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Research Article

Prescribing Quality, Rational Medicine Use, and Guideline Concordance in Bronchial Asthma: A Hospital-Based Outpatient Prescription Audit

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ABSTRACT

Background: Rational prescribing in bronchial asthma requires appropriate selection of controller and reliever therapy, preference for cost-effective essential medicines, avoidance of unnecessary antibiotics and injections, clear prescription documentation, and adequate patient instruction. Prescription auditing provides a practical method for identifying gaps between routine clinical practice and evidence-based standards. This study evaluated prescribing quality among adolescents and adults with bronchial asthma attending a tertiary-care medical outpatient department.

Methods: A descriptive hospital-based observational study was conducted among 400 patients with bronchial asthma attending the General Medicine outpatient department of a tertiary-care teaching hospital in Jaipur, India. Prescriptions were evaluated for completeness of general and medical components, World Health Organization (WHO) core prescribing indicators, pharmacological patterns, routes of administration, patient instructions, and concordance with the Global Initiative for Asthma (GINA) treatment framework. Continuous variables were summarized as mean ± standard deviation and categorical variables as frequencies and percentages.

Results: The mean age was 37.83 ± 12.78 years; 220 patients (55.0%) were male. β2-agonists were prescribed in 71.0% of patients, leukotriene receptor antagonists in 70.0%, and corticosteroids in 67.0%. Oral and inhalational medicines were used in 94.3% and 87.3%, respectively. The mean number of medicines per encounter was 4.3 ± 1.8, while 75.6% of prescriptions contained four or more medicines. Generic-name prescribing was recorded in 100% of prescriptions, no injections were prescribed, antibiotics were used in 7.7%, and 93.6% fulfilled the study criterion for essential-list prescribing. General prescription details were complete in 91.2%, whereas medical components were complete in 68.5%. Inhaler-use instructions were documented in 95.7%, but follow-up was advised in only 52.3%. Overall, 350 prescriptions (87.5%) were classified as concordant with the GINA treatment framework.

Conclusion: The audit demonstrated strong performance in generic prescribing, low antibiotic and injection use, essential-medicine selection, inhaler counselling, and overall guideline concordance. However, the high medicine count, incomplete medical documentation, and inconsistent follow-up advice identify important opportunities for prescription optimization and structured audit-feedback interventions.

Keywords: bronchial asthma; prescription audit; rational drug use; WHO prescribing indicators; GINA; generic prescribing; polypharmacy; essential medicines

INTRODUCTION

Bronchial asthma is a heterogeneous chronic inflammatory airway disorder characterized by variable respiratory symptoms and variable expiratory airflow limitation. Its clinical manifestations include episodic wheeze, breathlessness, chest tightness, and cough, with substantial heterogeneity in triggers, inflammatory phenotypes, disease severity, and therapeutic response[1]. Although effective pharmacological therapies are widely available, preventable exacerbations, impaired quality of life, emergency visits, hospitalization, and avoidable treatment expenditure continue to occur because of

delayed diagnosis, inadequate controller treatment, poor adherence, incorrect inhaler technique, and inappropriate medicine use.

Asthma affects individuals throughout the life course and remains an important noncommunicable disease in both high-income and low- and middle-income settings. Epidemiological patterns differ according to age, sex, environmental exposures, smoking, atopy, occupational factors, and socioeconomic circumstances[2]. The chronic and variable nature of asthma means that optimal care requires considerably more than symptom relief. Pharmacotherapy must address underlying airway inflammation, minimize future exacerbation risk, reduce treatment-related adverse effects, and be accompanied by patient education and periodic clinical reassessment.

Contemporary asthma management increasingly emphasizes inhaled corticosteroid (ICS)-containing therapy. GINA recommendations advise that adults and adolescents should receive ICS-containing treatment rather than short-acting β2-agonist therapy alone, with low-dose ICS-formoterol forming the preferred reliever strategy in many clinical situations[3,4]. These recommendations reflect a shift from a symptom-driven bronchodilator approach toward risk reduction through anti-inflammatory therapy. Correct diagnosis, assessment of asthma control, identification of modifiable risk factors, treatment of comorbid conditions, correct inhaler technique, adherence assessment, and planned follow-up are integral components of guideline-based care.

Appropriate selection of an antiasthmatic regimen represents only one dimension of rational medicine use. The WHO framework for investigating drug use in healthcare facilities evaluates prescribing practices through standardized measures including the average number of medicines per encounter, generic-name prescribing, antibiotic exposure, injection use, and selection from essential-medicine lists[5]. These measures provide reproducible indicators of prescribing efficiency and identify potentially avoidable polypharmacy, unnecessary antimicrobial exposure, excessive parenteral therapy, and inefficient brand-based prescribing.

The GINA strategy additionally provides a disease-specific framework against which therapeutic choices can be examined[6]. Combining disease-specific guideline assessment with WHO indicators is particularly valuable in asthma because prescriptions frequently include multiple therapeutic classes, fixed-dose combinations (FDCs), treatment of allergic or gastrointestinal comorbidities, and medicines for acute symptoms. Consequently, a prescription may perform well according to one rational-use indicator while remaining suboptimal in another domain.

Prescription audits across Indian healthcare institutions have demonstrated substantial variability. A multicentric ICMR Rational Use of Medicines study reported an average of approximately 3.34 medicines per prescription, frequent polypharmacy, and incomplete generic prescribing[7]. Similarly, an outpatient audit from a tertiary-care centre in central India reported a mean of 2.53 medicines per prescription, with low generic and National List of Essential Medicines prescribing despite comparatively acceptable antibiotic and injectable use[8]. Such variability highlights the importance of institution-specific audits rather than assuming that prescribing quality is uniform across healthcare settings.

The present study therefore evaluated prescriptions issued to adolescent and adult patients with bronchial asthma attending a tertiary-care General Medicine outpatient department. The principal objectives were to assess prescription completeness, evaluate rational medicine use using WHO core prescribing indicators, characterize antiasthmatic treatment patterns, and determine concordance with the GINA treatment framework. By examining documentation, pharmacological selection, essential-medicine use, polypharmacy, and guideline concordance simultaneously, the study aimed to identify both strengths and actionable gaps in routine outpatient asthma prescribing.

MATERIALS AND METHODS

Study design and setting

A descriptive, hospital-based observational study was conducted in collaboration between the Department of Pharmacology and the General Medicine outpatient department of SMS Hospital, Jaipur,

Rajasthan, India. The overall study period extended from March 2023 to February 2024. Recruitment and prescription assessment were initiated after institutional permissions had been obtained.

Study population and sample size

The study population comprised patients diagnosed with bronchial asthma who attended the General Medicine outpatient department. A sample size of 400 was selected on the basis of an anticipated 50% prevalence of prescriptions following standard treatment recommendations, a 95% confidence level, and the precision specified in the study protocol. Patients diagnosed with bronchial asthma, of either sex, and older than 12 years were eligible. Written informed consent was obtained before participation. Patients presenting with other respiratory disorders that could substantially confound the prescription assessment were excluded.

Ethical considerations

The study was initiated only after approval had been obtained from the institutional Research Review Board and Institutional Ethics Committee. Participants provided informed consent, and confidentiality of prescription and clinical information was maintained throughout data handling and analysis.

Data collection and prescription assessment

A total of 400 eligible asthma prescriptions were evaluated using a structured study proforma. General prescription details included patient name, age, sex, outpatient registration information, consultation date, and legibility. Medical components included history, examination findings, diagnosis, investigations, drug dose and dosage schedule, treatment duration, follow-up advice, referral information where applicable, written behavioural or trigger-avoidance instructions, prescriber signature, and registration details. WHO core prescribing indicators included average number of medicines per encounter, generic-name prescribing, antibiotic exposure, injection use, and essential-medicine use. Pharmacotherapy was additionally classified by therapeutic group, fixed-dose combinations, and route of administration.

Guideline assessment

Prescriptions were categorized as concordant or nonconcordant with the GINA standard-treatment framework by the study investigators. Because the GINA 2024 update followed most of the stated data-collection period, the 2024 framework should be interpreted as a retrospective benchmark for the reported concordance classification rather than proof that every prescription had originally been written under that subsequent version.

Statistical analysis

Data were summarized using descriptive statistics. Continuous variables were reported as mean ± standard deviation and categorical variables as frequencies and percentages. For selected aggregate variables, exploratory inferential testing was performed only where the reported counts and denominators permitted a valid calculation. Multicategory demographic distributions were evaluated by chi-square goodness-of-fit testing against equal expected category frequencies. Binary indicators were evaluated using two-sided exact binomial tests against a prespecified null proportion of 0.50. These p values quantify departure from the stated null distribution; they do not represent patient-level association, treatment-effect, or between-group analyses. Such association analyses could not be reconstructed because the supplied thesis results did not preserve individual-level linkage among demographic characteristics, prescriptions, guideline concordance, and clinical outcomes. A two-sided p value <0.05 was considered statistically significant for these exploratory tests.

RESULTS

A total of 400 prescriptions from patients with bronchial asthma were evaluated. The mean age was 37.83 ± 12.78 years. Most participants were aged 31-60 years (64.2%), followed by those older than 60 years (21.3%), while 14.5% were in the 12-30-year group. Males constituted 55.0% of the population. Smoking was documented in 62.0%, family history of asthma in 56.0%, and an allergic history in 88.0%. Obstructive sleep apnea and gastroesophageal reflux disease were prominent recorded comorbid conditions. Approximately one-fifth of participants reported loss of working days, and 105 patients (26.3%) had a history of

hospitalization associated with illness. The age-group distribution was significantly non-uniform (chi-square goodness-of-fit, $p<0.001$), whereas the male-to-female distribution did not differ significantly from 50:50 on exact binomial testing ($p=0.051$).

The prescribing pattern demonstrated frequent use of multiple therapeutic classes. β2-agonists were the most frequently recorded class (71.0%), closely followed by leukotriene receptor antagonists (70.0%) and corticosteroids (67.0%). Antihistamines and methylxanthines were used in 42.0% and 36.0%, respectively. Oral therapy was recorded in 94.3% of patients and inhalational therapy in 87.3%, indicating that the two routes were commonly used together. Fixed-dose combinations were frequent, particularly combinations containing montelukast with levocetirizine and budesonide with formoterol. Directions regarding inhaler administration were provided in 95.7% of patients, although only 52.3% received documented follow-up advice.

WHO prescribing indicators revealed a mixed pattern of strong rational-use performance and substantial medicine burden. The average number of medicines per encounter was 4.3 ± 1.8, and 302 prescriptions (75.6%) contained four or more medicines. Conversely, generic-name prescribing was documented in all 400 prescriptions, injectable therapy was absent, antibiotics were prescribed in only 31 encounters (7.7%), and 93.6% met the study criterion for essential-list prescribing. General prescription details were complete in 91.2%, while 68.5% fulfilled the assessed medical-component criteria. Overall, 350 prescriptions (87.5%) were classified as concordant with the GINA treatment framework. On exploratory one-sample testing, the proportions for four-or-more medicines, generic-name prescribing, injection avoidance, low antibiotic use, and essential-list prescribing each differed significantly from 50% (all $p<0.001$). Follow-up advice, however, did not differ significantly from an equal 50:50 distribution ($p=0.342$), whereas GINA concordance did ($p<0.001$).

Table 1. Demographic and selected clinical characteristics of the study population

Characteristic	n	%	P value
Age 12-30 years	58	14.5	<0.001
Age 31-60 years	257	64.2	—
Age >60 years	85	21.3	—
Mean age	37.83 ± 12.78 years	-	—
Male	220	55.0	0.051
Female	180	45.0	—
Smoking history	248	62.0	<0.001
Family history of asthma	224	56.0	0.019
Allergic history	352	88.0	<0.001
Exercise-related symptoms	33	8.3	<0.001
Obstructive sleep apnea	147	36.8	<0.001
Gastroesophageal reflux disease	110	27.5	<0.001
Dysfunctional breathing	65	16.3	<0.001
Rhinitis	33	8.3	<0.001

The population was predominantly composed of middle-aged adults, with a modest male predominance. Smoking, allergic history, and familial predisposition were frequently documented, suggesting substantial exposure to potentially relevant asthma risk or modifying factors. The high frequency of obstructive sleep apnea and gastroesophageal reflux disease is clinically important because comorbid disorders may aggravate respiratory symptoms and complicate assessment of asthma control. These findings support comprehensive evaluation beyond pharmacotherapy alone when managing patients attending asthma clinics.

Table 2. Pattern of pharmacotherapy, routes, and patient instructions

Prescribing variable	n / %
β2-agonists	71.0%
Leukotriene receptor antagonists	70.0%
Corticosteroids	67.0%
Antihistamines	42.0%
Methylxanthines	36.0%
Other medicines	26.0%
Oxygen therapy	5.3%
Oral route	377 (94.3%)
Inhalational route	349 (87.3%)
Nasal route	88 (22.0%)
Inhaler-use directions documented	383 (95.7%)
Follow-up advised	210 (52.3%)

Asthma management was characterized by multimodal pharmacotherapy, with β2-agonists, leukotriene antagonists, and corticosteroid-containing treatment dominating the prescribing profile. Although oral medicines were extremely common, inhalational therapy was also used in nearly nine of every ten patients, indicating substantial incorporation of pulmonary drug delivery. The particularly high rate of documented inhaler instruction represents an important strength. In contrast, follow-up advice was recorded for only about half of patients, identifying continuity of care as a potentially modifiable weakness.

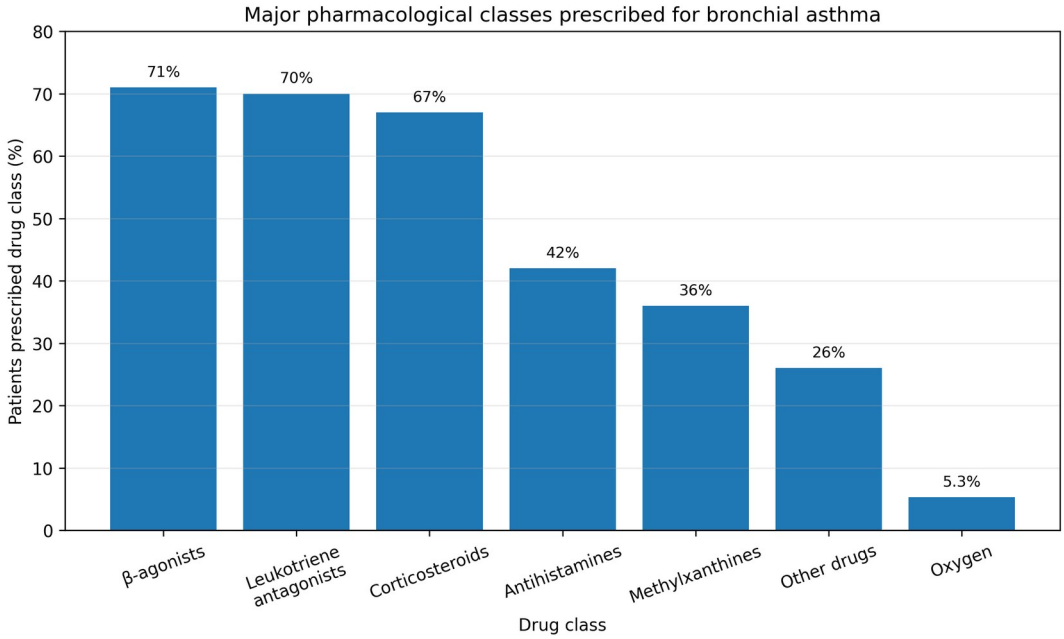


Figure 1. Distribution of major pharmacological classes prescribed to patients with bronchial asthma.

The figure demonstrates that β2-agonists, leukotriene receptor antagonists, and corticosteroids formed the dominant therapeutic groups, whereas antihistamines and methylxanthines were used less frequently. The pattern indicates extensive combination therapy rather than reliance on a single drug class. High use of bronchodilators must be interpreted alongside corticosteroid-containing therapy and fixed-dose combination prescribing because modern asthma management emphasizes anti-inflammatory treatment rather than bronchodilator-only treatment. The relatively frequent use of leukotriene antagonists may also reflect concomitant allergic manifestations.

Table 3. WHO core prescribing indicators

WHO-related prescribing indicator	Study finding	P value
Average number of medicines per encounter	4.3 ± 1.8	—
Prescriptions with ≥4 medicines	302/400 (75.6%)	<0.001
Generic-name prescribing	400/400 (100%)	<0.001
Encounters with injectable medicine	0/400 (0%)	<0.001
Encounters with antibiotic	31/400 (7.7%)	<0.001
Prescriptions meeting essential-list criterion	374/400 (93.6%)	<0.001

The WHO indicator profile demonstrated substantial strengths in generic prescribing, avoidance of injectable medicines, low antibiotic exposure, and high essential-medicine use. These findings suggest attention to affordability and avoidance of unnecessary antimicrobial and parenteral treatment. Nevertheless, the mean medicine count of 4.3 per encounter and the finding that three-quarters of prescriptions contained at least four medicines indicate a substantial medication burden. Rational prescribing should therefore be interpreted across indicators rather than inferred from a single composite impression.

Table 4. Prescription completeness and GINA guideline concordance

Quality measure	n (%)	P value
General prescription details complete	365 (91.2)	<0.001
Prescriptions with illegible handwriting	35 (8.8)	<0.001
Medical components complete	274 (68.5)	<0.001
Lacking clear do's/don'ts or trigger-related instructions	126 (31.5)	<0.001
Inhaler directions documented	383 (95.7)	<0.001
Follow-up advice documented	210 (52.3)	0.342
GINA-concordant prescriptions	350 (87.5)	<0.001
Nonconcordant prescriptions	50 (12.5)	<0.001

General prescription documentation was satisfactory in most encounters, but medical-content completeness was appreciably lower. Nearly one-third lacked clear written behavioural or trigger-related instructions, and approximately half had no documented follow-up advice. Conversely, inhaler counselling was recorded in the overwhelming majority of cases and overall GINA concordance approached 90%. The findings indicate that pharmacological guideline adherence may coexist with deficiencies in documentation and continuity-of-care elements, both of which are integral to high-quality long-term asthma management.

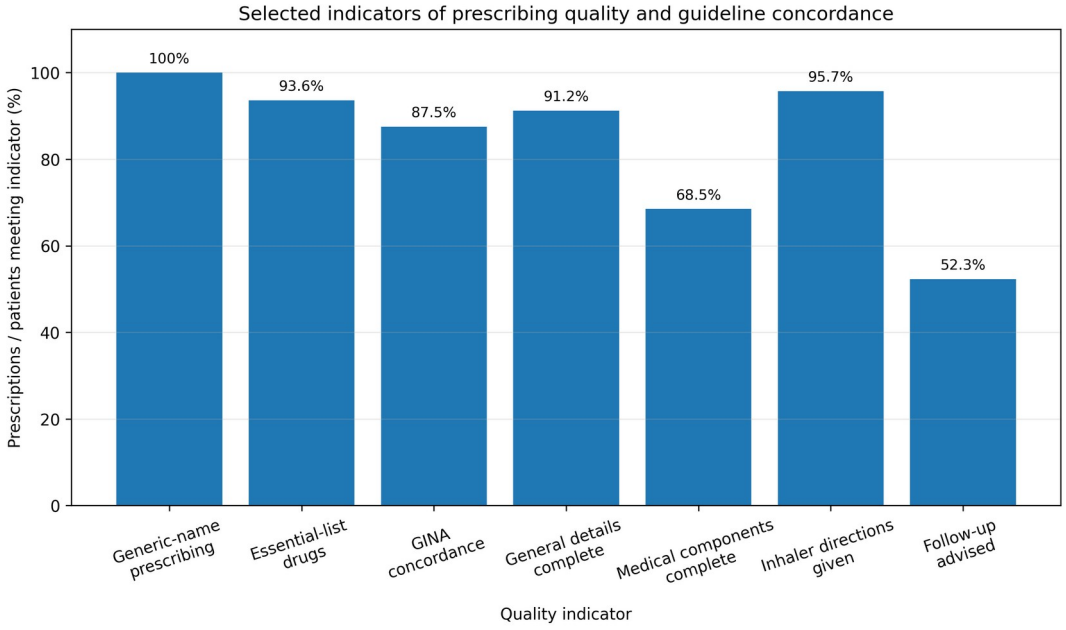


Figure 2. Selected indicators of prescribing quality and guideline concordance.

The quality-indicator profile shows particularly high performance for generic prescribing, essential-list selection, general prescription completeness, inhaler instruction, and GINA concordance. Medical-component completeness was comparatively lower, while follow-up advice represented the weakest measured domain. This contrast illustrates that guideline-concordant medication selection alone does not guarantee complete asthma care. Structured documentation templates, explicit return instructions, trigger counselling, and longitudinal reassessment could complement the strong prescribing indicators and improve continuity and reproducibility of outpatient management.

DISCUSSION

The present prescription audit identified a generally favourable pattern for several dimensions of rational medicine use, while simultaneously revealing a high medication burden and gaps in prescription documentation and follow-up. This multidimensional pattern is important because rational prescribing cannot be reduced to a single percentage. An encounter may demonstrate generic and essential-medicine prescribing yet still contain unnecessary medicines, incomplete instructions, or inadequate follow-up planning.

The mean number of medicines per encounter was 4.3 ± 1.8, with 75.6% containing at least four medicines. This exceeded the 3.34 drugs per prescription reported by Joshi et al. in a multicentric Indian tertiary-care audit[7] and the 2.53 reported by Atal et al.[8]. Aravamuthan et al. reported a mean of 3.7 medicines in community pharmacy encounters[14], while Meena et al. found 3.2 medicines per prescription in South Indian public health facilities[15]. The present medicine count therefore suggests comparatively greater polypharmacy. Some of this burden may be explained by multimorbidity and treatment of allergic symptoms, GERD, rhinitis, or other associated conditions; however, routine medication review remains warranted because unnecessary drug combinations can increase cost, adverse effects, drug interactions, and treatment complexity.

The observed antiasthmatic pattern was broadly consistent with previous Indian drug-utilization research while also demonstrating evolution toward inhalational therapy. Paneerselvam et al. reported β2-agonists and corticosteroids among the principal antiasthmatic drug classes in 422 outpatients and observed frequent inhalational therapy[9]. Earlier studies from Gorakhpur and Shamli also identified β-agonists as the most frequently prescribed antiasthmatic medicines but reported greater dependence on oral treatment and concluded that prescribing did not fully meet guideline expectations[11,12]. In the present study, inhalational medicines were used in 87.3% of patients, suggesting greater integration of inhaled therapy than in these older reports.

This transition is clinically relevant because GINA emphasizes ICS-containing therapy for adults and adolescents and discourages SABA-only management[3,4,6]. The Indian SABINA III analysis by Modi et al. found that approximately one-quarter of evaluated patients had SABA overprescribing and highlighted the continuing need for guideline-directed controller therapy[10]. The present study's reported 87.5% GINA concordance is encouraging. Nevertheless, because therapeutic classes and fixed-dose combinations were tabulated separately in the thesis dataset, the exact proportion of patients receiving any ICS-containing regimen cannot be reconstructed confidently from the aggregate class percentages alone. Patient-level auditing would strengthen future assessment.

Generic-name prescribing was recorded in 100% of the present prescriptions, substantially higher than most published Indian audits. Joshi et al. reported generic prescribing in fewer than half of prescriptions in their multicentric study[7], while Atal et al. observed generic prescribing of approximately 16%[8]. Singh et al. reported 85.8% generic prescribing in a rural Delhi prescription audit[16], and Aravamuthan et al. found only 2.5% of drugs prescribed generically in selected Southern Indian community pharmacies[14]. The present finding therefore represents a notable institutional strength, provided that generic documentation accurately reflected medicines dispensed to patients.

Essential-list prescribing was also high at 93.6%, closely resembling the 93.3% reported by Meena et al.[15] and exceeding values reported in several tertiary-care audits[7,8,17]. Use of essential medicines can

improve procurement efficiency, affordability, familiarity among prescribers, and equitable access. Nevertheless, essential-list adherence should remain linked to individual clinical appropriateness rather than being interpreted as an isolated measure of prescription quality.

Antibiotic exposure was limited to 7.7%, and no injectable medicines were prescribed. Atal et al. similarly found outpatient antibiotic and injection indicators to be comparatively favourable despite deficiencies in generic and essential-medicine prescribing[8]. Meena et al. reported markedly higher antibiotic and injection use of 36.6% and 11.4%, respectively[15]. Because uncomplicated asthma is not an indication for routine antibacterial therapy, the low antibiotic exposure observed here is reassuring and potentially reflects antimicrobial stewardship.

Prescription documentation showed a more mixed pattern. General details were complete in 91.2%, but only 68.5% fulfilled the assessed medical-component requirements. Singh et al. previously emphasized prescription auditing as an effective method for identifying omissions in diagnosis, dose information, and patient understanding[16]. The Indian multicentric analysis by Joshi et al. similarly demonstrated that completeness remains an important rational-prescribing domain[7]. Standardized electronic or printed prescription templates could help reduce omissions and illegibility.

A particularly strong finding was the documentation of inhaler-use instructions in 95.7% of participants. Earlier work by Kotwani et al. in Delhi demonstrated substantial deficiencies in asthma education and inhaler use in community practice[13]. Systematic review evidence from Klijn et al. has subsequently shown that inhaler-technique educational interventions usually improve technique, particularly when training is reinforced[19]. Thus, the high counselling rate in the present study represents an important quality marker. However, follow-up advice was documented in only 52.3%, potentially undermining opportunities to reassess inhaler technique, adherence, symptoms, exacerbation risk, and need for step-up or step-down treatment.

Guideline concordance in the present audit was considerably higher than the 28.8% adherence reported by Baldacci et al. among Italian general practitioners, where greater guideline adherence was associated with improved asthma control[18]. Direct comparison should be cautious because study populations, guideline versions, severity distributions, and definitions differed. Nevertheless, the finding supports continued use of prescription audit and feedback as a quality-improvement strategy.

Several limitations should be acknowledged. The study was conducted at a single tertiary-care institution and may not represent community or private-sector prescribing. The analysis was primarily descriptive, preventing adjustment for asthma severity, comorbidities, or disease control. Patient-level reconciliation of overlapping therapeutic classes and fixed-dose combinations was unavailable, and clinical outcomes were not linked directly to guideline concordance. In addition, the 2024 GINA classification represented a retrospective benchmark for prescriptions collected predominantly before publication of the May 2024 update. Future multicentre studies should incorporate asthma-control scores, spirometry, severity classification, patient-level ICS exposure, adherence, exacerbation history, cost, and longitudinal clinical outcomes.

CONCLUSION

This hospital-based prescription audit demonstrated strong performance in several important domains of asthma prescribing, including universal generic-name documentation, low antibiotic use, absence of injectable therapy, high essential-medicine utilization, frequent inhalational treatment, comprehensive inhaler counselling, and substantial concordance with the GINA treatment framework. Nevertheless, the high average number of medicines, incomplete medical documentation, and inconsistent follow-up advice identify meaningful opportunities for improvement. Periodic prescription audits combined with prescriber feedback, structured documentation, medication review, and systematic follow-up could strengthen rational medicine use and translate pharmacological guideline adherence into more comprehensive long-term asthma care.

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