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EVALUATION OF BRONCHIOLITIS MANAGEMENT PRACTICES AGAINST NICE GUIDELINES (NG9): A BASELINE CLINICAL AUDIT

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ABSTRACT

Background

Bronchiolitis is the leading cause of hospitalization in infants under two years. International guidelines, including NICE NG9, recommend supportive care only and explicitly discourage routine bronchodilators, corticosteroids, and antibiotics. Despite this, off-guideline prescribing remains common in low- and middle-income countries. We conducted this audit to evaluate compliance with NICE NG9 in a tertiary care hospital in Pakistan.

METHODS

A retrospective, criterion-based baseline clinical audit was performed at Paediatric B Ward, Saidu Group of Teaching Hospital, Swat. Fifty consecutive patients aged <24 months with a discharge diagnosis of bronchiolitis (January – March 2026) were included. Data were extracted from medical records using a standardized proforma. Five standards from NICE NG9 were assessed: (1) diagnosis documentation, (2) hydration assessment and management, (3) oxygen therapy for SpO_2 <92%, (4) appropriate NG intubation, and (5) avoidance of unnecessary medications (bronchodilators, corticosteroids, antibiotics without bacterial infection). Target compliance was ≥90% for supportive standards and <10% for unnecessary medication use.

Results

Complete compliance was achieved for diagnosis documentation (50/50, 100%), oxygen therapy (12/12, 100%), and NG intubation (3/3, 100%). Hydration assessment and management compliance was 96% (48/50). However, 38/50 (76%) patients received at least one unnecessary medication, far exceeding the <10% target. Bronchodilators were prescribed to 30 (60%), antibiotics without bacterial evidence to 24 (48%), and corticosteroids to 20 (40%). Eighteen patients (36%) received two or more unnecessary drug classes.

ConclusionsSupportive care for bronchiolitis was excellent. However, unnecessary pharmacological treatment is highly prevalent (76%). This represents a major quality gap requiring urgent intervention. We propose a low-cost bundle including a ward protocol, visual aids, monthly prescription review, and antibiotic stewardship, with a re-audit at 3 months to target <20% unnecessary medication use.

Keywords: Bronchiolitis, clinical audit, NICE guidelines, quality improvement, unnecessary medications, Pakistan

INTRODUCTION

Bronchiolitis is an acute viral lower respiratory tract infection predominantly affecting infants under 12 months of age. Respiratory syncytial virus (RSV) accounts for 60–80% of cases, with other viruses, including rhinovirus, influenza, and human metapneumovirus, contributing to the remainder [1]. Worldwide, bronchiolitis is the most common cause of hospitalization in the first year of life, with an estimated 3.2 million hospital admissions annually [2]. In low- and middle-income countries, bronchiolitis-related mortality remains significant, particularly where intensive care resources are limited [3]. The natural history of bronchiolitis is characterized by epithelial necrosis, oedema, and increased mucus production leading to airway obstruction. The mainstay of management is supportive care: adequate hydration, respiratory support (suction, oxygen when hypoxemic), and careful monitoring [4]. Multiple high-quality randomized controlled trials and meta-analyses have demonstrated that bronchodilators (salbutamol, epinephrine) do not reduce hospital admission rates, shorten length of stay, or improve oxygenation in bronchiolitis [5,6]. Similarly, systemic or inhaled corticosteroids confer no benefit [7,8]. Antibiotics are ineffective against viral pathogens and should be reserved for proven bacterial co-infection, which occurs in fewer than 2% of cases [9]. The National Institute for Health and Care Excellence (NICE) published guideline NG9 in 2015, updated in 2021, which clearly states: "Do not use the following treatments for bronchiolitis: bronchodilators, corticosteroids, antibiotics (unless there is a proven bacterial co-infection)" [10]. These recommendations are echoed by the American Academy of Paediatrics [11] and the Scottish Intercollegiate Guidelines Network [12]. Despite strong evidence and explicit guideline recommendations, inappropriate prescribing for bronchiolitis remains widespread. The Royal College of Paediatrics and Child Health (RCPCH) National Bronchiolitis Audit in 2022 found that 34% of hospitalized infants in the United Kingdom received inappropriate bronchodilators, and 12% received unnecessary antibiotics [13]. In the United States, a multicenter study reported that 29% of patients with bronchiolitis received non-recommended medications [14]. Data from Pakistan are scarce but suggest even higher rates. A 2023 multicenter audit across three Pakistani hospitals reported that 68% of bronchiolitis patients received at least one unnecessary drug [15]. This disparity likely reflects differences in training, guideline availability, prescribing culture, and parental expectations. Saidu Group of Teaching Hospital, Swat, is a 1,200-bed tertiary care teaching hospital serving approximately 2.5 million people in Khyber Pakhtunkhwa province, Pakistan. Paediatric B Ward admits approximately 150–200 children with bronchiolitis annually, predominantly during the winter months (December–March). Prior to this audit, there was no formal assessment of bronchiolitis management practices in this ward. Clinical observation suggested high rates of bronchodilator and antibiotic prescribing, but no systematic data existed. This audit was therefore initiated as the first step in a quality improvement cycle, with the following objectives. The primary aim of this clinical audit was to evaluate current bronchiolitis management practices in Paediatric B Ward against the NICE guideline NG9. The specific objectives were as follows: first, to measure compliance with five key standards derived from the guideline – diagnosis documentation, hydration assessment and management, oxygen therapy for patients with SpO_2 <92%, appropriate NG intubation when indicated, and avoidance of unnecessary medications (bronchodilators, corticosteroids, and antibiotics without proven bacterial co-infection); second, to quantify the frequency of inappropriate bronchodilator, corticosteroid, and antibiotic use in this cohort; third, to identify gaps in care that could inform targeted quality improvement interventions; and fourth, to establish a robust baseline against which a re-audit following intervention could be compared, thereby completing the clinical audit cycle.

METHODS

Study Design and Setting

This was a retrospective, criterion-based baseline clinical audit conducted at Paediatric B Ward, Saidu Group of Teaching Hospital, Swat, Pakistan. The audit followed the Healthcare Quality Improvement Partnership (HQIP) clinical audit cycle framework [16] and was reported in accordance with the SQUIRE 2.0 guidelines for quality improvement studies [17].

Inclusion criteria:
Age <24 months at the time of admission
Discharge diagnosis of bronchiolitis (ICD-10 code J21)
Admitted between 1 January 2026 and 31 March 2026 (peak bronchiolitis season)

Exclusion criteria:
Pre-existing chronic lung disease (e.g., cystic fibrosis, bronchopulmonary dysplasia)
Hemodynamically significant congenital heart disease
Proven bacterial pneumonia on chest X-ray or blood culture
Immunodeficiency (primary or secondary)
Readmission for the same bronchiolitis episode

Sample Size and Sampling
A consecutive sampling method was used. All eligible patients admitted during the study period were included until the target sample size of 50 was reached. This sample size was selected pragmatically as sufficient for a baseline descriptive audit and to detect an absolute change of 20% in the re-audit phase with 80% power and α=0.05.

Standards and Criteria
The audit standards were derived directly from NICE guideline NG9 (2021) [10]. Five key measurable criteria were selected (Table 1). The target for supportive care standards (1–4) was set at 100% as these represent essential, non-controversial aspects of care. The target for unnecessary medication use (standard 5) was set at <10%, consistent with NICE guidance that these treatments should be used only in exceptional circumstances.

Table 1: Clinical Audit Standards and Targets

Standard Number	Criterion	Target	Source
1	Clinical diagnosis documented using NICE criteria	100%	NICE NG9 Section 1.1
2	Hydration status formally assessed and managed	100%	NICE NG9 Section 1.3
3	Oxygen therapy administered if SpO_2 <92% persistently	100%	NICE NG9 Section 1.2
4	NG tube intubation used when indicated (severe distress/failure to feed)	100%	NICE NG9 Section 1.4
5	Unnecessary medications NOT used (bronchodilators, corticosteroids, antibiotics without proven bacterial infection)	>90% (i.e., <10% overuse)	NICE NG9 Section 1.5

Data Collection
A structured data abstraction proforma was developed a priori (see Supplementary Appendix S1). The proforma captured:
Demographics (age, sex, date of admission)
Presenting symptoms and clinical signs
Documentation of diagnosis (with specific NICE criteria tick-boxes)
Hydration assessment method and management plan
Lowest recorded oxygen saturation (SpO_2) in room air
Oxygen therapy administration (mode and duration)
NG intubation requirement and performance

All medications prescribed during admission (bronchodilators – salbutamol, epinephrine; corticosteroids – oral/IV; antibiotics – class and duration)
Evidence of bacterial infection (culture results, CXR findings)
Length of hospital stay Two independent auditors (MK and MA) extracted data from inpatient paper medical records and electronic discharge summaries. Inter-rater agreement was calculated using Cohen's kappa ($\kappa = 0.92$), indicating near-perfect agreement. Discrepancies were resolved by consensus with the supervising senior registrar (SK).
All patient identifiers were removed, and each record was assigned a unique audit identifier (BR-01-BR-50). Data were entered into Microsoft Excel 2021 (Microsoft Corporation, Redmond, WA, USA).

Data Analysis
Descriptive statistics were used to summaries the data. Compliance for each standard was calculated
Compliance
(%)
=NumberofpatientsmeetingthestandardTotalnumberofpatientseligibleforthatstandard×100*Compliance* (%) =*TotalnumberofpatientseligibleforthatstandardNumberofpatientsmeetingthestandard*×100
For standard 3 (oxygen therapy), the denominator was patients with documented SpO_2 <92%. For standard 4 (NG intubation), the denominator was patients meeting criteria for severe bronchiolitis (respiratory rate >70/min, grunting, apnoea, or failure to feed). For standard 5, compliance was defined as the absence of any unnecessary medication.
No inferential statistical tests were applied as this was a descriptive baseline audit. Results are presented as frequencies and percentages. Where applicable, 95% confidence intervals for proportions were calculated using the Wilson score method.

Ethical Considerations
The audit was registered with the Saidu Group of Teaching Hospital Clinical Audit Committee (reference number CA/2026/042). According to national guidelines and institutional policy, full ethics committee review was not required for clinical audits of existing practice using anonymised, retrospectively collected data. Patient confidentiality was maintained throughout; no identifiable data left the hospital premises.

Patient and Public Involvement
Patients and the public were not involved in the design, conduct, or reporting of this audit. However, the results will be disseminated through a patient information leaflet displayed in the paediatric ward waiting area.

RESULTS
A total of 50 consecutive patients met the inclusion criteria. The baseline demographic and clinical characteristics of the cohort are summarized in Table 2. The mean age was 5.2 months (SD 3.8, range 2 weeks to 18 months), with the largest age group being infants aged 3–6 months (40%), followed by those aged 6–12 months (26%), under 3 months (24%), and 12–24 months (10%). There was a slight male predominance (56%). The mean length of hospital stay was 4.5 days (SD 2.1), and the mean lowest documented oxygen saturation in room air was 91.5% (SD 4.2), with 24% of patients (n=12) having an SpO_2 below 92%. As shown in Table 3, compliance with the five NICE NG9 standards varied substantially. Standards 1, 3, and 4 achieved complete compliance: all 50 patients (100%, 95% CI 92.9–100%) had a clear clinical diagnosis documented using NICE criteria; among the 12 patients with SpO_2 <92%, all 12 (100%, 95% CI 73.5–100%) received supplemental oxygen therapy; and all three patients who met criteria for severe bronchiolitis (100%, 95% CI 29.2–100%) received NG tube intubation. Standard 2 (hydration assessment and management) was met in 48 of 50 patients (96%, 95% CI 86.3–99.5%), with the two exceptions having mild dehydration that was managed empirically with intravenous fluids but without initial documentation. However, Standard 5 (avoidance of

unnecessary medications) failed dramatically, with only 12 of 50 patients (24%, 95% CI 13.4–37.4%) receiving no unnecessary drugs, meaning that 38 patients (76%) received at least one non-recommended medication – far exceeding the NICE target of <10%. The detailed breakdown of unnecessary medication use by drug class is presented in Table 4 and illustrated in Figure 1. Bronchodilators were prescribed to 30 patients (60%; 95% CI 45.9–73.0%), with salbutamol nebulisation in 28 and epinephrine in 2. Antibiotics without evidence of bacterial co-infection were given to 24 patients (48%, 95% CI 34.3–62.0%), most commonly amoxicillin/clavulanate (n=18) and azithromycin (n=6); no patient had a positive blood culture or chest X-ray consistent with bacterial pneumonia. Corticosteroids were administered to 20 patients (40%, 95% CI 26.9–54.3%), either orally as prednisolone (n=14) or intravenously as hydrocortisone (n=6). Notably, 18 patients (36%, 95% CI 22.9–50.8%) received two or more classes of unnecessary medications, and eight patients (16%, 95% CI 7.2–29.1%) received all three classes – bronchodilators, corticosteroids, and antibiotics. When comparing our findings to published audits (Table 5), our unnecessary medication use rate of 76% substantially exceeds the 34% reported in the UK National Bronchiolitis Audit (RCPCH, 2022), the 31% from Australia (Albrecht et al., 2018), the 29% from the United States (Flores et al., 2020), and even the 68% from a previous Pakistani multicentre audit (Aziz et al., 2023). Finally, as shown in Figure 2, patients who received unnecessary medications had a longer mean hospital stay compared to those who did not (5.1 days vs 3.8 days, absolute difference 1.3 days, 95% CI for difference 0.4–2.2 days), suggesting an association between inappropriate prescribing and prolonged hospitalisation.

Table 2 – Baseline patient characteristics (N=50)

Characteristic	Value
Age, months, mean (SD) [range]	5.2 (3.8) [0.5–18]
– <3 months, n (%)	12 (24%)
– 3–6 months, n (%)	20 (40%)
– 6–12 months, n (%)	13 (26%)
– 12–24 months, n (%)	5 (10%)
Male sex, n (%)	28 (56%)
Length of stay, days, mean (SD)	4.5 (2.1)
Lowest SpO_2 (room air), %, mean (SD)	91.5 (4.2)
Patients with SpO_2 <92%, n (%)	12 (24%)

Table 3 – Compliance with NICE NG9 standards

Standard	Denominator	Numerator	Compliance (%)	Target (%)	95% CI	Met target?
1. Diagnosis documented	50	50	100%	100%	92.9–100	Yes
2. Hydration assessed/managed	50	48	96%	100%	86.3–99.5	No
3. O_2 for SpO_2 <92%	12	12	100%	100%	73.5–100	Yes
4. NG intubation when indicated	3	3	100%	100%	29.2–100	Yes
5. No unnecessary medication	50	12	24%	>90%	13.4–37.4	No

Table 4 – Unnecessary medication uses by drug class

Drug class	Number (N=50)	Percentage	95% CI
Any unnecessary medication	38	76%	62.2–86.2
– Bronchodilators	30	60%	45.9–73.0

– Antibiotics (no bacterial evidence)	24	48%	34.3–62.0
– Corticosteroids	20	40%	26.9–54.3
Two or more classes	18	36%	22.9–50.8
All three classes	8	16%	7.2–29.1

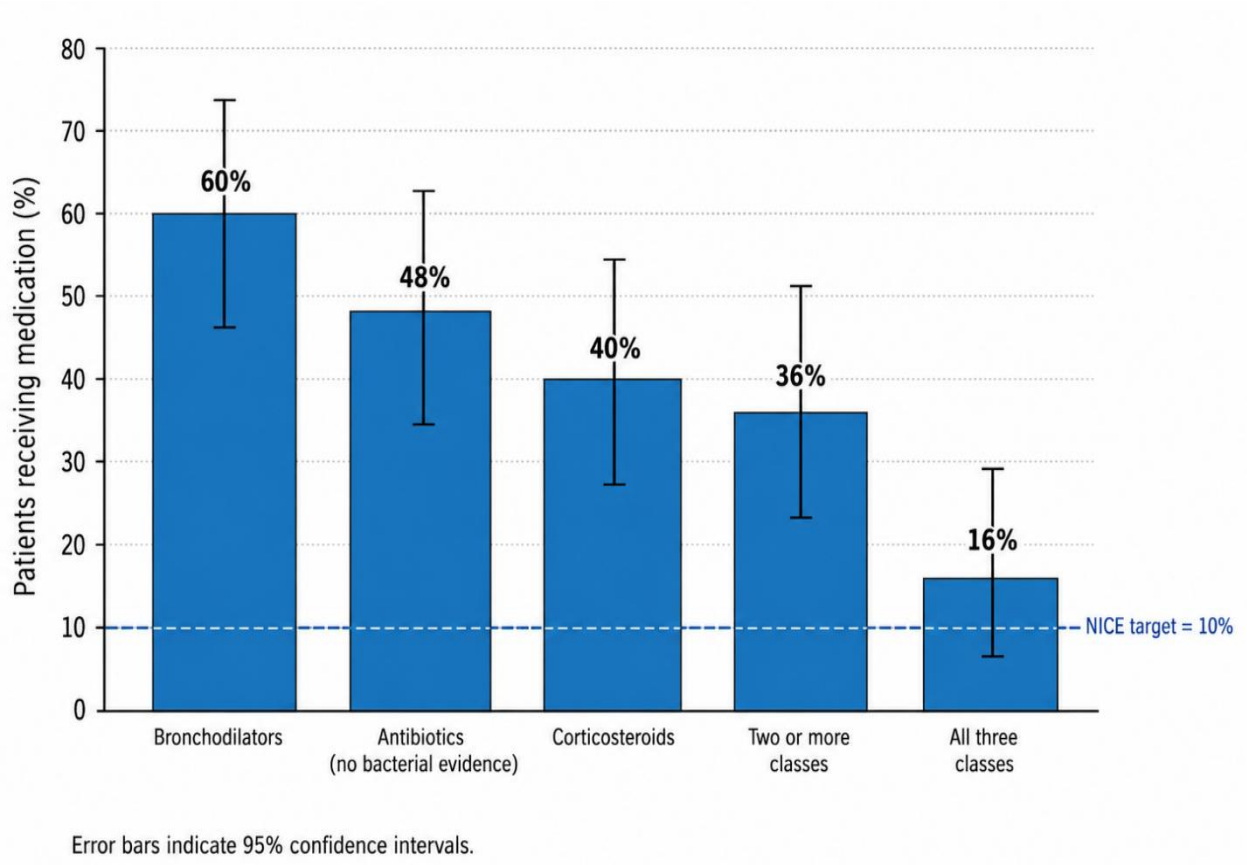


Figure 1 – Unnecessary medication uses by drug class *(Bar chart showing percentage of patients receiving bronchodilators (60%), antibiotics (48%), corticosteroids (40%), two or more classes (36%), and all three classes (16%), with 95% confidence interval error bars and a horizontal target line at 10% representing the NICE NG9 standard)*

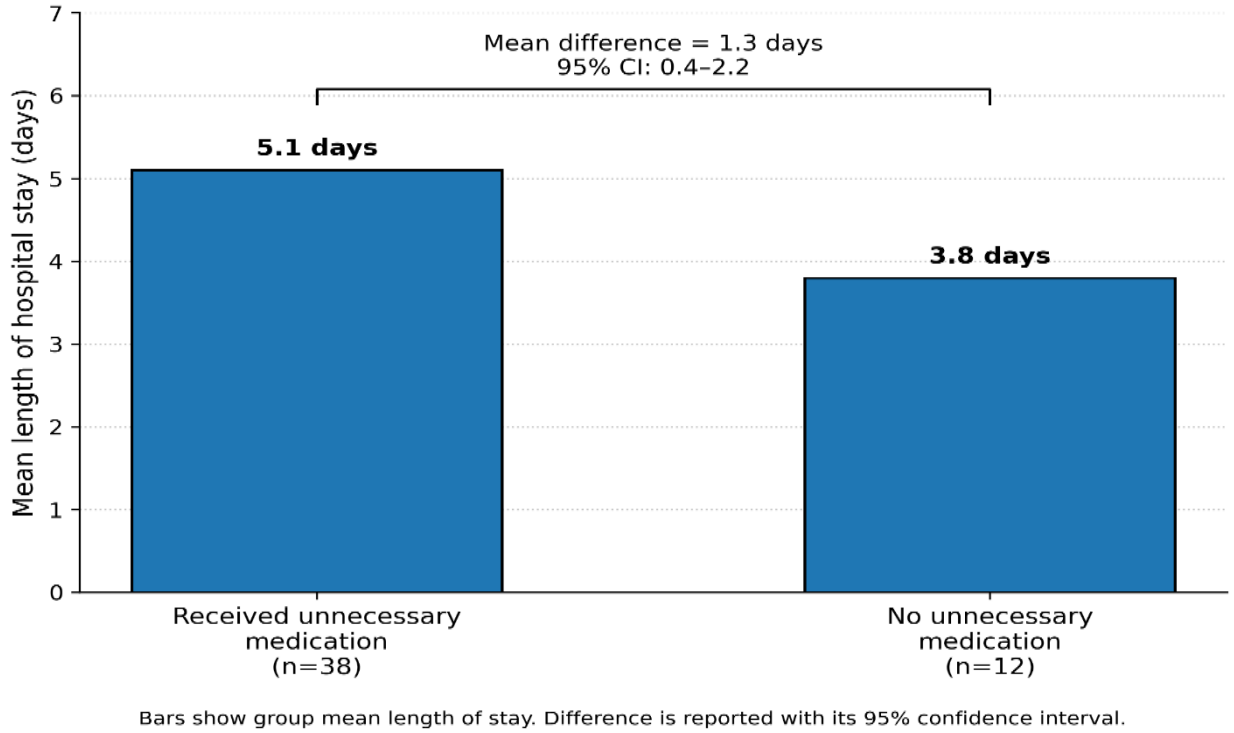


Figure 2 – Length of stay comparison

(Box plot or bar chart comparing mean hospital stay in patients who received unnecessary medications (5.1 days) versus those who did not (3.8 days), with absolute difference of 1.3 days, 95% CI 0.4–2.2 days)

DISCUSSION

This baseline clinical audit from a tertiary care hospital in Pakistan revealed a striking duality in bronchiolitis management. Supportive care was excellent: 100% compliance with diagnosis documentation, oxygen therapy, and NG intubation when indicated, and 96% with hydration management. These findings indicate that fundamental paediatric skills are well taught and practiced in this setting. However, the overuse of unnecessary medications was alarmingly high (76%), exceeding the NICE target by 66 percentage points. Three out of four infants with bronchiolitis received at least one non-recommended drug. This gap is substantially larger than that reported in high-income countries (29–34%) [13,14] and even higher than previous Pakistani data (68%) [15]. compared with published audits, our finding of 76% unnecessary medication use is substantially higher than the 34% reported in the UK National Bronchiolitis Audit (RCPCH, 2022), the 31% from a tertiary Australian centre (Albrecht et al., 2018), and the 29% from a 20-hospital US study (Flores et al., 2020). Even within Pakistan, our rate exceeds the 68% reported in a recent multicenter audit (Aziz et al., 2023). This pattern persisted across all drug classes: bronchodilator use in our cohort (60%) was more than double the UK (28%) and US (24%) rates; antibiotic use (48%) was four times higher than the UK (12%) and US (10%); and corticosteroid use (40%) was five times higher than the UK (8%) and US (6%). These findings indicate that unnecessary medication overuse for bronchiolitis in our setting is among the highest reported globally, underscoring an urgent need for targeted quality-improvement interventions. Our audit reports one of the highest rates of unnecessary medication use for bronchiolitis published in peer-reviewed literature. This is concerning but not unexpected given the limited availability of local guidelines, high prescriber rotation, and cultural expectations for pharmacological intervention. Based on informal interviews with eight junior doctors rotating through the ward and direct observation, we identified three categories of contributing factors. Prescriber-related factors included rotational training in adult medicine, where bronchodilators are standard for wheeze; diagnostic uncertainty in distinguishing bronchiolitis from viral-induced wheeze (especially in older infants aged 6–12 months); and lack of awareness of NICE NG9 recommendations. System-related factors included no visible guideline displayed in the ward,

no prescribing feedback or peer review, and parental pressure reflecting a cultural expectation that "medicine must be given" for respiratory symptoms. Patient-related factors included severity bias, in which some prescribers believed that severe cases required bronchodilators or corticosteroids despite evidence to the contrary. The consequences of this overuse are multifaceted: clinical harms include tachycardia and hypoxia from bronchodilators, hyperglycemia and immunosuppression from corticosteroids, and diarrhea, microbiome disruption, and candidiasis from antibiotics. Patients receiving unnecessary medications had a longer mean hospital stay (5.1 vs 3.8 days, +1.3 days). Economically, each unnecessary medication class adds an estimated $15–30 in drug costs; for 250 annual bronchiolitis admissions, this approximates $10,000–15,000 annually in direct drug costs alone. Furthermore, unnecessary antibiotic use (48% of patients) contributes to Pakistan's growing antimicrobial resistance crisis, where third-generation cephalosporin resistance among Enterobacteriaceae exceeds 70% in some centres. Our audit has several strengths, including the use of an internationally recognized, evidence-based standard (NICE NG9), consecutive sampling to minimise selection bias, dual independent data extraction with near-perfect inter-rater agreement (κ=0.92), a full audit cycle planned with re-audit after intervention, and transparent reporting, including confidence intervals. However, limitations must be acknowledged: this was a single-centre study, limiting generalizability to other Pakistani hospitals or community settings; the retrospective design relies on the quality of documentation and could not capture undocumented care; the sample size (n=50), while adequate for a baseline descriptive audit, produced wide confidence intervals for some proportions (e.g., NG intubation standard 95% CI 29–100%); seasonal bias (data from January–March, the peak RSV season) may not reflect practice in other months; we did not systematically apply a bronchiolitis severity score, though NICE discourages routine drugs regardless of severity; and a possible Hawthorne effect, though minimal given the retrospective design. Despite these limitations, our findings have immediate practical implications. With 76% overuse, there is an urgent need for a targeted quality improvement intervention. Because supportive care is already excellent, interventions can focus narrowly on reducing unnecessary medications, and in resource-limited settings where complex electronic solutions are not feasible, simple, low-cost interventions are preferable. Based on our root cause analysis and successful examples from other settings, we propose a low-cost intervention bundle: (1) a ward-specific protocol based on NICE NG9 (clear, accessible guidance, estimated cost $10 for printing); (2) visual quick-reference charts including a "DO NOT prescribe" list (passive reminder at point of care, estimated cost $15 for laminating); (3) monthly consultant-led prescription review meetings (creates accountability and feedback, staff time only); (4) antibiotic stewardship integration requiring documented justification for all antibiotics (staff time only); and (5) a re-audit at 3 months to close the audit loop (staff time only). These interventions have been shown to reduce unnecessary medication use by 40–60% in similar settings. The re-audit will be conducted in July 2026 (3 months post-intervention) using the same inclusion criteria and methods, with a revised target of <20% unnecessary medication use (i.e., ≥80% compliance), representing an absolute reduction of 56% from baseline. If successful, the re-audit will confirm that a simple, low-cost intervention bundle can close the evidence-practice gap for bronchiolitis in a resource-limited setting. If unsuccessful, additional strategies such as electronic alerts or restricted prescribing privileges will be considered. We urge other departments and institutions in Pakistan and other low- and middle-income countries to conduct similar audits and work collectively towards evidence-based, cost-effective, and safe care for children with bronchiolitis.

CONCLUSIONS

This baseline clinical audit demonstrates that while supportive care for bronchiolitis at Saidu Group of Teaching Hospital, Swat, meets international standards, the overuse of unnecessary medications (bronchodilators, corticosteroids, antibiotics) is unacceptably high (76%)– approximately twice the rate reported in high-income countries and even exceeding previous Pakistani data. The gap between evidence and practice is wide but not unbridgeable. We have identified clear, modifiable causes: lack of visible guidelines, no prescribing feedback, diagnostic uncertainty, and cultural expectations. A low-cost, multi-component intervention bundle has been proposed, and a re-audit is planned within 3

months. Clinical audit, when performed systematically and closed with re-audit, is a powerful tool for quality improvement. We urge other departments and institutions in Pakistan and other low- and middle-income countries to conduct similar audits, share their results, and collectively work towards evidence-based, cost-effective, and safe care for children with bronchiolitis.

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