

Review Article

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# Understanding Barriers to Rational Antibiotic Prescribing in Healthcare Settings: A Narrative Review

Shyamala Ravikoti<sup>1</sup> and Sekkulanandai Kuppuswamy Mohanasundari<sup>2\*</sup>

<sup>1</sup>ACME, FAIMER Additional Professor, Department of Microbiology, AIIMS Bibinagar, Hyderabad, Telangana India

<sup>2</sup>College of Nursing, AIIMS Bibinagar, Hyderabad, India

\*Corresponding author

## ABSTRACT

Antimicrobial resistance (AMR) is a growing global health threat driven largely by irrational antibiotic prescribing practices. Despite the development of stewardship frameworks, inappropriate antibiotic use persists across primary care, hospitals, dental practice, veterinary care, and community settings. This narrative review synthesizes global evidence on barriers to rational antibiotic prescribing and identifies opportunities for improvement, with particular emphasis on low- and middle-income countries (LMICs). Literature indicates that prescribing behavior is influenced by multilevel determinants including clinician knowledge, patient expectations, diagnostic uncertainty, health system limitations, pharmaceutical pressures, sociocultural norms, and policy enforcement gaps. Evidence shows that patient demand, time constraints, lack of diagnostic tools, and inadequate stewardship support contribute significantly to inappropriate antibiotic use. In LMICs, structural challenges such as drug accessibility without prescriptions, weak regulation, and limited training exacerbate irrational use. Behavioral drivers and cultural prescribing norms further influence decision-making. This review proposes a conceptual framework integrating individual, interpersonal, organizational, and policy-level determinants influencing prescribing behavior. Strengthening stewardship programs, improving diagnostic capacity, enhancing training, regulating antibiotic access, and addressing patient expectations are critical strategies for rational antibiotic use. A systems-based approach is essential to mitigate AMR and ensure sustainable antibiotic effectiveness.

### Keywords

Antimicrobial resistance, antibiotic stewardship, prescribing behavior, healthcare systems, LMICs, rational drug use

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## Introduction

Antibiotics have transformed modern medicine by significantly reducing morbidity and mortality from infectious diseases and enabling advanced medical procedures such as surgery, transplantation, and cancer

therapy. However, their effectiveness is increasingly threatened by antimicrobial resistance (AMR), which the World Health Organization identifies as one of the top ten global public health threats. Recent estimates indicate that bacterial AMR was associated with approximately 4.95 million deaths globally in 2019, including 1.27

million deaths directly attributable to resistant infections, with the highest burden in low- and middle-income countries (LMICs) (1). Without effective interventions, AMR could cause up to 10 million deaths annually by 2050, alongside substantial economic losses (2).

Irrational antibiotic prescribing—defined as unnecessary use, inappropriate drug selection, incorrect dosing, or improper duration—remains a major driver of AMR. Rational prescribing requires selecting the appropriate antimicrobial agent, dose, route, and duration based on clinical evidence and patient-specific factors. However, prescribing decisions are complex and influenced by diagnostic uncertainty, time constraints, perceived patient expectations, and healthcare system limitations. Qualitative evidence shows that clinicians often balance clinical judgment with patient satisfaction and workload pressures when prescribing antibiotics (3).

In LMICs, rational antibiotic use is further complicated by limited regulatory oversight, over-the-counter access, inadequate diagnostic capacity, and high infectious disease burden. [4] Sociocultural beliefs and self-medication practices also contribute to misuse. Although antimicrobial stewardship programs have demonstrated effectiveness, implementation remains uneven, and existing interventions often fail to address behavioral and systemic determinants simultaneously.

Current literature is fragmented across healthcare settings and regions, with limited integration of behavioral, organizational, and policy influences. Therefore, this narrative review synthesizes global evidence on barriers to rational antibiotic prescribing and proposes a conceptual framework to guide context-sensitive stewardship interventions across diverse healthcare systems.

## **Materials and Methods**

This narrative review synthesized evidence on barriers to rational antibiotic prescribing across diverse healthcare settings. Relevant literature published between 2000 and 2025 was reviewed to capture evolving prescribing practices and antimicrobial stewardship efforts in the context of rising antimicrobial resistance. Electronic databases including PubMed/MEDLINE, Scopus, Web of Science, Google Scholar, and the Cochrane Library were searched using terms such as *antibiotic prescribing behavior*, *rational antibiotic use*, *antimicrobial stewardship*, and *prescribing barriers*. Reference lists of

key articles were also screened to identify additional relevant studies.

Studies were included if they examined factors influencing antibiotic prescribing, evaluated antimicrobial stewardship interventions, or explored barriers in primary care, hospitals, dental practice, pediatric care, veterinary settings, or community health systems. Evidence from high-income countries and low- and middle-income countries (LMICs) was considered to ensure global relevance. Editorials without empirical evidence and studies focusing only on resistance patterns without prescribing context were excluded.

Findings from qualitative studies, systematic reviews, and observational research were analyzed to identify recurring themes influencing prescribing behavior. These themes were grouped into clinician-related factors, patient influences, health system constraints, and policy or regulatory determinants to provide a comprehensive understanding of the drivers of irrational antibiotic use.

## **Global burden of irrational antibiotic prescribing**

Inappropriate antibiotic prescribing is a widespread problem affecting both high-income countries and low- and middle-income countries (LMICs), although the underlying drivers vary across settings. Studies from Europe and Asia demonstrate marked variability in outpatient prescribing rates, reflecting differences in local prescribing cultures, diagnostic practices, and guideline adherence. Even within the same country, district-level variations suggest that prescribing behavior is influenced not only by clinical need but also by professional norms and regional practice patterns (5).

In LMICs, the burden of irrational antibiotic use is intensified by limited stewardship infrastructure, workforce shortages, and constrained diagnostic capacity (6). A scoping review of antimicrobial stewardship programs in resource-limited settings reported persistent challenges including lack of trained personnel, inadequate surveillance systems, and weak policy enforcement, all of which contribute to inappropriate prescribing (6). Additionally, over-the-counter access and informal healthcare providers further exacerbate misuse.

Primary care settings account for a substantial proportion of antibiotic consumption worldwide. Antibiotics are frequently prescribed for self-limiting viral illnesses such

as upper respiratory tract infections, especially in pediatric populations. The Integrated Management of Childhood Illness (IMCI) strategy has demonstrated potential to reduce unnecessary antibiotic use by improving diagnostic accuracy and standardizing treatment decisions. However, adherence to guidelines remains inconsistent.

Pediatric prescribing patterns are particularly concerning because children commonly present with febrile illnesses where distinguishing bacterial from viral infections is challenging. Studies indicate that respiratory infections remain a leading cause of antibiotic prescriptions despite viral etiology in most cases (7). In addition, community-level prescribing and pharmacy dispensing practices continue to drive unnecessary exposure to antibiotics.

### **Clinician-Related Barriers**

**Knowledge Gaps and Clinical Uncertainty:** Clinicians often prescribe antibiotics due to diagnostic uncertainty and fear of complications. Studies indicate that limited access to rapid diagnostics leads to precautionary prescribing (8, 9). A qualitative review revealed that clinicians frequently perceive antibiotics as a “safety net” when definitive diagnosis is unavailable (10). Similarly, prescribers report uncertainty in differentiating viral and bacterial infections.

**Prescribing Habits and Behavioral Norms:** Prescribing behaviors are shaped by professional culture and learned practices. Research among general practitioners found that prescribing patterns often reflect local norms rather than guidelines (11). District-level differences further highlight the influence of peer practice patterns (5). Hospital prescribing practices are also influenced by managerial priorities and institutional culture (12).

**Fear of Complications and Defensive Medicine:** Fear of clinical deterioration or legal consequences may lead clinicians to prescribe antibiotics unnecessarily. This defensive approach is common in high-pressure clinical environments.

### **Patient-Related Barriers**

**Patient Expectations and Demand:** Patient demand plays a major role in antibiotic overuse. Studies show clinicians sometimes prescribe antibiotics to maintain patient satisfaction or avoid conflict (13). In many settings, patients equate antibiotics with effective

treatment, creating pressure on providers to prescribe even when not clinically indicated (14).

**Health Literacy and Misconceptions:** Misunderstanding about antibiotics further contributes to misuse. Patients often believe antibiotics are effective against viral illnesses such as colds and influenza, leading to inappropriate requests and self-medication practices. Limited health literacy, easy over-the-counter access in some regions, and advice from family or community members also influence misuse. Community-based studies indicate that health-seeking behavior, cultural beliefs, and prior experiences with illness strongly shape antibiotic use patterns (14). Additionally, fear of complications, desire for quick recovery, and trust in medication over non-drug therapies reinforce expectations for antibiotics.

### **Health system and organizational barriers**

**Time Constraints and Workload:** Heavy patient loads, high outpatient turnover, and limited consultation time encourage empirical prescribing. Clinicians frequently report that issuing an antibiotic prescription is quicker than explaining the natural course of viral illness, addressing patient concerns, and providing symptomatic management advice (3). In busy primary care clinics and emergency settings, this time pressure promotes defensive prescribing to ensure perceived patient satisfaction and reduce repeat visits. Overcrowded facilities and staff shortages further exacerbate this pattern.

**Lack of Diagnostic Support:** Limited access to laboratory services and point-of-care diagnostic tools contributes significantly to uncertainty-driven prescribing. When clinicians cannot rapidly distinguish bacterial from viral infections, antibiotics are often prescribed as a precautionary measure (9). This challenge is particularly pronounced in rural and primary care settings, where microbiology facilities, rapid antigen tests, and inflammatory marker testing may be unavailable. Diagnostic uncertainty not only increases unnecessary prescriptions but also encourages the use of broad-spectrum antibiotics.

**Limited Access to Guidelines and Decision Support:** Clinicians may lack timely access to updated treatment guidelines, antimicrobial policies, or electronic decision-support systems (20). In some settings, printed guidelines are outdated, poorly disseminated, or not adapted to local

resistance patterns. Studies show that integrating clinical decision support tools into electronic medical records and providing audit-feedback mechanisms can significantly improve prescribing practices and adherence to guidelines (15). However, adoption remains uneven, especially in resource-limited facilities.

**Pharmaceutical Influence and Drug Availability:** Easy availability of antibiotics and aggressive pharmaceutical marketing may influence prescribing patterns. In some settings, financial incentives, promotional activities, and industry-sponsored education can shape clinicians' drug preferences. Additionally, procurement policies and supply chain dynamics affect prescribing behavior; when certain antibiotics are more readily available or stocked in bulk, clinicians may preferentially prescribe them regardless of guideline recommendations (16). Inadequate regulation of antibiotic sales and widespread availability through private pharmacies further reinforce inappropriate use.

### **Policy and regulatory barriers**

**Weak Enforcement of Prescription Regulations:** In many LMICs, antibiotics are readily available without prescriptions through pharmacies, informal drug vendors, and online sources. Weak regulatory oversight, limited inspection capacity, and economic incentives for drug sellers promote self-medication and inappropriate use (4). Inadequate penalties for non-compliance and fragmented drug supply chains further weaken enforcement efforts.

**Stewardship Implementation Challenges:** Barriers to effective antimicrobial stewardship include resource limitations, inadequate training, lack of microbiology laboratory support, and insufficient leadership commitment (6). Overburdened health systems, absence of standardized treatment guidelines, and poor surveillance systems hinder monitoring of antibiotic use and resistance trends. Multicountry studies highlight variability in stewardship uptake due to policy enforcement gaps, financing constraints, and differences in health system capacity (17).

### **Specialty-specific prescribing challenges**

**Pediatric Prescribing:** Antibiotic misuse in children is common due to diagnostic uncertainty, overlapping symptoms of viral and bacterial infections, and parental

expectations for quick recovery (18). Weight-based dosing complexities, fear of complications, and limited rapid diagnostic tools further contribute to precautionary prescribing. Inappropriate use for upper respiratory infections and otitis media remains frequent. Pediatric antimicrobial stewardship programs, delayed prescribing strategies, and caregiver education are essential to improve prescribing practices (19).

**Dental and Periodontal Practice:** Dentists may prescribe antibiotics prophylactically or unnecessarily due to outdated knowledge, fear of postoperative infections, and time constraints in managing dental abscesses (20). Antibiotics are sometimes used in place of definitive procedures such as drainage or extraction. Lack of adherence to updated prophylaxis guidelines for infective endocarditis and implant procedures contributes to overprescribing. Continuing dental education and clear clinical protocols can support rational use.

**Veterinary and Agricultural Use:** Antibiotic prescribing in veterinary practice contributes to antimicrobial resistance transmission through the food chain and environment. Use for growth promotion, disease prevention, and mass medication in livestock remains a concern in some regions. Studies show varying adherence to guidelines in animal care and limited veterinary oversight in rural farming systems (21, 22).

### **Barriers in low- and middle-income countries**

LMICs face unique structural and systemic barriers including:

- Over-the-counter antibiotic availability and self-medication practices
- Limited diagnostic infrastructure and delayed laboratory reporting
- Inadequate training opportunities in antimicrobial stewardship
- Weak stewardship programs and limited infection prevention systems
- High infectious disease burden and overcrowded healthcare facilities

Systematic reviews highlight resource constraints, fragmented health systems, and policy enforcement gaps as major challenges to stewardship implementation (4,6). In many settings, informal healthcare providers and unregulated pharmacies influence antibiotic access and

use. Supply chain inconsistencies may lead to stock-outs of first-line drugs, prompting use of broader-spectrum alternatives.

Healthcare providers in LMIC settings often face competing priorities, limited infrastructure, and high patient loads, which encourage empirical antibiotic use.

Poor sanitation, limited vaccination coverage, and delayed health-seeking behavior further increase infection risk and antibiotic demand.

### **Opportunities and facilitators for rational prescribing**

**Antimicrobial Stewardship Programs (ASPs):** ASPs are among the most effective strategies for optimizing antibiotic use. Core components include prospective audit and feedback, formulary restriction, guideline implementation, and monitoring of prescribing patterns. Multimodal stewardship interventions—combining education, clinical protocols, and surveillance—have demonstrated significant reductions in inappropriate prescribing, antimicrobial consumption, and healthcare-associated infections (23). Effective programs also promote multidisciplinary collaboration among physicians, pharmacists, microbiologists, infection control teams, and nursing staff.

**Education and Training:** Continuous professional development strengthens clinicians' knowledge, confidence, and adherence to evidence-based guidelines. Training programs that include case-based learning, prescribing audits, and feedback improve decision-making and reduce defensive prescribing. Incorporating antimicrobial stewardship principles into undergraduate curricula and ongoing in-service training supports sustained behavior change (17).

**Rapid Diagnostic Tools:** Point-of-care tests (e.g., C-reactive protein testing, rapid antigen detection tests, molecular diagnostics) help differentiate bacterial from viral infections, reducing diagnostic uncertainty. Improved access to timely microbiological results enables targeted therapy, shortens treatment duration, and limits broad-spectrum antibiotic use.

**Digital Decision Support Systems:** Electronic prescribing platforms, clinical decision support tools, and mobile guideline applications assist clinicians in

selecting appropriate drugs, doses, and durations. Integration with electronic health records enables real-time alerts, antibiotic time-outs, and audit-feedback mechanisms that enhance guideline adherence (15).

**Public Awareness and Community Engagement:** Public education campaigns improve health literacy and reduce patient-driven demand for antibiotics. Community outreach, school programs, and mass media messaging help correct misconceptions, promote adherence to prescriptions, and discourage self-medication. Engaging patients as partners in stewardship strengthens trust and supports rational antibiotic use.

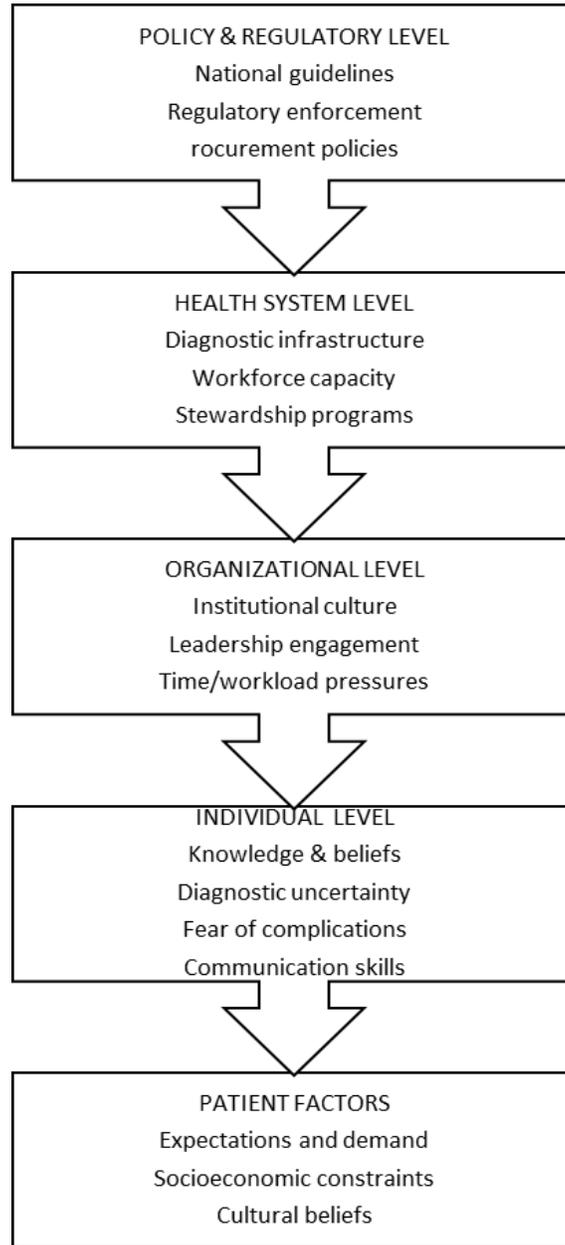
This review underscores the multifactorial and context-dependent nature of irrational antibiotic prescribing. Prescribing decisions are not determined solely by clinical knowledge; rather, they are shaped by an interplay of behavioral, sociocultural, organizational, and policy-level determinants. Understanding these interconnected influences is essential for designing effective antimicrobial stewardship strategies.

Across healthcare systems, patient expectations and clinician time pressures remain persistent drivers of inappropriate prescribing (3,13). In busy outpatient settings, clinicians may perceive that prescribing antibiotics is quicker than explaining why they are unnecessary, particularly when consultation time is limited. Concerns about patient satisfaction, fear of losing trust, and avoidance of conflict further reinforce this behavior. Such pressures can lead to “just-in-case” prescribing, especially for self-limiting viral infections.

At the clinician level, diagnostic uncertainty and risk aversion strongly influence prescribing behavior. When distinguishing between bacterial and viral infections is challenging, clinicians may prescribe antibiotics defensively to prevent potential complications or medicolegal consequences. Professional norms and peer practices also shape prescribing patterns; in some settings, antibiotic use becomes normalized through institutional culture and informal mentorship (5,11). Junior clinicians often adopt prescribing habits observed during training, perpetuating entrenched practices.

In low- and middle-income countries (LMICs), structural barriers significantly intensify misuse (4,6). Weak enforcement of prescription regulations enables over-the-counter antibiotic access and self-medication.

**Figure.1** Multi-Level Determinants of Antibiotic Prescribing



Limited diagnostic infrastructure forces reliance on empirical therapy, while workforce shortages and high patient volumes encourage rapid prescribing decisions. Additionally, fragmented health systems and supply chain constraints may influence antibiotic selection and duration.

Health system factors such as inadequate access to updated treatment guidelines, limited stewardship leadership, and insufficient surveillance systems further

complicate rational prescribing. Without feedback mechanisms or prescribing audits, clinicians may remain unaware of inappropriate practices. Pharmaceutical marketing and drug availability can also shape prescribing preferences, particularly where regulatory oversight is weak.

The findings highlight that irrational prescribing is not merely a knowledge deficit but a systems problem. Behavioral determinants, including beliefs about

antibiotics, perceived patient expectations, and professional identity, interact with systemic constraints such as time pressures, diagnostic limitations, and policy gaps. Therefore, interventions focusing solely on education are unlikely to achieve sustained improvements.

Effective antimicrobial stewardship requires multilevel, context-sensitive strategies. Educational interventions should be paired with audit and feedback, rapid diagnostics, and clinical decision support tools to reduce uncertainty and support evidence-based decisions. Strengthening regulatory enforcement, improving access to diagnostics, and integrating stewardship into health system governance are particularly critical in LMIC settings. Public awareness campaigns can reduce patient-driven demand, while community engagement helps align expectations with appropriate care.

Furthermore, stewardship initiatives must be tailored to local contexts, recognizing variations in healthcare infrastructure, cultural norms, and disease burden. Multidisciplinary collaboration involving clinicians, pharmacists, microbiologists, nurses, policymakers, and community stakeholders enhances program effectiveness and sustainability.

In the era of escalating antimicrobial resistance, addressing irrational antibiotic prescribing requires a shift from individual responsibility to system-wide accountability. Integrative stewardship models that combine behavioral insights, technological innovations, and policy reforms offer the greatest potential to optimize antibiotic use and preserve antimicrobial effectiveness for future generations.

### **Conceptual framework: multi-level determinants of antibiotic prescribing**

Below is a conceptual framework developed from synthesized evidence:

This framework illustrates the interdependent, multi-layered influences on prescribing behavior.

### **Implications for practice and policy**

**Clinical Practice** Strengthening evidence-based prescribing competencies is essential to improve rational antibiotic use. Continuous professional development

programs should emphasize diagnostic reasoning, antimicrobial selection, dose optimization, and duration of therapy aligned with current clinical guidelines. Simulation-based learning, case discussions, and mentorship models can reinforce practical decision-making skills. Equally important is improving clinician communication skills to manage patient expectations. Training clinicians to explain the natural course of viral illnesses, risks of unnecessary antibiotics, and benefits of symptomatic management can reduce perceived pressure to prescribe. Shared decision-making approaches enhance patient satisfaction while promoting appropriate care. Promoting adherence to clinical guidelines through easy access to updated protocols, pocket references, and mobile applications supports consistent prescribing practices. Embedding stewardship principles into routine clinical workflows encourages rational decision-making at the point of care.

**Health Systems:** Expanding diagnostic infrastructure is critical to reduce uncertainty-driven prescribing. Access to microbiology laboratories, rapid diagnostic testing, and point-of-care tools enables clinicians to differentiate bacterial from viral infections and tailor therapy appropriately. Investment in diagnostics is particularly important in primary care and rural settings. Implementing audit and feedback systems allows healthcare facilities to monitor antibiotic use patterns and provide clinicians with performance feedback. Evidence shows that regular prescribing audits, peer comparisons, and feedback sessions significantly improve adherence to stewardship standards. Integration of digital decision support tools within electronic health records can guide clinicians toward appropriate antibiotic choices, dosing, and duration. Clinical alerts, guideline integration, and prescribing dashboards support real-time evidence-based decision-making.

**Policy and Regulation:** Strong regulatory frameworks are essential to control antibiotic misuse. Governments must enforce prescription-only antibiotic policies to curb over-the-counter sales and self-medication practices. Regulatory authorities should conduct routine inspections and impose penalties for non-compliance. Strengthening national antimicrobial stewardship programs ensures coordinated action across healthcare sectors. Policies should mandate stewardship committees in hospitals, surveillance systems for antibiotic consumption, and national treatment guidelines aligned with resistance patterns. Regulation of pharmaceutical

promotion and marketing practices is necessary to prevent inappropriate influence on prescribing behavior. Transparent policies and ethical standards can minimize commercial pressures affecting clinical decisions.

**Public Health:** Public awareness is a cornerstone of antimicrobial stewardship. Large-scale AMR awareness campaigns can educate communities about the dangers of antibiotic misuse and antimicrobial resistance. Messaging should emphasize that antibiotics are ineffective against viral infections and should only be used when prescribed.

Community-based education programs, school health initiatives, and media campaigns can promote responsible antibiotic use and improve health literacy. Empowering patients with knowledge reduces demand-driven prescribing and enhances adherence to prescribed treatments.

In conclusion, Irrational antibiotic prescribing is driven by complex interactions between clinician behavior, patient expectations, healthcare system constraints, and regulatory environments. LMICs face additional structural challenges that intensify inappropriate use.

Addressing these barriers requires a comprehensive systems approach integrating stewardship programs, policy enforcement, diagnostic support, clinician training, and public education. Strengthening rational antibiotic prescribing is essential to combat antimicrobial resistance and safeguard global health.

## Declarations

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**Ethical Approval:** Not applicable as this is a narrative review of published literature.

## Author Contributions

Dr Shyamal Ravikoti and Dr. S.K. Mohanasuddari conceptualized the study, conducted literature synthesis, developed the conceptual framework, and drafted the manuscript.

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