

# The Effectiveness of Health Campaigns on Antibiotic Resistance: A Media and Pharmacy Practice Perspective

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**Abstract:** Antimicrobial resistance (AMR) is a critical global health threat that demands effective public education and stewardship interventions. This systematic review examines how public health campaigns targeting antibiotic resistance influence public behavior and the role of pharmacists in amplifying these campaign messages. A comprehensive search (2010–2025) was conducted in PubMed, Scopus, Web of Science, Google Scholar, and ScienceDirect for campaigns addressing AMR with pharmacy practice involvement. Twenty studies met inclusion criteria, spanning diverse regions and study designs. Results indicate that mass media campaigns, especially multi-channel national initiatives, can significantly improve public knowledge and reduce inappropriate antibiotic use (eg a 26.5% prescription reduction in France’s campaign). Pharmacists, as accessible healthcare professionals, were shown to be underutilized in these campaigns: only a minority explicitly involved pharmacy services. However, when pharmacists reinforce campaign messages at the point of dispensing, positive impacts (such as increased acceptance of delayed prescriptions) are observed. Integrating pharmacists into campaign planning and delivery emerged as a key opportunity to enhance effectiveness. In conclusion, well-designed media campaigns are effective tools for improving antibiotic use behaviors, and their impact can be strengthened by actively engaging pharmacy professionals. Future antibiotic stewardship efforts should unite public communication strategies with pharmacy practice to capitalize on pharmacists’ expertise and public trust.

**Keywords:** antibiotic resistance, health campaigns, pharmacy practice, antimicrobial stewardship, media interventions

## Introduction

Antimicrobial resistance (AMR) is a major public health threat that risks reversing gains in modern medicine. The World Health Organization lists AMR among the top ten global health threats and warns that common infections and minor injuries may again become fatal as antibiotic effectiveness declines.<sup>1</sup> If unaddressed, AMR could cause up to 10 million deaths annually by 2050, with substantial economic impact.<sup>2,3</sup> Overuse and misuse of antibiotics in human health and agriculture continue to drive resistance, particularly in low- and middle-income countries where access without prescription remains common.<sup>4</sup>

Public awareness and pharmacist engagement are central to AMR mitigation. Pharmacists, as accessible providers, guide appropriate antibiotic use and educate on misuse risks.<sup>5</sup> Their frontline role enables them to influence behavior, reduce non-prescription dispensing, and reinforce stewardship practices.<sup>6</sup> Appropriate, patient-specific antibiotic use is critical for successful treatment outcomes and for preventing resistance. This reality highlights the importance of pharmacist-led counseling and careful adherence monitoring.<sup>7</sup> Despite many national AMR campaigns, it is still unclear how large-scale media messages and pharmacy counseling work together to change public antibiotic use. This review aims to clarify that gap by analyzing campaigns through established behavior-change models (eg, COM-B/BCW) and by examining whether these campaigns reach all segments of the population equitably.<sup>8</sup>

Health communication campaigns, especially those using mass media and digital channels, can shift knowledge, attitudes, and behaviors related to antibiotics. Evidence indicates that sustained, culturally adapted campaigns reduce

inappropriate prescribing and self-medication.<sup>9</sup> Recent analyses also show that new-media formats improve learning and retention, supporting multi-channel, interactive approaches in public.<sup>10</sup> These campaigns can amplify consistent messages delivered by pharmacists and support stewardship at the point of care.

Linking media strategies with pharmacy practice offers a coordinated approach to stewardship. When aligned, campaign messaging, pharmacist responsibilities, and professional standards reinforce each other; however, research on integrated campaigns with pharmacists as active participants or message amplifiers remains limited.<sup>11,12</sup> This review examines how media campaigns and pharmacy practice can be combined to improve outcomes, focusing on design, delivery, and reception of antibiotic-awareness initiatives through a pharmacy lens to inform future public health interventions.

## Background

### Antimicrobial Resistance: Scope and Drivers

The phenomenon of antimicrobial resistance is not new, but its current global trajectory is unprecedented in scale and complexity. While AMR is a natural evolutionary response of microbes to antibiotic pressure, human actions, particularly overprescribing, incomplete treatment courses, and misuse in agriculture, have drastically accelerated the rate at which resistance develops.<sup>13</sup> Countries with weak regulatory systems, unrestricted access to antibiotics, and limited surveillance capacity are disproportionately affected.<sup>14</sup> However, even in high-income countries, inappropriate antibiotic prescriptions in outpatient settings remain prevalent, often driven by patient expectations and diagnostic uncertainty.<sup>15</sup>

### Role of Pharmacists in Antimicrobial Stewardship

Pharmacists are increasingly acknowledged as critical actors in antimicrobial stewardship (AMS) efforts, especially in community settings where they are often the first and sometimes only healthcare contact for patients. Their ability to counsel patients, verify prescriptions, and provide over-the-counter guidance equips them with a unique opportunity to influence appropriate antibiotic use.<sup>16</sup> Studies across Europe and the Middle East confirm that pharmacist-led AMS interventions, such as patient education, prescription audits, and decision support, can reduce unnecessary antibiotic dispensing.<sup>16,17</sup> Despite this, the integration of pharmacists into national AMR strategies remains uneven. In many regions, especially those with high self-medication rates, pharmacists are under-utilized or face conflicting pressures from customers and business owners.<sup>18</sup> This highlights a gap between policy intentions and practice reality, necessitating systems-level support, incentives, and public alignment through complementary strategies like health campaigns.

### Media Campaigns as Tools for Behavior Change

Health communication campaigns have a long-standing history in public health promotion, influencing behaviors in areas such as smoking cessation, vaccination uptake, and safe sex practices.<sup>19</sup> When it comes to AMR, media campaigns seek to reframe the public's perception of antibiotics, from "quick fixes" to "last-resort medicines." Successful campaigns often rely on multi-channel dissemination (eg TV, radio, social media), emotional narratives, and repeated exposure to core message themes.<sup>9,19</sup>

One of the most cited examples is the "Antibiotics are not always the answer" campaign by Public Health England, which led to a significant reduction in patient demand for antibiotics over time.<sup>11</sup> In France, a long-running media campaign between 2002 and 2007 reportedly reduced antibiotic prescriptions by 26.5% over six years, demonstrating the potential of well-orchestrated, government-led media strategies.<sup>12</sup> These campaigns illustrate how sustained public messaging can shift social norms around antibiotic use.

### Linking Media Campaigns with Pharmacy Practice

The convergence of media-based awareness and pharmacy-based intervention remains an underexplored yet promising domain. Pharmacists can act as reinforcers of media messages, providing continuity between a campaign's mass communication and the patient's real-time decision-making process. Several studies suggest that when pharmacists reference public campaigns in their consultations, patients are more receptive to delayed prescriptions or alternative treatments.<sup>20</sup>

Yet, challenges persist. Campaigns are often designed independently of pharmacy input, limiting their practical relevance. Moreover, pharmacists in many regions report feeling uninformed or disconnected from national campaigns, highlighting the need for better integration through professional bodies or healthcare systems.<sup>21</sup> Collaborative models, where pharmacists co-create or tailor campaigns for local populations, show promise but remain largely anecdotal.

## Gaps in Current Literature

While the literature demonstrates the individual effectiveness of media campaigns and pharmacy-led stewardship, there is limited research evaluating coordinated strategies that link these two domains. Most studies assess outcomes in isolation, such as prescription rates or campaign reach, without exploring how synergistic models might amplify behavior change. Furthermore, cultural, linguistic, and health-system variations mean that best practices must be locally adapted, especially in multilingual or low-literacy environments.<sup>22</sup> Taken together, these gaps underscore the need for research on integrated approaches that leverage both media and pharmacy channels in AMR interventions.

## Methods

### Review Design

This study is a systematic literature review conducted in accordance with PRISMA 2020 guidelines. The objective is to synthesize published evidence on the effectiveness of public health campaigns targeting antibiotic resistance, with a specific focus on their interplay with pharmacy practice.

### Research Question

#### Primary Question

How effective are health media campaigns in influencing public behavior regarding antibiotic use, and what role do pharmacists play in amplifying or reinforcing these messages?

### Eligibility Criteria

#### Inclusion Criteria

1. Peer-reviewed journal articles published between 2010 and 2025.
2. Studies evaluating or discussing mass media, social media, or nationwide campaigns targeting antibiotic resistance.
3. Studies that include aspects of pharmacy practice or pharmacist roles in antimicrobial stewardship or behavior change.
4. English-language publications.
5. Article types: systematic reviews, campaign evaluations, observational studies, and qualitative research.

#### Exclusion Criteria

1. Articles unrelated to human healthcare (eg veterinary or agriculture-only contexts).
2. Conference abstracts, posters, and opinion pieces without primary data.
3. Studies without any behavioral outcomes or campaign evaluation component.

### Information Sources and Search Strategy

We searched the following databases between January and April 2025: PubMed, Scopus, Web of Science, Google Scholar, and ScienceDirect. A Boolean keyword strategy was employed, combining terms such as: “antibiotic resistance” AND (“health campaign” OR “public awareness” OR “media”) AND (“pharmacy practice” OR “pharmacist” OR “community pharmacy”).

Reference lists of included articles were also manually screened (snowballing) to identify additional relevant studies.

## Study Selection

Titles and abstracts of retrieved records were screened to remove clearly irrelevant studies. Full-text articles of potentially eligible studies were then reviewed against the inclusion criteria. The final selection of studies was agreed upon for data extraction and synthesis.

## Data Extraction

Data from the included studies were extracted using a standardized form capturing: author(s), year, country or region, study design, type of campaign/intervention, any pharmacy involvement (explicit or implicit), and key findings related to behavior change, antibiotic use, or campaign impact ([S1 Table, Supplementary data](#)).

## Data Synthesis

A narrative synthesis approach was used, given the heterogeneity of study designs and outcome measures among the included studies. Themes were organized under the following domains:

- Campaign strategies and behavioral impact – how different media approaches affected antibiotic use behaviors.
- Role and perception of pharmacists in AMR awareness – involvement and public perception of pharmacy contributions.
- Integration challenges and success factors – barriers/enablers to linking campaigns with pharmacy practice.
- Evaluation methods – how campaign outcomes were measured, including any pharmacy-specific metrics.

This thematic grouping allowed a comparative analysis across healthcare systems and regions.

## Results

### Overview of Study Selection

Following the PRISMA-guided screening process demonstrated below in [Figure 1](#), a total of 432 records were initially identified through database searches ([Figure 1](#)). After removing duplicates ( $n = 47$ ), 385 titles and abstracts were screened. Of these, 320 records were excluded for failing to meet the inclusion criteria – primarily because they lacked relevance to antibiotic resistance campaigns or pharmacy involvement. Sixty-five full-text articles were assessed for eligibility, with 45 excluded due to various reasons:

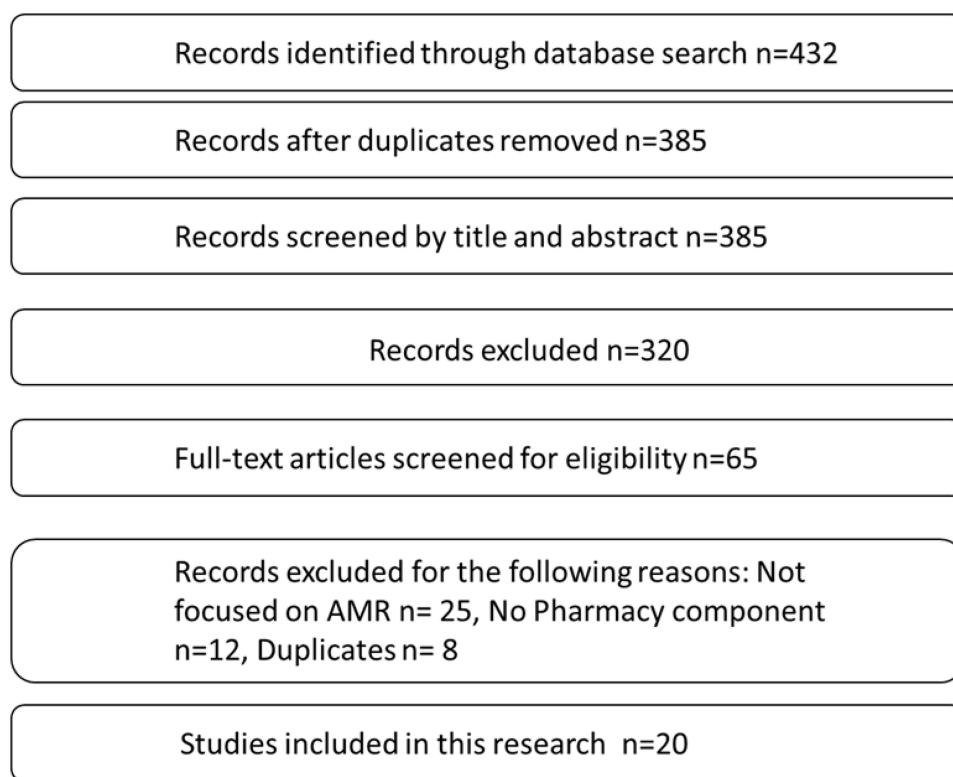
- Lack of a campaign-specific focus ( $n = 25$ )
- No pharmacist or pharmacy practice relevance ( $n = 12$ )
- Grey literature or unverified source type ( $n = 8$ )

Ultimately, 20 studies met all inclusion criteria and were incorporated into the review. These comprised systematic reviews, observational studies, campaign evaluations, and pharmacist-focused research published between 2009 and 2024 ([Figure 1](#)).

### Characteristics of Included Studies

The 20 studies reviewed spanned a range of geographic regions and contexts. Regions represented included: Western Europe (eg UK,<sup>11</sup> France<sup>12</sup>), Northern Europe (Scandinavia) and other European countries,<sup>5,6</sup> North America, Asia, and Africa. Several were global or multi-country reviews.<sup>18,19</sup>

The majority of studies ( $n = 14$ ) employed a narrative (qualitative) synthesis or process evaluation approach to analyze campaign outcomes. Six studies were quantitative systematic reviews or meta-analyses, providing broader evidence on public health communication outcomes and pharmacist roles in AMS.



**Figure 1** A PRISMA flow diagram summarizes the selection process.

## Campaign Strategies and Media Formats

Across the 20 included studies, mass media campaigns were the most commonly reported intervention type. These campaigns typically utilized multi-platform strategies, including television, radio, print media, and social media, particularly in high-income countries.<sup>9,11,19</sup> Key examples included:

- “Keep Antibiotics Working” (UK), A nationally coordinated campaign evaluated for public recall, behavioral intentions, and prescription impact.<sup>11</sup>
- “Antibiotiques, c’est pas automatique” (France), A multi-year campaign associated with a 26.5% reduction in antibiotic prescriptions over six years.<sup>12</sup>
- “Antibiotic Guardian” (UK), A campaign encouraging individual pledges and cross-sector engagement, notably involving pharmacy teams in its outreach.<sup>21</sup>

Most campaigns used culturally sensitive messaging, evolving from alarmist tones to more positive behavioral nudges (eg encouraging patients not to expect antibiotics for self-limiting illnesses). Notably, campaigns that combined broad mass-media outreach with community-level messaging (such as printed materials in pharmacies or clinics) tended to achieve higher public recall and greater impact on prescribing trends.<sup>11,12</sup> In contrast, purely digital campaigns or those relying on voluntary public pledges showed mixed engagement and often lacked reinforcement by healthcare professionals.

## Pharmacy Involvement in Campaigns

Only 8 of the 20 studies explicitly addressed the role of pharmacists in antibiotic stewardship campaigns. Among these:

- a. Tonna et al (2020) and Avent et al (2018) highlighted pharmacists' underutilized position in AMR initiatives and called for structured involvement through professional networks and policy support.<sup>6,17</sup>
- b. McNulty et al (2019) and Hu et al (2018) reported that pharmacists often played an informal role in reinforcing campaign messages at the point of dispensing.<sup>11,20</sup>
- c. Auta et al (2019) found that unrestricted antibiotic access in community pharmacies remains a key challenge in many countries, indicating that campaigns need to be coupled with regulatory measures.<sup>18</sup>

Notably, most public campaigns did not actively feature pharmacists in their design or media content. Exceptions included the UK's Antibiotic Guardian campaign, which explicitly involved pharmacy organizations in disseminating pledges and materials.<sup>21</sup> In general, the studies suggest that pharmacists were more often reactors to campaigns, answering patients' questions and providing advice, rather than proactive partners in campaign design.

## Reported Outcomes and Measures of Effectiveness

Out of the 20 studies:

- Fifteen reported behavioral or prescribing outcomes associated with campaigns (eg reductions in patient demand for antibiotics, increased acceptance of delayed prescription strategies, or declines in inappropriate antibiotic use).
- Five studies included pre- and post-intervention data on antibiotic prescribing trends, such as nationwide prescription rates<sup>15</sup> or primary care antibiotic consumption.<sup>11,23</sup>
- Seven studies focused on changes in public knowledge or attitudes, typically measured through surveys.

Only a minority of studies tracked long-term behavioral change or pharmacist-specific impact metrics. Outcome measures were heterogeneous: some relied on objective data (prescription volumes, dispensing records), while others used self-reported behaviors or intentions. No standardized evaluation framework was apparent across studies, which makes direct comparison challenging. However, an overarching observation is that multi-channel campaigns with sustained messaging generally achieved more substantial behavior change than one-off or single-medium initiatives.

Furthermore, the combination of media outreach with pharmacy engagement was seldom formally evaluated, pointing to an evidence gap. Where such combination did occur informally, as noted anecdotally in several studies, the potential for enhanced outcomes was evident but not quantified.

## Gaps in Current Literature

Despite the existence of campaign evaluations, few studies have integrated pharmacy practice and public health communication in a cohesive framework. The literature indicates several key gaps:

- Scarcity of pharmacist-led campaigns: There is a lack of documented cases where pharmacists or pharmacy organizations spearhead public AMR awareness campaigns.
- Limited inter-sectoral planning: Public health campaign planners and pharmacy networks often operate in silos, leading to missed opportunities for campaign amplification at the point of care. Only a few campaigns (eg Antibiotic Guardian) actively engaged pharmacy stakeholders in planning.<sup>21</sup>
- Inadequate localization: Generic national messages may not resonate in diverse communities.
- Studies noted that campaign materials are rarely adapted by local pharmacies to fit specific cultural or linguistic contexts, even though pharmacies could serve as community hubs for tailored messaging.<sup>21,24</sup>
- Lack of longitudinal data: Many evaluations focus on immediate outcomes, with very few tracking whether improvements (in awareness or behavior) persist beyond the campaign period.<sup>24</sup>

These gaps underscore the need for future initiatives to formally incorporate pharmacists and to evaluate the added value of doing so.

## Discussion

This systematic review set out to evaluate the effectiveness of media-based health campaigns in influencing antibiotic use behaviors and to explore the role pharmacists play in reinforcing these messages. The findings reveal a nuanced landscape where public health communication and pharmacy practice are independently effective, but rarely integrated in a structured or synergistic manner. Some recent digital campaigns for example, those using targeted social media influencers and messaging apps have shown clear changes in public behavior. After these campaigns, more people sought professional medical advice instead of self-medicating.<sup>25</sup> By incorporating case studies from low- and middle-income countries, the findings become more applicable across diverse settings and the lessons learned can be shared more broadly.<sup>26,27</sup>

## Health Campaigns and Behavioral Change

The included studies consistently demonstrate that mass media campaigns can effectively reduce public demand for antibiotics and improve knowledge about AMR. For example, France's "Antibiotics are not automatic" campaign led to a 26.5% reduction in community antibiotic prescriptions over six years,<sup>12</sup> while the UK's "Keep Antibiotics Working" campaign contributed to measurable shifts in public attitudes and expectations around antibiotic use.<sup>11</sup> These findings align with broader evidence from health communication research, which suggests that repeated, well-targeted messaging through trusted channels can facilitate meaningful behavior change.<sup>9,11,19</sup>

However, effectiveness is contingent upon several factors – including cultural appropriateness, message clarity, and media saturation. Studies like Roope et al (2020) and Huttner et al (2010) emphasize that one- off or fear-based messages often fail to produce lasting change. By contrast, long-term engagement, consistent messaging, and trust-building emerge as critical components of success.

Although direct comparisons of communication channels were beyond the scope of most studies, patterns suggest that media mix and delivery format significantly influence campaign reach and impact. Traditional media (TV, radio) can achieve broad awareness, especially among older populations, whereas social media and online platforms engage younger, digitally connected audiences.<sup>23</sup> Campaigns that layered multiple channels, for instance, combining national TV/radio spots with social media outreach and in-pharmacy posters, were more likely to report positive behavioral outcomes.<sup>11,12</sup> This supports the idea that reinforcing messages across different touchpoints (mass media plus pharmacist interactions) enhances both credibility and retention of AMR messages.

## Pharmacy Practice: Untapped Potential in AMR Communication

While pharmacists are routinely identified as key actors in antimicrobial stewardship,<sup>5,6</sup> their integration into AMR public awareness campaigns remains inconsistent. This review found that only a minority of campaigns involved pharmacists explicitly in either message delivery or content design. Most studies portrayed pharmacists as reactive reinforcers rather than proactive partners in public outreach.

Yet the strategic value of pharmacists in AMR communication is well-supported by the literature. They offer high accessibility, frequent patient contact, and credibility as medication experts. As shown by Avent et al (2018) and Auta et al (2019), pharmacists can serve as gatekeepers of antibiotic access, particularly in regions where prescriptions are loosely regulated.<sup>17,18</sup> These strengths position pharmacists as ideal conduits for campaign messages, translating national slogans into personalized advice during pharmacy encounters.

The underrepresentation of pharmacies in campaign strategies appears to be a missed opportunity. Pharmacists' consultations provide "teachable moments" that could reinforce campaign themes (eg, discouraging antibiotics for viral illnesses). However, without being formally included in campaign planning, pharmacists may lack the resources or awareness to effectively echo these messages.

## Sustainability of Campaign Effects and the Role of Pharmacy Reinforcement

Available evaluations show that media campaigns can reduce inappropriate antibiotic use in the short term; however, effects often attenuate without structured post-campaign reinforcement. To sustain behavior change, campaigns should be paired with

pharmacy-based touchpoints, eg, brief counseling at dispensing, adherence checks, and targeted reminders tied to common infection seasons. Integrating these activities into the everyday workflow of pharmacies can help sustain the campaign's benefits beyond the initial surge of awareness. It's important to track specific metrics for example, the percentage of patients counseled, referral rates, or how often patients return for antibiotics to ensure that the positive effects persist. Whenever possible, campaigns should be evaluated again at around 3–6 months and at 12 months after they end to see whether the improvements are holding up or fading away. Linking this approach to the clinical rationale for appropriate, individualized antibiotic use strengthens stewardship at point of care.<sup>7</sup>

## Adaptation for Low-Literacy, Multilingual, and Low-Income Communities

Public health campaigns work best when they are tailored to the community's context, for instance, using the local language, accounting for literacy levels, and considering how easily people can access information. There are several practical ways to tailor campaigns. One approach is to use pictograms and very clear, plain-language scripts so that even those with limited reading skills understand the message. Another is to deliver key points through audio or short videos on community radio stations or via popular messaging apps, which can reach audiences who might not read pamphlets. It's also helpful to provide materials in multiple languages and have pharmacists use a “teach-back” method at the counter (asking patients to repeat information in their own words) to ensure understanding. Using newer media formats that let people actively engage with the content — and see it multiple times — can help these audiences understand and remember the information better.<sup>9</sup>

## Gaps and Missed Opportunities

Several gaps and missed opportunities emerge at the intersection of health promotion and pharmacy practice:

- Inter-sectoral collaboration is limited: Health agencies designing AMR campaigns seldom collaborate with pharmacy organizations during development. This siloed approach means campaigns might not leverage pharmacists' insight into common public misconceptions about antibiotics or their channels for community engagement. Only in a few instances (eg, the UK's Antibiotic Guardian) were pharmacy bodies engaged, and those cases highlight the potential benefits of partnership.<sup>21</sup>
- Pharmacy impact is rarely evaluated: Campaign evaluations tend to focus on broad outcomes (overall antibiotic prescription rates, public knowledge surveys). Little attention is given to pharmacy-specific metrics (such as changes in non-prescription antibiotic sales, or pharmacist interventions made), making it hard to quantify pharmacists' contributions.
- Lack of localized campaign adaptation: National campaigns often produce generic materials that are not translated or tailored for all segments of the population. As noted by Machowska and Lundborg (2019), without localization, messages may fail to engage certain communities.<sup>24</sup> Local pharmacists could play a role in adapting and disseminating culturally appropriate materials, but this is seldom supported or funded.
- Need for sustained engagement: Many campaigns operate within a fixed timeframe, after which focus shifts elsewhere. Pharmacists, however, interact continuously with patients. There is an opportunity for pharmacists to maintain AMR education year-round, extending the lifespan of campaign messages. Capitalizing on this would require empowering pharmacists with updated information and materials even when mass media attention wanes.

Addressing these gaps will require intentional policy and planning changes, as discussed below.

## Systemic and Institutional Barriers

There are several barriers that limit close alignment between public health campaign planners and pharmacy organizations, including:

- i. Governance of these campaigns is often fragmented, and accountability for who owns the campaign and handles follow-up is unclear.

- ii. data-sharing constraints, including privacy rules, inconsistent consent processes, and lack of interoperable IT systems for referral/feedback.
- iii. Incentives and performance metrics in pharmacies (like funding formulas or staff evaluations) are often misaligned with public health goals. Pharmacists are typically not rewarded for providing education or antibiotic stewardship counseling to patients at the counter, so these activities tend to be overlooked.
- iv. Scope-of-practice variability and protocol/authorization gaps that restrict pharmacist-initiated stewardship actions
- v. Operational timing mismatches between campaign peaks and pharmacy staffing/stocking cycles
- vi. Uneven training and audit pathways for standardized health-promotion delivery.

To overcome these challenges, stakeholders should put formal agreements in place that clearly assign responsibilities (explicit commissioning arrangements) and agree on common data standards for sharing information. It's also important to reimburse pharmacists for the time they spend on patient counseling, and to develop integrated campaign protocols that include clear pharmacy roles at every stage from planning to evaluation.

## Implications for Policy and Practice

To maximize campaign effectiveness in combating AMR, there is a need to reframe pharmacists not as peripheral participants but as active campaign partners. This can include:

- Involving pharmacists in campaign planning and message development: Pharmacy perspectives can ensure that public messages are realistic and reinforce advice given in healthcare settings. Early input from pharmacists (and other front-line professionals) could improve campaign relevance.
- Providing pharmacies with tailored educational toolkits: Campaign organizers should supply pharmacies with ready-to-use materials – posters, handouts, talking points – that align with national messages. This would enable consistent communication and equip pharmacists to confidently engage the public.
- Evaluating pharmacy-level outcomes: Future campaign evaluations should incorporate metrics like changes in patient inquiries at pharmacies, instances of pharmacists intervening to prevent inappropriate antibiotic use, or community-level antibiotic dispensing trends. Such data can demonstrate the tangible impact of pharmacy engagement.
- Encouraging community pharmacy micro-campaigns: Pharmacy networks, perhaps through professional associations, could initiate their own local awareness drives in synchrony with national efforts. These might involve pharmacist-led workshops, community talks, or social media outreach focused on local needs, thereby complementing broader campaigns.

Additionally, public health authorities and policymakers should invest in inter-professional collaboration platforms that unite media strategists, pharmacists, physicians, and behavioral scientists. An integrated approach is essential to align high-level communication strategy with ground-level implementation. When pharmacists and media campaigns operate in harmony, each reinforces the other – media messages drive patients to ask questions at pharmacies, and pharmacists' advice reinforces media messaging.

## Conclusion

This systematic review examined the effectiveness of health campaigns targeting antibiotic resistance, with particular attention to their design, delivery, and the role of pharmacy practice in reinforcing campaign messages. The findings confirm that media-based public health campaigns can significantly influence public understanding and reduce inappropriate antibiotic demand, especially when messages are sustained, culturally attuned, and behaviorally focused.

However, despite pharmacists' central role in antimicrobial stewardship, their involvement in AMR communication strategies remains limited and largely informal. Most campaigns operate independently of pharmacy systems, and evaluations rarely assess the direct impact of pharmacist-led interventions. This disconnect represents a missed opportunity to harness the trusted position and accessibility of pharmacists in combating AMR.

As AMR continues to evolve as a global threat, a more integrated approach to health communication, one that combines mass media campaigns with pharmacist engagement, is essential for amplifying public health messages and supporting rational antibiotic use at the community level. By aligning national media campaigns with community pharmacy intervention, an approach consistent with the WHO's Global Action Plan on AMR and the One Health perspective, our review offers a novel integrated model. This media–pharmacy partnership, with its built-in measures for pharmacy-level follow-up, is a key contribution of our study and provides a concrete guide for designing future antibiotic stewardship campaigns.

## Recommendations

Based on the review findings, the following recommendations are proposed to enhance the impact of future antibiotic resistance campaigns:

1. **Integrate Pharmacists into Campaign Design and Delivery:** Pharmacists should be recognized as strategic partners in AMR campaigns, not peripheral actors. In practice, this means including pharmacists in message development, campaign planning meetings, and pilot testing of materials to ensure messages are actionable at the pharmacy level.
2. **Develop Pharmacy-Specific Communication Toolkits:** Health authorities should support campaigns with materials designed for use in pharmacies, including posters, leaflets, infographics, and conversation scripts. These tools would enable pharmacists to deliver consistent, evidence-based messages during consultations and when dispensing antibiotics.
3. **Incorporate Pharmacy-Level Metrics in Campaign Evaluation:** Campaign outcomes should be tracked not only in terms of public behavior or overall prescription rates, but also through pharmacy-specific indicators. For example, measure the number of antibiotic advice consultations in pharmacies, instances where pharmacists recommended non-antibiotic therapies, or reductions in over-the-counter antibiotic sales (in jurisdictions where that is an issue).
4. **Encourage Localized Micro-Campaigns via Pharmacy Networks:** Pharmacy organizations and local health authorities should encourage community pharmacists to conduct micro-campaigns tailored to local languages and cultural contexts. These could run concurrently with national campaigns, ensuring that messages reach diverse populations in an accessible manner.
5. **Support Longitudinal Research and Data Sharing:** There is a need for more robust, long-term studies that follow up on campaign impacts. Researchers should examine whether improvements in public knowledge and antibiotic use are sustained over time and whether repeated or continuous exposure (potentially through ongoing pharmacy engagement) is necessary. International collaboration and data sharing on AMR campaign outcomes can accelerate learning about what works in different settings.
6. **Integrate pharmacists from the start:** Ensure pharmacy organizations are involved at the campaign design stage. **Establish clear performance metrics:** Define shared key performance indicators for success (for example, the number of patient counseling sessions' completed or appropriate referral rates achieved). **Provide necessary support:** Allocate dedicated time and funding for pharmacists to counsel patients (so that this responsibility is not squeezed into an already busy workday). **Enable seamless communication:** Implement referral and feedback tools that link pharmacies with the broader health system, while maintaining patient privacy.
7. **Schedule follow-ups in pharmacies:** Link each campaign with planned pharmacy-based follow-ups — for instance, pharmacists providing brief counseling, doing adherence checks, or offering seasonal reminders after the campaign. **Monitor long-term impact:** Collect data at regular intervals (around 3–6 months after the campaign, and again at 12 months) to see if the campaign's effects are lasting or fading over time.
8. **Make materials accessible:** Prepare patient education materials in multiple languages and in formats suitable for people with low literacy for example, using pictograms or audio/video clips. Use the “teach-back” method: Encourage pharmacists to confirm understanding by asking patients to repeat information in their own words. **Leverage community channels:** Share campaign messages through local media channels (like radio broadcasts or popular messaging apps), and set up clear referral pathways so pharmacists can easily direct patients to clinics when needed.

By implementing these recommendations, future efforts can better align public awareness campaigns with on-the-ground stewardship practices. Ultimately, bridging the gap between media messaging and pharmacy practice will be crucial for achieving lasting improvements in antibiotic use and preserving the effectiveness of these life-saving drugs.

## Disclosure

The author reports no conflicts of interest in this work.

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