotics without reducing satisfaction with dental care.

Fifth, healthcare-system factors should be explicitly incorporated into stewardship research. The relationship between emergency dental access and antibiotic prescribing is particularly important in rural, underserved, and low-resource settings.

Finally, future research should assess stewardship interventions through a health-equity lens. A successful programme should reduce unnecessary antibiotics while ensuring that vulnerable patients retain access to timely definitive dental treatment.

7. Conclusions

Systemic antibiotics have a limited role in the management of acute endodontic conditions. Current evidence and international guidelines consistently indicate that symptomatic irreversible pulpitis, symptomatic apical periodontitis, and localized acute apical abscesses without systemic involvement should primarily be managed through definitive local treatment, drainage when appropriate, and analgesia.

Antibiotics are mainly justified when infection is spreading or accompanied by systemic manifestations such as fever, diffuse swelling, cellulitis, progressive trismus, dysphagia, or other signs of significant infection. When systemic therapy is indicated, stewardship principles support appropriate narrow-spectrum therapy, careful allergy assessment, avoidance of unnecessary broad-spectrum combinations, and treatment durations that are no longer than clinically necessary.

Nevertheless, inappropriate antibiotic prescribing remains a persistent problem. The discrepancy between guidelines and clinical practice is influenced by diagnostic uncertainty, fear of complications, patient expectations, time pressure, professional habits, limited access to urgent dental treatment, and healthcare-system characteristics.

The central implication of this review is that dental antibiotic stewardship should not be understood solely as a pharmacological or clinical issue. It is also a behavioural, organizational, technological, and public-health challenge. Effective stewardship requires interventions at multiple levels: accessible clinical guidance, continuing professional development, decision-support tools, audit and feedback, patient communication, prescription surveillance, and timely access to definitive dental treatment.

The development of digital decision-support systems represents a particularly promising area for future research because it may connect clinical guidelines with real-time prescribing decisions while generating data for population-level surveillance. However, technology should complement rather than replace clinical judgment.

Ultimately, reducing unnecessary dental antibiotic use requires a shift from a prescription-centred model toward a source-control and stewardship-centred model of care. Such an approach has the potential to improve patient safety, reduce unnecessary antimicrobial exposure, support efforts against antimicrobial resistance, and contribute to more sustainable and equitable healthcare systems.

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