

Antimicrobial Resistance in Childhood: A Narrative Update on Causes, Consequences and Prevention Strategies in the Context of Healthy Families

Erika Alejandra Cuadrado Ormaza, Nicole Carolina Maldonado Novillo, Carlos Eduardo Arteaga Bravo*

Pontifical Catholic University of Ecuador – Manabí Campus, Portoviejo-Ecuador.

*Corresponding Author: Carlos Eduardo Arteaga Bravo, Pontifical Catholic University of Ecuador – Manabí Campus, Portoviejo-Ecuador.

Received Date: January 30, 2026 | Accepted Date: February 20, 2026 | Published Date: March 17, 2026

Citation: Cuadrado Ormaza EA, Maldonado Novillo NC, Carlos E. Arteaga Bravo, (2026), Antimicrobial Resistance in Childhood: A Narrative Update on Causes, Consequences and Prevention Strategies in the Context of Healthy Families, *International Journal of Clinical Case Reports and Reviews*, 34(5); DOI:10.31579/2690-4861/1045.

Copyright: © 2026, Carlos Eduardo Arteaga Bravo. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract:

Antimicrobial resistance is an increasing global public health threat, particularly in the pediatric population, where children are especially vulnerable due to the frequent and often inappropriate use of antibiotics; the aim of this study was to analyze preventive strategies, therapeutic limitations, and risk factors associated with the emergence and persistence of resistant bacteria in children under five years of age; a qualitative methodology was used based on a narrative review of scientific literature and previous essays, drawing on secondary sources from databases such as PubMed, Scielo, Lilacs, and technical documents from the World Health Organization; the main findings identified empirical antibiotic use without microbiological diagnosis, self-medication by caregivers, lack of regulation in antimicrobial dispensing, and poor clinical differentiation between viral and bacterial infections, which contribute to unnecessary treatments and selective pressure on microbiota; it is concluded that tackling antimicrobial resistance in early childhood requires a multidimensional approach involving health education for both caregivers and professionals, implementation of hygiene measures, strengthening of immunization programs, and strict regulation of drug access to preserve the effectiveness of existing antibiotics.

Key words: drug resistance; microbial; pediatrics; self-medication; rational use of medicines; hygiene

1. Introduction

Antibiotic resistance is a warning sign that poses a future health risk, as the WHO has warned that by 2050 it could cause 10 million deaths and affect the population. The economy is suffering due to drug-resistant diseases (WHO, 2024). In recent decades, the use of antibiotics has revolutionized the treatment of infectious diseases, particularly in the pediatric population. Conditions such as otitis media, bacterial tonsillitis, and community-acquired pneumonia, which were once potentially fatal, are now relatively easy to treat. However, this therapeutic tool has begun to lose effectiveness due to its indiscriminate and irrational use.

The World Health Organization (WHO) has declared antimicrobial resistance one of the top ten threats to health, which necessitates a critical reassessment of antibiotic use in children, evaluating both its effectiveness and limitations. The rise in antimicrobial-resistant bacteria poses a growing threat to global public health, and this problem particularly impacts children due to the indiscriminate use of antibiotics, often without clinical justification. It has become common for these drugs

to be administered for viral infections, where they are ineffective, thus facilitating the evolution of resistant strains (WHO, 2020).

Outpatient pediatric care has been particularly vulnerable to this practice, since, as Hersh et al. (2021) state, the inappropriate use of antibiotics in children continues to be a serious concern. Given this scenario, it is necessary to implement preventive strategies from an early age to safeguard both children's health and the future effectiveness of these treatments. In light of this situation, the present study aimed to analyze the causes, consequences, and preventive strategies for antimicrobial resistance in children under five years of age, considering current scientific evidence and providing an update of existing knowledge.

2. Materials and Methods

This article was developed through a comprehensive literature review using a qualitative approach and hermeneutic narrative methodology to conduct a rigorous analysis of the scientific literature. Works of significant academic and scientific value were selected, prioritizing those

articles addressing specific topics related to antibiotic resistance in children under 5 years of age: causes, resistant antibiotics, and prevention strategies. Initially, the importance of standardizing search terms was determined through the creation of descriptors based on the DeCS and MeSH health sciences descriptors. The terms “Antimicrobial resistance,” “Risk factors,” “Bacteria,” “Children,” and “Primary prevention” were prioritized.

Two search equations were generated, and each of these descriptors was combined with truncation and Boolean operators in the thesaurus languages. The resulting equations were: “Risk Factors AND “Drug Resistance, Bacterial AND Child”, “Primary Prevention and Drug The search terms used were: Resistance, Bacterial AND “Child”, (Antimicrobial Resistance) AND (children), and (Antimicrobial Resistance) AND (Prevention) AND (children). Once the search equations were designed, searches were conducted in databases such as LILACS, SciELO, and PubMed, including the WHO database, using a time filter that restricted the search to articles published in the last 5 years. A preliminary analysis of titles and abstracts was carried out, giving preference to those that met strict methodological criteria and addressed the key theoretical aspects of the study. From this selection, a detailed evaluation of the articles was performed, identifying recurring themes.

3. Results

This paper compiles and synthesizes the main evidence explaining the growing problem of antimicrobial resistance in childhood, highlighting its causes, consequences, and prevention strategies. Based on a review of various studies, it is evident that the inappropriate use of antibiotics, whether through self-medication, empirical prescription, or misdiagnosis that confuses viral infections with bacterial ones, is the primary trigger of this phenomenon.

Causes and Direct Consequences of Antimicrobial Resistance in Children: This pattern of indiscriminate use, combined with limited innovation in the development of new drugs, has allowed previously susceptible bacteria to develop defense mechanisms that complicate current treatments, especially in children under five. Furthermore, factors such as a lack of health education in the population, limited access to diagnostic tests, and the repeated use of antibiotics without antibiograms exacerbate this crisis (Saldaña et al., 2024). In this regard, research highlights the importance of implementing educational programs for families and professionals, strengthening microbiological surveillance, promoting vaccination, and establishing strict regulatory policies on the sale of antibiotics. Addressing antimicrobial resistance in pediatrics not only represents a clinical challenge but also a collective commitment to preserving therapeutic efficacy for future generations and ensuring the sustainability of global public health (León and Parrales, 2025). Within this framework, the present analysis incorporates a review of theoretical and empirical approaches that highlight the causes, clinical implications, and social challenges surrounding antimicrobial resistance in childhood. It also delves into the benefits of rational antibiotic use, the restrictions imposed by increasing bacterial resistance, and the ethical challenges associated with the responsible management of treatments in pediatric patients. This comprehensive perspective facilitates an understanding of how the indiscriminate use of antibiotics affects not only therapeutic efficacy but also the quality of medical care and the relationship between healthcare professionals, patients, and their families. Furthermore, it allows for reflection on the need for an interdisciplinary approach that ensures well-founded clinical decisions and promotes preventive practices in the community (Andrade et al., 2024).

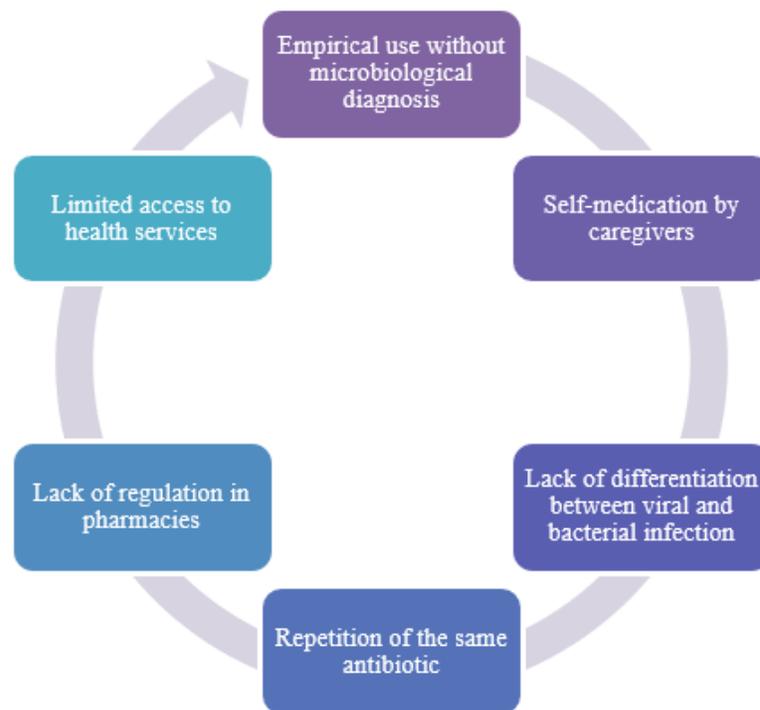


Figure 1: Causes that contribute to antimicrobial resistance in pediatrics.

Note: Prepared by the authors; based on reviewed antimicrobial resistance trials.

The loss of antibiotic effectiveness and limitations in treatment regimens has put the world on alert, but even with this alert, there is a lack of awareness, as this could compromise future complications and treatments for diseases. Common bacteria such as *Streptococcus pneumoniae*, *Escherichia E. coli* and *Helicobacter pylori* have shown increasing

resistance to antibiotics that have been used to treat them, including common ones such as penicillins, macrolides, and trimethoprim-sulfamethoxazole (Mulchandani et al., 2025). This is due to the irrational use of antibiotics and even self-medication, which is further aggravated by the empirical use of antibiotics without an antibiogram, preventing the

selection of the most effective antibiotic and ensuring proper eradication of the bacteria (Okumu et al., 2025). Inaccurate or incorrect diagnosis in differentiating between viral and bacterial diseases is another factor that has led to the overuse of antibiotics in viral infections that do not benefit from antibiotic treatment.

Consequently, drug classes such as penicillins have reduced their therapeutic effect against common pathogens, complicating the treatment of these various infections (Hsia et al., 2019). In addition to this, the aforementioned self-medication has a long-term impact, as people, especially parents, may administer medications without understanding the illness, simply because they experienced the same symptoms, all without medical guidance or the appropriate dosage. This combination of factors, coupled with the limited development of new antibiotics, has accelerated and will continue to accelerate antibiotic resistance, since empirical treatment with traditional drugs is the most common approach to managing these infections. Over time, this resistance to antibiotic medications has become a global health alert, a silent but latent threat to humanity. Therapeutic limitations for various common diseases have led to prolonged treatments, complications, and hospitalizations (Telles and Bombassaro, 2025). One of the main current obstacles is the resistance of common bacteria to antibiotics, such as *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Escherichia E. coli*, common pathogens in children, have developed resistance mechanisms to commonly used drugs, such as beta-lactams and macrolides, significantly reducing treatment options, increasing the duration of illness, and complicating the resolution of infectious diseases (Ventola, 2015). Furthermore, drugs that were previously effective in treating common infections, such as amoxicillin or trimethoprim -sulfamethoxazole, no longer eliminate the infection in many cases. Recent studies show that 25% of *E. coli* strains

isolated from children with urinary tract infections are resistant to ampicillin, which implies a greater risk of recurrence, complications, and the need for hospitalization (Tamma et al., 2021).

An inaccurate clinical diagnosis can also lead to the inappropriate use of antibiotics, with many viral infections, such as adenovirus or rhinovirus pharyngitis, being incorrectly treated with antibiotics due to a lack of rapid tests or pressure from caregivers. In the current context, this type of practice is not only ineffective but also promotes the development of resistance in the patient's commensal microbiota. A critical issue is the repeated use of the same antibiotic to treat clinical conditions with different characteristics or etiologies. What exacerbates the problem is its common use in pediatric outpatient care, without considering the potential for changes in bacterial sensitivity or the pharmacodynamics of the medications. This leads to therapeutic failures, prolonged symptoms, and an increased risk of complications (Caicedo et al., 2024). In areas with limited access to healthcare services, the problem of resistance is even more acute because the lack of microbiological diagnosis, self-medication, and weak pharmaceutical regulation contribute to the selection of multidrug-resistant bacteria. This poses a significant challenge for public health systems, as these populations lack effective alternatives. Finally, the use of antibiotics prescribed by unqualified personnel, such as some pharmacists or pharmacy assistants, is a common practice in various countries, including regions of Latin America; this phenomenon, driven by the lack of access to medical care and the demand for quick solutions, promotes inappropriate treatments that reinforce bacterial resistance, which, in many of these cases, do not follow therapeutic guidelines or consider factors such as weight, age or allergies of the patient (Caicedo et al., 2024).

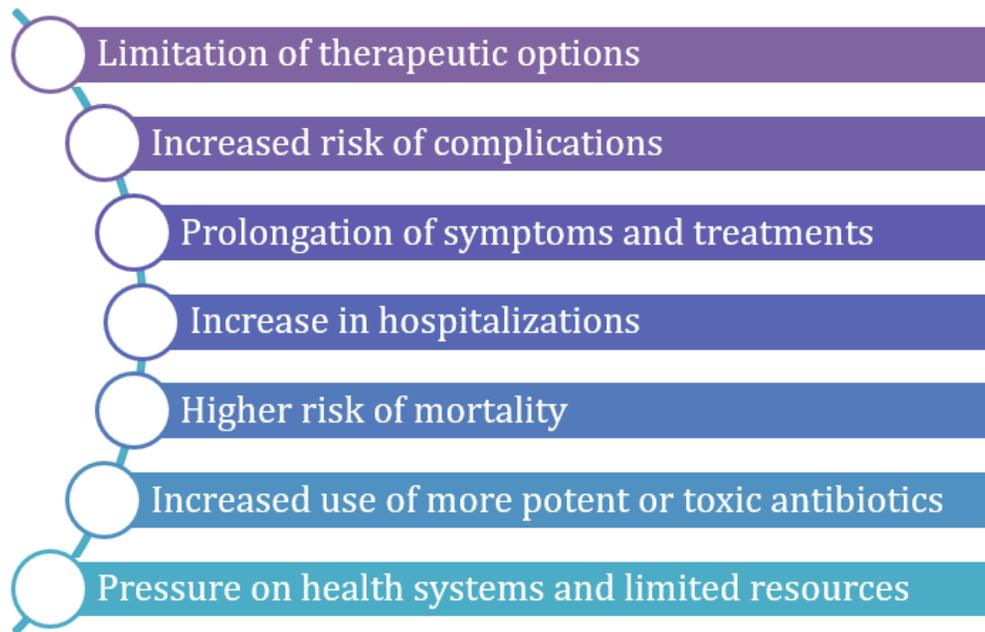


Figure 2: Consequences of antibiotic resistance in the pediatric population

Strategies for Preventing Antimicrobial Resistance in Childhood In the general context of this situation, one of the most important strategies for preventing antibiotic resistance in children is to teach parents when antibiotics are necessary and when they are not. In many cases, infections are viral and tend to resolve on their own, but due to a lack of information, unnecessary treatments are initiated. Recent studies have shown that improving caregivers' knowledge can reduce self-medication and inappropriate use (Messina et al., 2021). Another essential element is maintaining a complete vaccination schedule, since vaccines prevent common diseases that, if complicated, could require antibiotics. Various experimental studies and international organizations recognize that

vaccination significantly decreases the burden of infectious disease and reduces the need for antimicrobial medications (Coque et al., 2024). In addition to this, promoting handwashing as a daily routine at home and at school is crucial. It is a simple yet powerful practice that has been key in preventing respiratory and gastrointestinal infections in pediatric settings (Oliveira et al., 2025). Furthermore, avoiding complications through timely medical checkups can prevent unnecessary hospitalizations, where the risk of exposure to resistant bacteria is higher. Prolonged hospital stays have been shown to contribute to the spread of multidrug-resistant pathogens, particularly affecting children (Rosales et al., 2025).

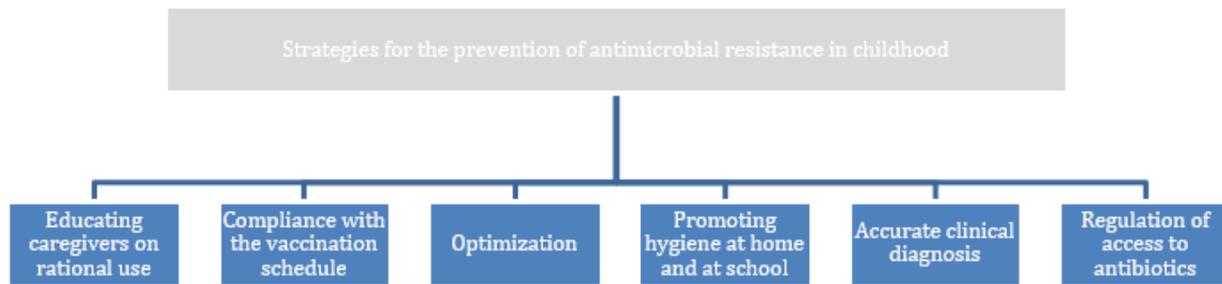


Figure 3: Preventive strategies on antimicrobial resistance in pediatrics

Another key point is that healthcare professionals must be able to differentiate between viral and bacterial infections before initiating treatment. This clinical process is fundamental to avoiding antibiotics in cases where they will not be effective. Furthermore, the sum of these measures has a direct impact on preserving the efficacy of current treatments, limiting the pressure that favors the evolution of bacterial

resistance (Montesdeoca et al., 2024; Rivera, 2025). The following summarizes the strategies, benefits, and key factors related to antimicrobial resistance in the pediatric population, developed by the authors based on a comparative analysis of multiple trials and relevant scientific literature.

Dimension	Preventive strategies	Applications and benefits of therapeutic analysis	Resistance factors in children under 5 years old
Health education on the rational use of antibiotics	Training caregivers on when to use antibiotics, avoiding unnecessary treatments in viral infections (Messina et al., 2021; Gerber et al., 2021).	<ul style="list-style-type: none"> • Reduction of self-medication • Improving pediatric prescribing • Reduced pressure on professionals 	Empirical use at home without medical indication, common in contexts with low access to services
Coverage of childhood vaccination programs	Strengthening the immunization schedule from childhood against preventable diseases (World Health Organization, 2020).	Primary prevention of infections that would avoid antibiotic treatments, contributing to less antimicrobial pressure (WHO, 2020).	Weak implementation exacerbates the unnecessary use of antibiotics due to a lack of immune protection (Hsia et al., 2019).
Personal hygiene and infection prevention at home and school	Handwashing, basic hygiene education and healthy habits in homes and educational settings	Significant reduction in respiratory and gastrointestinal illnesses that commonly receive antibiotics	Poor hygiene conditions promote infectious recurrence and exposure to antibiotics
Differential clinical diagnosis and rationality in prescribing	Promoting accurate clinical diagnosis before prescribing antibiotics, especially differentiating viral from bacterial conditions (Gerber et al., 2021).	It reduces the inappropriate use of antimicrobials and improves clinical outcomes in primary care (Tamma et al., 2021).	Lack of rapid diagnostic tests or access to laboratories encourages empirical prescribing without evidence (Okumu et al., 2025).
Regulation of access to antibiotics and control of their sale	Implementation of regulations on non-prescription sales, education of pharmacy staff and health surveillance	Reduction of self-medication and rational use of antimicrobials in urban and rural areas	Unregulated informal sales remain a key cause of the emergence of resistant strains in children
Risk group: children under 5 years old with recurrent infections	Rigorous control in the face of frequent infections and avoid repeated empirical treatments without antibiogram (Mulchandani et al., 2025).	Lower risk of treatment failure and hospitalization by personalizing antimicrobial treatments	Children <5 years are at greater risk of selection of multidrug-resistant bacteria due to repeated and inadequate treatments (Okumu et al., 2025).

Table 1: Comparative summary of key approaches to antimicrobial resistance in the pediatric population.

4. Conclusion

In summary, one of the main challenges we currently face is the growing antibiotic resistance in children under 5 years of age, caused by the

indiscriminate use of medications, inaccurate diagnoses, and frequent self-medication within the family. This situation not only limits the available therapeutic options but also increases the risk of complications and of common illnesses becoming difficult-to-control threats in

childhood. Furthermore, the effectiveness of antibiotic treatments in pediatric infections has been compromised by multiple factors, ranging from bacterial resistance to a lack of accurate diagnoses and the empirical use of medications. These implications not only affect the clinical course of patients but also pose a challenge for healthcare systems, which face increased hospitalizations, treatment failures, and a future with increasingly limited therapeutic alternatives. Finally, given this scenario, prevention strategies emerge as a priority to guarantee long-term children's health. Parent education, vaccination promotion, the promotion of proper hygiene practices, and responsible prescribing are fundamental pillars in combating antimicrobial resistance. Acting through prevention and the rational use of antibiotics not only protects the effectiveness of these treatments but also ensures that future generations can benefit from medications that are still effective against bacterial infections.

Conflict of Interest

The authors state that there are no conflicts of interest in this study and confirm that they have complied with the ethical procedures established by this journal, ensuring that the work has not been published in whole or in part in any other journal.

References:

- Deaths due to AMR estimated to reach 10 million people by 2050, Ministry of Health and WHO launch national strategy. (sf). World Health Organization. Retrieved June 30, 2025.
- Hsia, Y., Lee, B. R., Versporten, A., Yang, Y., Bielicki, J., et al., (2019). Use of the WHO Access, Watch, and Reserve classification to define patterns of hospital antibiotic use (AWaRe): An analysis of paediatric survey data from 56 countries. *The Lancet Global Health*, 7(7), e861-e871.
- Luepke, K. H., Suda, K. J., Boucher, H., Russo, R. L., Bonney, M. W., et al., (2017). Past, present, and future of antibacterial economics: Increasing bacterial resistance, limited antibiotic pipeline, and societal implications. *Pharmacotherapy*, 37(1), 71-84.
- Mendelson, M., & Matsoso, M. P. (2015). The World Health Organization Global Action Plan for antimicrobial resistance. *South African Medical Journal*, 105(5), 325.
- Mulchandani, R., Tiseo, K., Nandi, A., Klein, E., Gandra, S., Laxminarayan, R., & Van Boeckel, T. (2025). Global trends in inappropriate use of antibiotics, 2000–2021: Scoping review and prevalence estimates. *BMJ Public Health*, 3(1), e002411.
- Okumu, N. O., Muloi, D. M., Moodley, A., Watson, J., Kiarie, A., et al., (2025). Antimicrobial resistance in community-acquired enteric pathogens among children aged ≤ 10 years in low- and middle-income countries: A systematic review and meta-analysis. *Frontiers in Microbiology*, 16, 1539160.
- Ventola, C. L. (2015). The antibiotic resistance crisis: Part 1: Causes and threats. *Pharmacy and Therapeutics*, 40(4), 277-283.
- Gerber, J. S., Prasad, P. A., Fiks, A. G., Localio, A. R., Grundmeier, R. W., et al., (2021). Effects of antimicrobial stewardship programs on antibiotic prescribing in pediatrics. *Clinical Infectious Diseases*, 72(9), e994-e1000.
- Grigoryan, L., Monnet, D. L., Haaijer-Ruskamp, F. M., Bonten, M. J., Lundborg, C. S., & Verheij, T. J. (2006). Self-medication with antibiotics in Europe: A case for action. *Current Drug Safety*, 1(1), 63–68.
- Hersh, A. L., Jackson, M. A., & Hicks, L. A. (2011). Principles of judicious antibiotic prescribing for upper respiratory tract infections in pediatrics. *Pediatrics*, 132(6), 1146–1154.
- Laxminarayan, R., Duse, A., Wattal, C., Zaidi, A. K., Wertheim, H. F., Sumpradit, N., Cars, O. (2013). Antibiotic resistance—the need for global solutions. *The Lancet Infectious Diseases*, 13(12), 1057–1098.
- McCaig, L. F., Besser, R. E., & Hughes, J. M. (2002). Trends in antimicrobial prescribing rates for children and adolescents. *JAMA*, 287(23), 3096–3102.
- World Health Organization. (2020). Antimicrobial resistance.
- Tamma, PD, Aitken, SL, Bonomo, RA, Mathers, AJ, van Duin, D., & Clancy, CJ (2021). Infectious Diseases Society of America Guidance on the treatment of AmpC β-Lactamase-producing Enterobacterales. *Clinical Infectious Diseases*, 72 (7), e169–e183.
- Ventola, CL (2015). The antibiotic resistance crisis: Part 1: Causes and threats. *Pharmacy and Therapeutics*, 40 (4), 277–283.
- Gerber, J. S., Prasad, P. A., Fiks, A. G., Localio, A. R., Grundmeier, R. W., et al., (2021). Effects of antimicrobial stewardship programs on antibiotic prescribing in pediatrics. *Clinical Infectious Diseases*, 72(9), e994–e1000.
- Hersh, A. L., Jackson, M. A., & Hicks, L. A. (2021). Antibiotic stewardship in pediatrics. *Pediatrics*, 147(1), e2020040295.
- Hulscher, M. E., Grol, R. P., & van der Meer, J. W. (2010). Antibiotic prescribing in hospitals: A social and behavioural scientific approach. *The Lancet Infectious Diseases*, 10(3), 167–175.
- McCullough, A. R., et al. (2016). Antibiotics for acute respiratory infections in general practice: Comparison of prescribing rates with guideline recommendations. *BMJ Open*, 6(6), e011914.
- Messina, A., Boari, GE, Berchiolla, P., & Gualano, MR (2021). Parents' knowledge, attitudes and practices on antibiotic use for their children: A cross-sectional study. *Antibiotics*, 10 (12), 1521.
- World Health Organization. (2020). Antimicrobial resistance.
- Ahmed, D. S., AboElela, A. M., Ismail, S. S., Hammour, Z. E., Fawaz, R. A., & Abdelmoniem, M. E. (2024). Pattern of antibiotic use among children's caregivers: A cross-sectional study. *Journal of the Egyptian Public Health Association*, 99(1), 33.
- Antimicrobial resistance. (s. f.). Recuperado 19 de agosto de 2025.
- Antimicrobial Resistance Collaborators. (2022). Global burden of bacterial antimicrobial resistance in 2019: A systematic analysis. *Lancet* (London, England), 399(10325), 629-655.
- Bert, F., Previti, C., Calabrese, F., Scafoli, G., & Siliquini, R. (2022). Antibiotics Self Medication among Children: A Systematic Review. *Antibiotics*, 11(11), 1583.
- GBD 2021 Antimicrobial Resistance Collaborators. (2024). Global burden of bacterial antimicrobial resistance 1990-2021: A systematic analysis with forecasts to 2050. *Lancet* (London, England), 404(10459), 1199-1226.
- Gerber, J. S., Jackson, M. A., Tamma, P. D., Zaoutis, T. E., & AAP Committee on Infectious Diseases and Pediatric Infectious Diseases Society. (2021). Policy Statement: Antibiotic Stewardship in Pediatrics. *Journal of the Pediatric Infectious Diseases Society*, 10(5), 641-649.
- Giroto, J. E., Nichols, K., Ogrin, S. L., Parsons, S., & Wilson, W. S. (2025). Pediatric Antibiotic Stewardship Programs: The Path Forward. *The Journal of Pediatric Pharmacology and Therapeutics*: JPPT, 30(3), 387-397.
- Graichen, J., Stingl, C., Pakarinen, A., Rosio, R., Terho, K., et al., (2024). Improving hand hygiene of young children with a digital intervention: A cluster-randomised controlled field trial. *Scientific Reports*, 14(1), 6157.
- Guidelines for Empiric Therapy: Pediatrics Infectious Diseases Management Program at UCSF. (s. f.). Recuperado 19 de agosto de 2025.
- McNicholl, J., Younie, S., Crosby, S., & Laird, K. (2024). A clinical trial evaluation of handwashing products and

- educational resources to improve hand hygiene in paediatric patients and school children. *Frontiers in Public Health*, 12.
32. Safarians, G., Guo, R., Weiss, I. K., & Lin, J. A. (2024). Improving Antibiotic Stewardship in a Pediatric Long-term Care Facility. *Pediatrics*, 154(2), e2022058444.
33. Zembles, T. N., Nakra, N., & Parker, S. K. (2022). Extending the Reach of Antimicrobial Stewardship to Pediatric Patients. *Infectious Diseases and Therapy*, 11(1), 101-110.



This work is licensed under Creative Commons Attribution 4.0 License

To Submit Your Article Click Here:

[Submit Manuscript](#)

DOI:10.31579/2690-4861/1045

Ready to submit your research? Choose Auctores and benefit from:

- fast, convenient online submission
- rigorous peer review by experienced research in your field
- rapid publication on acceptance
- authors retain copyrights
- unique DOI for all articles
- immediate, unrestricted online access

At Auctores, research is always in progress.

Learn more <https://auctoresonline.org/journals/international-journal-of-clinical-case-reports-and-reviews>