Understanding Antibiotics Talk On Social Media: A Review Of Infodemiology Studies

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Abstract. Antibiotics are essential for treating infections, but their effectiveness faces a growing threat from antimicrobial resistance (AMR). Impactful communication via social media platforms is crucial in the battle against AMR. This study reviews infodemiology research regarding antibiotics and AMR on social media platforms to elucidate information dissemination patterns, identify key influencers, and assess the prevalence of misinformation. Infodemiology or Information Epidemiology, focusing on the determinants and distribution of health information and misinformation online, forms the basis of this investigation. Searching Embase, PubMed, and the Cochrane Library, a systematic review was conducted, including ten peer-reviewed studies. The collective dataset comprises 10,650,139 conversations, covering the period from 2009 to 2022, encompassing tweets, retweets, comments, videos, and posts. The findings underscore the significant influence of health news sources, healthcare professionals, and organizations in shaping these discussions. While many posts exhibit a solid understanding of appropriate antibiotic usage, misinformation persists. Even when misinformation was present in small proportions, it could reach millions of individuals. Social media offers opportunities to shape public perceptions and behaviors. Ensuring the dissemination of accurate and reliable information is imperative, given that even marginal levels of misinformation can impact a vast audience. By deciphering social media dialogues, healthcare practitioners and policymakers can formulate effective strategies to combat antibiotic misuse and advocate for responsible antibiotic utilization.

Keywords. Antimicrobial stewardship**,** Antibiotics, Social media, Social networks, Information Epidemiology

1. Introduction

Since the groundbreaking discovery of Penicillin in 1928, antibiotics have stood as a powerful ally in humanity's ongoing battle against harmful microorganisms. The World Health Organization has estimated that antimicrobials have contributed approximately 20 years to the global life expectancy[1]. However, the effectiveness of antimicrobials is gradually waning, primarily due to the emergence of antimicrobial resistance (AMR). In 2019, the number of deaths linked to AMR soared to 4.95 million[2]. In addition to the immense human impact, AMR poses a substantial economic burden[3]. In 2017, the World Bank projected a decline of 1.1% to 3.8% in the global annual gross domestic product (GDP) by 2050 due to AMR, and low-income countries will lose even more[4].

Effective communication about antibiotic misuse, including via social media, is a crucial strategy to control antimicrobial resistance[5]. As of 2023, an estimated 4.9 billion people use social media worldwide[6], with popular platforms including Facebook, Twitter, Instagram, TikTok, Reddit, and LinkedIn.

As social media usage grows, more people seek health-related information online. In this context, a research discipline and methodology has emerged to study the determinants and distribution of health information and misinformation online and its impact on public and individual health: information epidemiology or infodemiology[7]. Analyzing how individuals search, navigate, and share health information online can provide valuable insights into the health-related behavior of populations[8].

Social media platforms offer opportunities to identify and address antibiotic misuse and misinformation, promote positive behavior change, and disseminate accurate information. However, it is unclear how

prevalent AMR-related misinformation is on social media, who the key influencers are, and how information spreads.

This article aims to synthesize peer-reviewed literature on discussions about antibiotics and antibiotic resistance on social media, offering insights into the current landscape of online conversations on this topic.

2. Methods

2.1 Databases and search strategy

A systematic review was performed using the databases Embase, PubMed (MEDLINE), and Cochrane Library. No time and language restrictions were applied during database searches.

The search strategy combined synonyms and relevant terms for "antibiotics," "resistance," and "social media" as follows: (antibiotic OR antibiotics OR antimicrobial) AND (resistance OR stewardship OR awareness OR rational OR misuse OR overuse OR "inappropriate use") AND ("social media" OR "social medias" OR "social networking" OR "social network" OR "social networks" OR "social platforms" OR Twitter OR Instagram OR Facebook OR TikTok OR YouTube). The terms were searched in the title, abstract, and keywords.

2.2 Screening and selection

All outputs were imported into Zotero for deduplication. After removing the duplicates, the records were imported into Rayyan software[9] for screening and selection. Titles and abstracts were screened for the inclusion of potentially eligible studies sourced from the database searches.

Studies analyzing conversations revolving around antibiotics and antimicrobial resistance on social media platforms were included. Conference abstracts, viewpoints, reviews, AMR campaign evaluations, interventional studies, and surveys were excluded.

2.3 Data extraction

From each included article, the following information was extracted: title, first author, year of publication, social media platform analyzed, method of data collection, language of social media content, and key findings.

3. Results

The literature search retrieved 408 records from three databases. After removing 136 duplicates, 272 records underwent title and abstract screening. Among these, 230 studies were excluded for not meeting the inclusion criteria. Subsequently, 42 studies underwent full-text screening, with ten ultimately meeting the inclusion criteria and being selected for this review. Figure 1 illustrates the selection process for the final included studies.
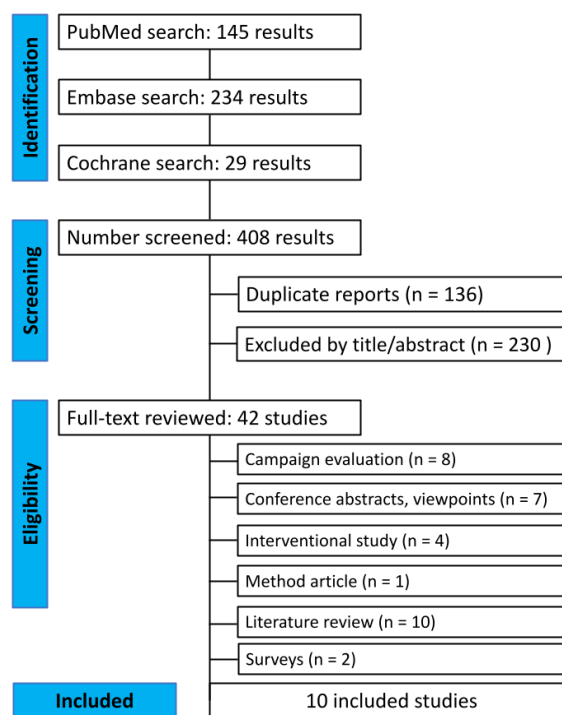

Fig. 1 - Flow diagram of study screening and selection

3.1 Social media platforms

Among the ten included studies, five analyzed data from X (formerly Twitter)[10-14], one studied YouTube[15], one focused on TikTok[16], one examined the BabyCenter United States social media site[17], one analyzed both X and Facebook[18], and one conducted a comprehensive analysis across multiple platforms including X, Reddit, YouTube, forums, blogs, Facebook, and Instagram[19].

3.2 Languages

Eight articles analyzed content exclusively in English[10,12-18], while one considered English and Spanish[11]. One study included content in the local languages of Germany, Italy, Spain, Mexico, Brazil, Thailand, Romania, and the Russian Federation[19].

3.3 Dataset size

The combined total of conversations collected by all studies, including tweets, retweets, comments, videos, and posts, was 10,650,139. This dataset encompasses data collected between 2009 and 2022.

Table 1 provides a summary of the article's characteristics.

Tab. 1 – Study Characteristics

Study reference	Social media	Dataset size	Date range
[10]	X	648,076	Nov 28, 2015, to Nov 25, 2016

[11]	X	8,935,710	Sept 21, 2016, to 8 Feb, 2017
[12]	X	243,000	Sept 24, 2012, to Sept 23, 2013
[13]	X	2762	Dec 2018 to Sept 2021
[14]	X	52,153	Mar 13 to July 31, 2009
[15]	YouTube	41	Mar 2016 to Jan 2020
[16]	TikToK	300	March of 2021 and before
[17]	BabyCenter US social media	5953	Jan 1, 2018, to Feb 1 2020 and 1 Mar, 2020, to 1 Dec, 2022
[18]	X, Facebook	144	Sept 2017 to Sept 2019
[19]	X, Reddit, YouTube, forums, blogs, Facebook, and Instagram	762,000	1 Jan, 2018, to 25 Nov, 2021
Total		**10,650,139**	

4. Discussion

With the growing concern over uncontrolled antimicrobial resistance (AMR), there are increasing calls for multidisciplinary approaches to address antibiotic misuse and improve public awareness. As more individuals seek health information online, understanding information networks on the Internet, particularly on social media, has become crucial. This study aimed to review infodemiology studies on antibiotics and AMR discussions to assess the spread of misinformation on these topics.

4.1 Social Media Platforms and Language Considerations

Most articles primarily focus on X (formerly Twitter), known for its rapid response to real-world events and its ability to accurately reflect offline behaviors and attitudes surrounding these events[20]. Another notable observation is that most of the articles analyzed content only in English, limiting the generalizability of the results to a few countries.

4.2 Influencers and Public Engagement

Health news sources and professionals in the medical and pharmaceutical fields were identified as top influencers in AMR discussions[10,11]. Large health organizations, such as the World Health Organization, were also found to be influential in AMR advocacy efforts[11].

Regarding the public's engagement, Kim et al.[13] found that followers of the @AntibioticResis account are mainly healthcare practitioners, professionals, or academic researchers, suggesting a need to target broader audiences. The study also highlighted that WHO critical priority pathogens and *K. pneumoniae* attract more URL clicks, indicating a higher level of interest in these topics.

4.3 Social Media Video Platforms

Two studies analyzed video content about antibiotics and AMR. Djerf-Pierre et al.[15] found a dominance of professionally produced content, which also yielded more views than user-generated content. In the vast majority of the most viewed videos, the communicative purpose was to educate, inform, or instruct the public. However, Evans et al.[16] found that, on TikTok, 75% of the videos were created by non-healthcare professionals. Videos produced by healthcare professionals were significantly more relevant and reliable than non-healthcare professionals.

4.4 Misinformation

While most tweets and forum posts demonstrated a strong understanding of appropriate antibiotic use, some contained misinformation[10,14,17]. In the sample examined by Scanfeld et al[14], the top tweet categories were general updates about taking antibiotics and accurate information about antibiotics. Misinformation ranked sixth, making up about 6% of the tweets sampled. While this might seem insignificant at first glance, the researchers found that this 6% reached over 1 million followers. The most common misinformation types were about using antibiotics to treat the flu and colds, reaching

an estimated audience of over 850,000 followers[14].

Furthermore, jokes about antibiotic misuse were popular in retweets, highlighting a potential area of concern for health policymakers[10]. Emmott et al.[18] found that antibiotic prescriptions were frequently linked with toothaches, leading to expressions of frustration or disappointment when antibiotics were not prescribed. The belief that antibiotics can cure toothaches, the desire to avoid dental treatment (due to dental phobia or anxiety), and perceived challenges in accessing urgent dental services were common factors driving antibiotic-seeking behavior. Similarly, factors associated with inappropriate antibiotic use claims among parents were limited access to healthcare, including transportation and wait times[17].

Examining multinational datasets, Essack et al.[19] identified that individuals with sore throats often believe antibiotics are effective for all types of sore throats, regardless of whether they are viral or bacterial. They frequently think that antibiotics work better than other treatments and can speed up recovery. The authors also identified posts demonstrating fear that, by taking too many antibiotics, a person could "get AMR". These posts highlight misunderstandings about how antimicrobial resistance develops.

4.5 Activity Patterns and Response Sustainability

Overall, AMR conversations on social media exhibited evident peaks related to announcements and publications from national and international health organizations, governments, and awareness weeks[11,12]. However, sustaining this level of engagement remains a challenge, emphasizing the need for strategies to achieve a more consistent response[11].

5. Conclusion

Social networks are crucial platforms for discussing antibiotics and AMR, offering unique opportunities to influence public perceptions and behaviors. This review underscores the significant role of health news sources, professionals, and organizations in shaping these conversations. Importantly, even a modest percentage of misinformation content has the potential to reach over a million individuals, highlighting the importance of ensuring accurate and reliable information dissemination. By understanding the dynamics of social media discussions, healthcare professionals and policymakers can develop effective strategies to combat antibiotic misuse and promote responsible antibiotic use, ultimately contributing to the global efforts to mitigate the threat of AMR.

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