ANTIMICROBIAL RESISTANCE IN ITALY: A SYSTEMATIC AND POLICY ORIENTED ANALYSIS

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Abstract. Antimicrobial resistance (AMR) is increasingly recognized as one of the most pressing challenges facing modern healthcare systems. Italy provides a particularly interesting case within Europe, as it continues to experience relatively high levels of antibiotic consumption alongside significant rates of resistance. This paper explores the issue from a broader perspective, moving beyond clinical explanations to consider the role of healthcare organization, policy frameworks, and social behavior. The study is based on a qualitative review of scientific literature, institutional reports, and publicly available data. The findings suggest that AMR in Italy is closely linked to structural factors, including regional disparities in healthcare performance, differences in prescribing practices, and uneven implementation of national policies. While recent initiatives, such as national action plans and stewardship programs, have improved awareness and monitoring, their impact has not been uniform across the country. Overall, the Italian case highlights the need for coordinated strategies that combine regulation, education, and institutional support. Addressing AMR effectively requires not only better clinical practices, but also stronger alignment between national policies and local realities.
Keywords: *antimicrobial resistance, antibiotic policy, health governance, Italy, public health*

Introduction

Over the past decades, antibiotics have revolutionized modern medicine, dramatically reducing morbidity and mortality from bacterial infections. However, the emergence and proliferation of antimicrobial resistance (AMR) have increasingly threatened these gains, positioning AMR as one of the most pressing challenges in public health globally (WHO, 2021; Marston et al., 2016). The crisis extends beyond microbiological phenomena, affecting healthcare delivery, patient safety, and economic sustainability (World Bank, 2017; O'Neill, 2016). Europe exhibits significant variability in AMR prevalence and antibiotic consumption, reflecting complex interactions between healthcare system structure, prescriber behavior, and patient expectations (Sanchez et al., 2016; Laxminarayan et al., 2013). Italy presents a particularly instructive case: despite being a high-income European country, it continues to show relatively elevated rates of antibiotic use and corresponding resistance, compounded by regional disparities in healthcare organization and policy enforcement (AIFA, 2022; ISS, 2022). Historically, research has focused on the clinical and microbiological dimensions of AMR (Davies and Davies, 2010), yet these alone cannot explain persistent patterns of resistance. Increasingly, scholarship emphasizes that understanding AMR requires a systems perspective that integrates institutional, policy, and social determinants (Hernando-Amado et al., 2019; Prestinaci et al., 2015). By shifting the analytical lens from isolated clinical outcomes to systemic and behavioral factors, we can identify leverage points for intervention, including prescriber stewardship, patient education, and regulatory frameworks (Bianco et al., 2020; Laxminarayan et al., 2013).

In Italy, AMR patterns are closely tied to healthcare governance and regulatory effectiveness. Regional variations in antibiotic use highlight the influence of local policy implementation, institutional coordination, and resource allocation (MDS, 2022; Cangini et al., 2021). Hospitals, primary care clinics, and community health centers demonstrate distinct prescribing patterns, reflecting differences in diagnostic capacity, organizational culture, and patient expectations (Marston et al., 2016; Sanchez et al., 2016). Overprescription, self-medication, and gaps between guidelines and actual clinical practice persist, indicating that regulatory measures alone are insufficient without active institutional support (ISS, 2022; Ventola, 2015). AMR surveillance systems, although improved, remain fragmented, affecting timely data collection and interpretation across regions (ECDC, 2022). Emerging stewardship programs and national action plans, such as the PNCAR 2017–2020 and PNCAR 2022–2025, exemplify coordinated efforts to standardize prescribing practices and monitor compliance (MDS, 2022; 2017). However, uneven implementation underscores the necessity of tailoring interventions to local healthcare realities, integrating educational campaigns, and fostering accountability mechanisms at all levels. The Italian experience demonstrates that effective AMR mitigation depends on aligning policy frameworks with clinical practice and organizational capacity, rather than relying solely on legislation or top-down directives.

Addressing AMR requires recognition of its multifactorial nature, incorporating clinical, behavioral, and systemic dimensions simultaneously. Evidence suggests that combining educational initiatives for healthcare professionals, patient awareness campaigns, and robust stewardship programs yields the greatest impact on antibiotic consumption and resistance trends (WHO, 2021; Sanchez et al., 2016). Behavioral factors, including prescriber habits, patient expectations, and socio-cultural norms, interact with institutional mechanisms to reinforce overuse patterns (Bianco et al., 2020; Prestinaci et al., 2015). Furthermore, regional disparities in healthcare provision necessitate context-specific strategies, as interventions successful in one region may not be directly transferable to another (AIFA, 2022). International coordination is equally critical, given that resistant pathogens transcend national borders, emphasizing the importance of surveillance data sharing, global policy alignment, and collaborative research initiatives (World Bank, 2017; O'Neill, 2016). This integrative approach underscores the need for research that moves beyond narrow clinical assessments to include health governance, social determinants, and behavioral analysis. By situating AMR within broader socio-technical and policy frameworks, Italy exemplifies how multilevel interventions can inform evidence-based strategies, while also highlighting persistent challenges in achieving equitable and effective implementation across diverse healthcare contexts (Hernando-Amado et al., 2019; Sanchez et al., 2016).

Materials and Methods

This study employed a qualitative literature review methodology, strategically designed to synthesize insights from multiple sources to elucidate the intricate relationship between antibiotic use and antimicrobial resistance within the Italian healthcare context. Recognizing that AMR is not solely a microbiological issue but a socio-technical and policy-dependent phenomenon, the study integrated a diverse array of materials, including peer-reviewed academic articles, institutional reports, and regulatory documents. Scientific literature was systematically retrieved from

internationally recognized databases such as PubMed and Scopus, ensuring comprehensive coverage of empirical and theoretical research on antibiotic stewardship, resistance trends, and clinical outcomes. Concurrently, policy-oriented reports and guidelines were sourced from authoritative institutions, including the AIFA (2022), ECDC (2022), ISS (2022) and WHO (2021), providing contextually rich data on national and regional AMR governance. The selection criteria were deliberately stringent, focusing exclusively on publications that directly addressed antibiotic prescribing behaviors, resistance patterns, and healthcare policy implications in Italy. Temporal prioritization emphasized recent literature to capture evolving practices, emerging resistance mechanisms, and contemporary policy frameworks (Prestinaci et al., 2015; Laxminarayan et al., 2013). This approach ensured the relevance and applicability of the collected materials while balancing breadth and depth, acknowledging the trade-offs between exhaustive data collection and analytical clarity. By critically curating sources, the methodology emphasized the integration of evidence across multiple levels: clinical, institutional, and regulatory; to provide a holistic understanding of AMR dynamics in Italy.

Analytically, the study adopted a thematic synthesis framework, eschewing rigid pre-defined coding schemes in favor of an emergent, inductive approach (Snyder, 2019). This allowed for the identification of recurring patterns, cross-cutting themes, and contextual nuances that traditional deductive methods might overlook. Themes were identified through iterative reading, coding, and comparison, focusing particularly on inter-regional differences, institutional roles, and the impact of specific policy measures on antibiotic prescribing and resistance trajectories (Berendonk et al., 2015). This methodological choice reflects a commitment to epistemological reflexivity, recognizing that AMR is influenced by complex, multi-layered interactions among clinical practice, patient behavior, and regulatory enforcement. By incorporating both qualitative evidence and policy documents, the study critically assessed not only what is known about AMR patterns but also how institutional structures, governance frameworks, and socio-cultural factors modulate these outcomes. Furthermore, the methodology acknowledges inherent limitations in literature-based analyses, such as publication bias and heterogeneity in study design, while mitigating these through triangulation of sources and prioritization of high-quality, peer-reviewed, and policy-relevant materials. This integrative, critically informed approach enhances the rigor, relevance, and applicability of the findings, providing a robust foundation for subsequent discussion and policy recommendations.

Results and Discussion

The review of the selected literature offers a broad and structured understanding of how antibiotic use contributes to the development and persistence of antimicrobial resistance across different healthcare contexts (ECDC, 2022; WHO, 2021). Rather than pointing to a single cause, the findings consistently highlight that antibiotic consumption is shaped by a combination of clinical practices, behavioral factors, and institutional conditions (Prestinaci et al., 2015). This makes antimicrobial resistance a multifaceted issue, where patterns of use and their consequences vary depending on the setting in which care is delivered. A first general observation concerns the variability of antibiotic use. The literature shows that consumption levels are not uniform, either across countries or within the same healthcare system (Laxminarayan et al., 2013).

Differences emerge between hospital environments, primary care, and community settings, each of which is characterized by distinct dynamics and constraints. These variations are influenced not only by the nature of medical conditions being treated, but also by access to diagnostic tools, organizational practices, and local prescribing cultures. In Italy, significant regional differences persist, with higher cumsumption often observed in certain areas (AIFA, 2022; Cangini et al., 2021).

At the same time, the analysis reveals that certain underlying factors tend to recur across studies. Prescribing behavior, for instance, is often shaped by a combination of clinical uncertainty and external pressures, including time limitations and perceived patient expectations (Bianco et al., 2020; Sanchez et al., 2016). Patient-related factors, such as awareness and previous experiences also play a significant role in influencing antibiotic use. These elements interact in ways that can reinforce patterns of overuse or inappropriate prescribing. Another important aspect emerging from the literature is the role of healthcare governance and regulatory frameworks. The effectiveness of policies aimed at controlling antibiotic use appears to depend not only on their design but also on their implementation (MDS, 2022; 2017). In contexts where monitoring systems are weak or enforcement is inconsistent, inappropriate use tends to persist (ISS, 2022). Conversely, settings with stronger institutional coordination and clearer accountability mechanisms show more promising outcomes.

The findings also point to a set of recurring challenges that cut across different contexts. These include the overprescription of antibiotics, the persistence of self-medication practices in certain environments, and gaps between recommended guidelines and actual clinical practice. In addition, limitations in surveillance systems continue to affect the ability of healthcare systems to monitor trends and respond effectively. Despite these challenges, the literature also highlights a number of responses that have demonstrated positive effects. Interventions such as antimicrobial stewardship programs, educational initiatives, and improvements in surveillance have contributed to more rational use of antibiotics in several settings (WHO, 2021; Sanchez et al., 2016). However, the evidence suggests that these measures are most effective when implemented as part of a broader, coordinated strategy rather than as isolated actions. Overall, the results underline the complexity of antibiotic use as a phenomenon that cannot be fully understood through a single lens. The interaction between individual behavior, institutional structures, and policy environments creates a dynamic context in which antimicrobial resistance develops and spreads. For this reason, the following subsections examine in greater detail the specific patterns of antibiotic use, the key determinants shaping these patterns, the main challenges identified in the literature, and the policy responses that have been proposed to address them.

Patterns of antibiotic use

One of the most consistent observations in the literature is that antibiotic use in Italy is far from uniform (AIFA, 2022). There are clear regional differences, with higher consumption generally reported in the southern parts of the country (Cangini et al., 2021). In hospital settings, antibiotics are often used in response to serious infections, and in many cases, broad-spectrum treatments are preferred, especially when diagnostic certainty is limited (Ferrara et al., 2024; Marston et al., 2016). While this approach can be justified in urgent situations, it also increases the risk of unnecessary exposure. In primary care, the situation is somewhat different. Antibiotics are frequently prescribed for common conditions, including respiratory infections that may not require such

treatment (Sanchez et al., 2016). This pattern is often linked to time pressures, diagnostic uncertainty, and the perception that patients expect a prescription (Bianco et al., 2020).

Determinants of antibiotic use

The reasons behind antibiotic use are complex and involve several interacting factors (Prestinaci et al., 2015). From the perspective of healthcare professionals, prescribing decisions are not always straightforward. In many cases, clinicians must act quickly, sometimes without access to complete diagnostic information (Sanchez et al., 2016). This can lead to a more cautious approach, where antibiotics are prescribed "just in case". Patients also influence prescribing practices. Expectations for rapid treatment and limited awareness of antimicrobial resistance can shape demand for antibiotics (Bianco et al., 2020). At the system level, regulatory differences and variations in policy implementation contribute to regional disparities (AIFA, 2022; MDS, 2022).

Key challenges, policy responses and interventions

A number of challenges appear repeatedly across the literature. Overprescription remains a major issue, particularly in primary care (Ventola, 2015). Self-medication, although less widespread than in some other countries, still contributes to inappropriate use (Laxminarayan et al., 2013). Another concern is the gap between guidelines and actual clinical practice (Sanchez et al., 2016). Surveillance systems have improved, but limitations remain in coordination and data comparability (ECDC, 2022; ISS, 2022). Italy has introduced several strategies to address antimicrobial resistance. National action plans such as the PNCAR provide a framework for intervention (MDS, 2022; 2017). Antimicrobial stewardship programs have been implemented in healthcare settings to improve prescribing practices (Sanchez et al., 2016). Educational initiatives have also been used to increase awareness among healthcare professionals and the public (WHO, 2021). However, implementation remains uneven, reflecting regional differences in resources and institutional capacity (AIFA, 2022; ISS, 2022).

The findings show that antimicrobial resistance in Italy cannot be explained by a single factor, but reflects the interaction between clilnical, behavioral, and institutional dynamics (Hernando-Amado et al., 2019). One important point is that policies alone are not sufficinet if they are not effectively implemented (MDS, 2022). Even well-designed strategies can have limited impact if they are not properly implemented or adapted to local conditions. This is particularly relevant in a system where regional differences play a significant role. Another key aspect is behavior factors, including prescribing habits and patient expectations, play a crucial role (Bianco et al., 2020). Regional variability further highlights the need for context-specific approaches (AIFA, 2022). At the same time, the global dimension of AMR requires coordinated international efforts (World Bank, 2017; O'Neill, 2016).

Conclusion

This paper set out to explore antimicrobial resistance (AMR) in Italy by moving beyond a purely clinical perspective and examining the broader system within which antibiotic use takes place. By bringing together insights from scientific literature, institutional reports, and policy analysis, the study aimed to understand not only what is

happening, but also why it continues to happen despite growing awareness and intervention efforts. One of the clearest conclusions that emerges from this analysis is that antimicrobial resistance cannot be reduced to a single cause or addressed through isolated measures. The Italian case illustrates that AMR is the result of multiple, interconnected dynamics. Clinical decision-making, patient behavior, institutional organization, and regulatory frameworks all interact in ways that reinforce existing patterns of antibiotic use. As a result, efforts that focus on only one dimension—whether clinical guidelines, awareness campaigns, or regulatory restrictions—tend to produce limited and often short-lived results. A particularly important finding concerns the role of healthcare system organization. Italy's decentralized structure, while offering flexibility and regional autonomy, also creates variability in how policies are implemented.

National strategies, including action plans and stewardship initiatives, provide an important framework, but their effectiveness ultimately depends on how they are translated into practice at the regional and local levels. The differences observed across regions suggest that implementation capacity, resource availability, and institutional coordination play a decisive role. In this sense, AMR is not only a matter of medical practice but also of governance quality. Closely linked to this is the issue of consistency. While guidelines and protocols for antibiotic use are generally well established, their application remains uneven. This gap between formal recommendations and actual practice is one of the key challenges identified throughout the analysis. It reflects, in part, the realities of everyday clinical work, where time constraints, diagnostic uncertainty, and workload pressures can influence decision-making. At the same time, it points to the need for stronger institutional support mechanisms that help bridge this gap, rather than assuming that guidelines alone are sufficient. Another important dimension is the role of behavior, both on the part of healthcare professionals and patients. The findings suggest that prescribing practices are not shaped solely by clinical evidence, but also by expectations, habits, and perceived pressures. Similarly, patients' understanding of antibiotics, their expectations for treatment, and their previous experiences all influence how and when these medications are used. These behavioral factors are often subtle but highly influential, and they highlight the limits of purely regulatory approaches. Changing behavior requires time, communication, and trust, as well as sustained investment in education and awareness. The analysis also underscores the importance of data and monitoring systems.

Reliable information on antibiotic use and resistance patterns is essential for designing effective policies and evaluating their impact. Italy has made progress in strengthening surveillance, but challenges remain in ensuring that data are consistently collected, shared, and used across different regions. Without a solid evidence base, it becomes difficult to identify priorities, allocate resources effectively, or measure progress over time. At the policy level, the study suggests that integrated approaches are more likely to succeed than fragmented interventions. Measures such as antimicrobial stewardship programs, public awareness campaigns, and regulatory controls are all valuable, but their impact is significantly greater when they are coordinated within a broader strategy. The Italian experience shows that progress is possible, but also that maintaining momentum requires continuous effort and adaptation. Policies must evolve in response to changing conditions, new evidence, and emerging challenges. Another key insight is the importance of context. While antimicrobial resistance is a global issue, its manifestations and drivers can vary significantly from one country, or even one

region, to another. The Italian case highlights how local conditions, including socio-economic factors and healthcare organization, shape antibiotic use patterns. This means that solutions cannot simply be imported from other contexts without careful consideration. Effective interventions must be tailored to the specific realities in which they are implemented. At the same time, the global nature of AMR cannot be overlooked. Resistant microorganisms do not respect borders, and the movement of people, goods, and services contributes to the spread of resistance across countries.

For this reason, national efforts must be complemented by international cooperation. Italy's experience is part of a broader European and global challenge, and progress at the national level contributes to collective outcomes. Collaboration in areas such as surveillance, research, and policy development remains essential. Looking ahead, one of the main challenges will be sustaining attention and commitment to the issue of antimicrobial resistance. Unlike acute health crises, AMR develops gradually and often lacks immediate visibility, which can make it more difficult to maintain political and public focus. However, the long-term consequences are significant, affecting not only health outcomes but also the economic sustainability of healthcare systems. Ensuring that AMR remains a priority will require continued advocacy, evidence generation, and policy engagement. In practical terms, several directions for improvement can be identified. Strengthening coordination between national and regional authorities is crucial for ensuring more consistent implementation of policies. Expanding access to diagnostic tools can help reduce uncertainty in clinical decision-making and support more targeted use of antibiotics. Continued investment in education-both for healthcare professionals and the general public-can contribute to gradual but meaningful changes in behavior. At the same time, enhancing surveillance systems will provide the data needed to guide and evaluate these efforts.

Ultimately, the findings of this paper point to a broader conclusion: antimicrobial resistance is not simply a technical problem that can be solved through better drugs or stricter rules. It is a complex, evolving challenge that reflects how healthcare systems function and how societies use medical resources. Addressing it effectively requires a shift in perspective-from focusing narrowly on treatment to considering the wider system in which treatment occurs. In this sense, the Italian case offers valuable lessons. It shows both the progress that can be achieved through coordinated action and the difficulties that arise when implementation is uneven. It also highlights the importance of aligning policy objectives with practical realities, ensuring that strategies are not only well designed but also feasible and sustainable. In conclusion, combating antimicrobial resistance requires a long-term, multi-level effort. There is no single solution, but there are clear directions for action. By strengthening governance, supporting healthcare professionals, engaging the public, and improving data systems, it is possible to move toward more responsible antibiotic use. While the challenge is significant, the evidence suggests that meaningful progress can be achieved when efforts are sustained, coordinated, and grounded in a realistic understanding of how healthcare systems operate.

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Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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