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The relationship between paediatric antibiotic misuse and recurrent acute respiratory tract infection

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ABSTRACT

Antimicrobial resistance (AMR) represents one of the most pressing challenges in contemporary public health. Neonates and children are among the most vulnerable populations, not only by being at heightened risk of developing AMR, but also for being among the ones most frequently being prescribed antibiotics, particularly for respiratory tract infections (RTIs). This study aimed at examining the relationship between antibiotic overuse and resistance in paediatric patients with recurrent RTIs. A descriptive cross-sectional design was employed from 10 December 2023 to 10 March 2024, targeting children in the Babil Province (Iraq) that were selected through a non-probability convenience sampling method. Findings revealed a high prevalence of antibiotic prescription errors: 62% of the cases involved inadequate course duration, 69% of the patients received duplicate therapy, and 61% were prescribed antibiotics with insufficient dosing frequency. A significant association was observed between these prescription errors and a history of recurrent RTIs. Such errors appear to contribute to the development of AMR, not only in children but potentially extending to adult populations. Given the potentially fatal consequences of antibiotic misuse, both paediatricians and parents must exercise rigorous caution when administering antibiotics to children.

1. Introduction

Acute respiratory infections are conditions affecting the respiratory tract that impair normal breathing, posing significant health risks,

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Table 1. Baseline characteristics and antibiotic usage patterns in Iraqi paediatric patients with respiratory tract infections.

Characteristics		**Frequency**	**Percentage**
Age	1–24 months 2–6 years 6–11 years 11–16 years	42 33 15 10	42% 33% 15% 10%
Sex	male female	61 39	61% 39%
Weight	3–10 kg 11–18 kg ≤19 kg	46 44 10	46% 44% 10%
Number of antibiotics prescribed per prescription	1 2 or more	28 72	28% 72%
Type of antibiotic	amoxicillin gentamycin augmentin azithromycin cefixime ceftriaxone meropenem vancomycin	25 3 11 18 15 20 4 4	25% 3% 11% 18% 15% 20% 4% 4%
Length of stay	short (<5 days) long (≥5 days)	73 27	73% 27%
Duration of course	short (5–7 days) long (7–30 days)	74 26	74% 26%
Acute respiratory tract infections	upper lower	69 31	69% 31%
Recurrent infection	yes no	62 38	62% 38%
Diseases	pneumonia bronchitis total lower respiratory tract infections tonsillitis and pharyngitis common cold whooping cough laryngitis and croup total upper respiratory tract infections	5 24 2 22 20 12 8 7	5% 24% 2% 22% 20% 12% 8% 7%
Total		**100**	**100%**

especially among children under 5 years of age in developing countries. According to Global Burden of Disease Study data (2019), lower respiratory infections ranked as the second leading cause of death in this age group.

When administered appropriately, antibiotics can eradicate or suppress bacterial growth. However, they can also trigger adverse outcomes, most notably antimicrobial resistance (AMR); the latter arises when bacteria evade antibiotic-induced stress through mutation or modified gene expression[1]. Saeedi *et al.*[2] note that resistance is particularly concerning when bacteria harbour multiple resistance genes. The escalating global crisis of multidrug-resistant bacteria – defined as resistance to at least one agent in three or more antimicrobial classes – has intensified morbidity and mortality, prolonged hospital stays, and raised healthcare costs[3]. Multid-

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rug-resistant organisms (or "superbugs") jeopardize socioeconomic and environmental sustainability and threaten global health initiatives. Projections suggest multidrug resistance-associated mortality could surge from 700,000 to 10 million annually by 2050, with cumulative global costs exceeding $100 trillion, thereby surpassing cancer-related deaths[4].

This study investigates the association between antibiotic overuse and resistance in Iraqi children with recurrent respiratory tract infections (RTIs).

2. Methodology

2.1. Study design

A descriptive cross-sectional design was employed in order to assess antibiotic misuse among paediatric acute RTI patients and its correlation with recurrent RTIs. The study was conducted from 10 December 2023 to 10 March 2024 in Babil Province (Iraq). A purposive (non-probability) sample of 100 children of both sexes was recruited from the Al-Sadiq Teaching Hospital.

2.2 Study instruments

A structured questionnaire was developed following a comprehensive literature review. It comprised sections on baseline characteristics, types of antibiotics prescribed, prescription errors, and respiratory disease classification.

2.3. Data collection

Data were collected *via* a well-prepared cross-sectional questionnaire.

2.4. Statistical analysis

Data were coded and analysed using SPSS (version 26.0 for Windows).

2.5. Ethical considerations

The study received ethical approval from the institutional review board of Al-Mustaqbal University's College of Nursing. All procedures complied with the Declaration of Helsinki. Approval documentation (ref.: 1751) was issued on 15 November 2023 after formal review of the research protocol, participant data, and informed consent forms.

3. Results and Discussion

Baseline characteristics revealed that 42% of the participants were aged 1–24 months, 46% weighed between 3–10 kg, and 61% were male (Table 1). Notably, 72.0% of the participants received two or more antibiotic prescriptions. Amoxicillin (25%), ceftriaxone (20%), azithromycin (18%), and cefixime (15%) were the most frequently prescribed antibiotics. A total of 73% of patients were hospitalized for fewer than five days, and 74% underwent a documented course of antibiotic therapy (Table 1). Upper RTIs accounted for 69% of cases, with 62% of the total cases experiencing recurrent infections. Diagnoses included bronchitis, tonsillitis, pharyngitis, and the common cold (Table 1).

The findings underscore how widespread antibiotic use – spanning human medicine, agriculture, and food production – has accelerated AMR. The peak incidence of acute RTIs occurred in patients aged 1–24 months, diverging from results reported by Walke *et al.*[5]. Overprescribing for viral acute RTIs has likely contributed to the dissemination of resistant bacterial strains.

A national survey in Pakistan has found that irrational prescribing practices are common, driven by resistance concerns and lack of diagnostic clarity[6]. Given that bronchitis and most acute RTIs are viral in origin, antibiotics are often prescribed due to inadequate diagnostic training, parental pressure, desire for rapid symptom resolution, and concern over secondary infections. In this cohort, 69% of children had RTIs, and 62% met criteria for recurrent RTIs according to Schaad[7]: ≥8 episodes / year in children <3 years, ≥6 episodes / year in those aged ≥3 years, or ≥3 episodes in one fall–winter season for 2 years in a row.

Antibiotic overuse perpetuates negative outcomes

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and therapeutic failures due to AMR emergence. A strategic management framework for recurrent RTIs is therefore essential, not only in order to alleviate symptoms, but to disrupt the pathogenic cycle of mucosal colonization.

Prescription errors were primarily linked to incorrect dosage, insufficient frequency, inappropriate duration, and duplication therapy. These errors appear to stem from nonadherence to paediatric dosing guidelines and national / international formularies. Incorrect frequency and duration have been strongly associated with recurrent RTI history. Antibiotic overuse for viral upper RTIs remains entrenched in outpatient care[8], and broad-spectrum prescriptions continue to rise, even when clinically unwarranted[9]. These practices contribute to avoidable drug-related adverse events, AMR development, and economic burden.

4. Conclusion

Prescription errors are strongly correlated with recurrent RTIs and may drive the emergence of antimicrobial resistance in children and, by extension, in adults. Given the potentially fatal consequences of antibiotic misuse, paediatricians and caregivers must exercise utmost caution when prescribing and administering antibiotics.

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Conflicts of interest

None exist.

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