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Adherence to GINA Guidelines in Asthma Pharmacotherapy: A Review of Medication Utilization Patterns and Determinants

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ABSTRACT: Asthma is common, chronic, and, for the most part, manageable, yet the gap between what current guidelines recommend and what patients actually receive has proved surprisingly stubborn. The Global Initiative for Asthma (GINA) strategy has changed considerably over the last decade, moving away from reliever-only treatment for mild disease toward early anti-inflammatory therapy for everyone. This review looks at how well that shift has actually been adopted in practice, drawing on international studies as well as the more limited body of Indian work on asthma prescribing. A recurring finding across settings is that short-acting beta-agonists continue to be overused, inhaled corticosteroids are prescribed inconsistently, and oral corticosteroid courses are sometimes repeated without adequate scrutiny of cumulative risk. Some of this can be traced to patients, particularly poor inhaler technique and inconsistent day-to-day adherence, and some to prescribers, who may be only partly familiar with the newer track-based GINA framework or simply pressed for time. Indian data on the subject exist but are thin, geographically patchy, and rarely benchmarked against the specific GINA track and step in effect at the time. Puducherry and the surrounding region are a particular blind spot despite having tertiary hospitals well placed to generate this evidence. This review sets out that background and argues, on the strength of it, for a retrospective evaluation of asthma medication utilization measured explicitly against GINA recommendations.

1. INTRODUCTION

Asthma is a chronic inflammatory disease of the airways. It shows up differently from one patient to the next, but the common thread is variable airflow limitation and recurring symptoms such as wheeze, breathlessness, chest tightness and cough.[1] It affects people across the age spectrum and remains one of the largest contributors to non-communicable respiratory disease

burden worldwide. Over the past two decades, how clinicians are told to treat it has changed considerably, largely because of the periodic strategy reports issued by the Global Initiative for Asthma (GINA).[1,2]

For a long time, the default approach was simple: give a short-acting beta-agonist (SABA) as needed and reserve inhaled corticosteroids (ICS) for patients whose disease was more persistent. It turned out this approach quietly allowed the underlying airway inflammation to go untreated, and it was linked to excess exacerbations and, in some cases, preventable deaths.[3] The 2019 GINA update broke from this. It advised against SABA-only treatment for any patient, regardless of how mild their disease appeared, and made as-needed low-dose ICS-formoterol the preferred reliever even at the mildest end of the spectrum.[3] The reports that followed, 2023, 2024 and 2025, have kept refining this stepwise, track-based approach as more evidence has accumulated on anti-inflammatory reliever therapy and combined maintenance-and-reliever regimens.[4-6]

None of this, however, seems to translate cleanly into everyday prescribing. Studies from very different settings, general practice clinics in Italy, tertiary hospitals in Saudi Arabia and the United States, keep turning up the same basic finding: what GINA recommends and what patients are actually given often diverge, sometimes considerably.[7-11] That gap is not just a paperwork issue. Prescriptive non-adherence to GINA has been tied to worse asthma control,[7] and continued reliance on SABA monotherapy has been associated with a higher risk of exacerbation and death.[12-16]

India's share of the global asthma burden is disproportionately large, with tens of millions of people affected and disability-adjusted life year (DALY) rates per case among the highest reported anywhere.[17,18] Yet the Indian literature on asthma drug utilization is comparatively thin. What exists tends to describe prescribing patterns rather than measure them against a specific guideline, and it is unevenly distributed geographically.[19-24] Whether prescribing in Indian tertiary hospitals actually mirrors current GINA recommendations, and if not, why not, is a question that matters both clinically and from a public-health standpoint.

This review pulls together the global and Indian evidence on asthma medication utilization and GINA adherence. It covers the burden of disease, how GINA's recommendations have evolved, what the literature says about actual prescribing, the clinical risks of guideline-discordant therapy, and the patient-, provider- and system-level factors behind it. It closes by setting out the gaps that, taken together, justify a retrospective drug use evaluation at a tertiary care hospital.

2. EPIDEMIOLOGICAL BURDEN OF ASTHMA

Roughly 260 to 300 million people live with asthma worldwide, making it one of the most common chronic diseases across both childhood and adulthood.[1,25] Global Burden of Disease (GBD) analyses show that age-standardised prevalence, incidence and mortality have generally fallen since 1990, but absolute case numbers keep climbing simply because the world's population is larger and older than it used to be; incidence is projected to keep rising in several regions through 2050.[25]

India's contribution to this total is not small. A GBD sub-national analysis covering 1990 to 2016 put the number of prevalent asthma cases in India at roughly 37.9 million, with DALY rates per case about 2.4 times the global average, which suggests Indian patients tend to experience more severe disease-related disability than the global norm, not just more disease.[17] More recent GBD estimates for Belt and Road Initiative countries place India, alongside China and Indonesia, among the countries carrying the largest absolute asthma burden, with millions of years of life lost each year attributable to the disease.[18] Earlier cohort data from a national epidemiological survey put adult prevalence at around 2%, implying a burden of more than 17 million people, though self-reported, questionnaire-based estimates like this one probably understate the true figure.[19]

What this burden translates to in practical terms is lost productivity, hospital admissions, and ongoing medication costs, all of which strain patients and the health system alike; the economic burden of asthma in India includes both direct medical costs and considerable indirect costs from lost work.[21] Much of it, crucially, is preventable through appropriate, guideline-concordant treatment.[19] So the gap between what is recommended and what is actually prescribed is not an abstract concern; it has real consequences for outcomes and for what the health system ends up spending.

There is also considerable variation within India itself. States with lower epidemiological transition levels, broadly, those with weaker health infrastructure, carry disproportionately higher DALY rates for asthma, which points to access to guideline-based care, rather than disease prevalence alone, as an important driver of these disparities.[17] Puducherry and the wider South Indian region have been comparatively overlooked in large-scale drug utilization research on asthma, despite having tertiary referral centres that see a substantial volume of respiratory disease. That gap in local evidence is part of the motivation for this review.

3. EVOLUTION OF GINA TREATMENT RECOMMENDATIONS

First issued in the 1990s and updated at least annually since, the GINA strategy report is probably the most widely used framework for asthma diagnosis and management anywhere.[1] Across its many editions, the underlying philosophy has shifted, from treating symptoms as they arise toward controlling the airway inflammation that causes them in the first place.

Before 2019, GINA's stepwise approach started with as-needed SABA for mild, infrequent symptoms, adding ICS or ICS-LABA combinations only once symptoms became more frequent or severe.[3] In effect, this allowed SABA-only treatment for the mildest patients. The trouble is that even patients labelled as having mild asthma were shown to remain at risk of severe or fatal exacerbations, and regular SABA use without any accompanying anti-inflammatory therapy turned out to be harmful in its own right.[3,12] That evidence is what pushed the 2019 revision through: no patient, regardless of severity, should be on SABA alone, and as-needed low-dose ICS-formoterol became the preferred reliever from Step 1 onward.[3]

Later GINA reports built this into a two-track system. Track 1, now the preferred pathway, uses ICS-formoterol as both the maintenance medication and, when needed, the reliever, an approach known as maintenance-and-reliever therapy (MART), or as anti-inflammatory reliever (AIR) therapy at the milder end.[4,5] Track 2 remains available where Track 1 is not feasible or not preferred, and pairs a separate ICS-containing maintenance inhaler with an as-needed SABA reliever.[5,6] The 2024 update was explicit that all adults and adolescents with asthma should be on ICS-containing treatment, and it discouraged SABA-only management at any step.[5,6] The most recent, 2025, update goes further still, expanding guidance on biomarker-driven assessment (blood eosinophils and fractional exhaled nitric oxide feature prominently) and refining the dosing tables for both tracks.[2,27]

Diagnosis has changed too, in a more practical direction. Spirometry is not available everywhere, certainly not in many Indian district hospitals and some tertiary centres either, so recent GINA reports lean more heavily on peak expiratory flow (PEF) monitoring as a workable alternative.[26] There is also more emphasis than before on the non-drug side of care: written action plans, structured inhaler-technique training, and involving the patient in choosing a device rather than simply prescribing one.[26]

All this matters for how drug utilization research should be read. A study conducted, or reported, without reference to the 2019 revision may still be treating SABA monotherapy as guideline-concordant for mild disease, which is really applying an outdated yardstick.[3,5] Any evaluation worth its salt needs to measure prescribing against the GINA edition that was actually in force during the study period, which is a basic but easily overlooked methodological point.

4. CLASSES OF ASTHMA MEDICATIONS AND RATIONAL USE

Broadly, asthma medications fall into two categories: controllers, which target the underlying inflammation, and relievers, used for quick symptom relief.[1] Inhaled corticosteroids are the backbone of controller therapy, cutting inflammation and lowering exacerbation risk when taken consistently.[1,5] Long-acting beta-agonists (LABA) such as formoterol and salmeterol are not used alone, safety concerns rule that out, but combined with ICS in a single inhaler they add useful bronchodilator effect on top of the anti-inflammatory action.[5]

SABAs, salbutamol being the usual example, work fast to relieve bronchospasm but do nothing for the underlying inflammation; current GINA guidance keeps them paired with ICS-containing therapy rather than allowing them to stand alone.[5,6] Leukotriene receptor antagonists, theophylline and long-acting muscarinic antagonists come in as add-on or alternative options for patients whose disease is harder to control.[1] Oral corticosteroids are meant for acute exacerbations, or, in a small subset of patients with severe asthma, as maintenance therapy once other options have been exhausted. Their long-term risks, osteoporosis, cataracts, adrenal suppression, metabolic disturbance, are well documented, and even short, repeated “burst” courses deserve more scrutiny than they typically get.[14] Biologic agents that target specific inflammatory pathways are a newer option for severe, uncontrolled disease with a defined phenotype, though cost and availability still limit their use in Indian tertiary care.[5]

How a drug is delivered matters as much as which drug is chosen. Indian prescribing studies consistently show a mix of inhalational, oral and nebulised routes, with a fair share of medications still given orally despite the clear pharmacological advantage of delivering drug directly to the airway.[22,23,24] That, together with the average number of drugs per prescription, itself often cited as a marker of polypharmacy in respiratory illness, forms a useful descriptive backdrop against which GINA-based appropriateness can be judged.[22,24]

5. GLOBAL EVIDENCE ON GINA-GUIDELINE ADHERENCE

A fair amount of international literature has now looked at how closely real-world asthma prescribing follows GINA, and the overall picture is one of persistent, if uneven, mismatch.

An Italian cross-sectional study of general practice, covering nearly 1,000 patients and more than 100 GPs, found that prescriptive adherence to GINA guidelines raised the odds of achieving good or optimal asthma control by around 85%, even after adjusting for comorbidity and disease severity.[7] That is one of the clearer demonstrations that adherence is not just a box-ticking exercise, it is actually associated with better outcomes for patients.

Hospital-based work tells much the same story. A retrospective cohort study looking at adherence to GINA-recommended reliever therapy after acute exacerbations found guideline-concordant prescribing in roughly four out of five patients, with adherence improving noticeably after hospitalisation, which hints that an acute event may prompt closer guideline alignment even where routine outpatient care lags.[8] A more recent US retrospective chart review, presented at a major pharmacy conference, found that only around a fifth of patients were on the GINA-preferred Track 1 ICS-formoterol regimen, with SABA monotherapy overuse still very much present even years after the 2019 shift.[9,10] A retrospective cohort study from a tertiary hospital in Saudi Arabia went further: only a small minority of patients discharged after an exacerbation were sent home on ICS-formoterol as their reliever, while most continued on SABA alongside an ICS-containing controller, a pattern the study's authors described as worse than comparable US figures.[11]

Put these studies side by side, general practice, emergency care, inpatient wards, across several different health systems, and a fairly consistent picture emerges: the gap between what GINA recommends and what actually gets prescribed has narrowed only partly since 2019, and Track 1 therapy specifically remains underused relative to how strongly it is recommended.[8-11] That this pattern shows up so consistently across such different settings suggests the underlying causes are not purely local. They probably reflect more general barriers, clinical habit, patient preference, how well guidelines are actually disseminated, that are worth exploring further.

None of the large-scale, track-based adherence studies available so far have been done in an Indian tertiary care setting. What Indian data exist tend to describe overall drug utilization and prescribing patterns without explicitly checking prescriptions against a defined GINA track or step, and that is a meaningful distinction, since it changes what “guideline adherence” actually measures.[22-24]

6. INDIAN EVIDENCE ON ASTHMA DRUG UTILIZATION

Indian data on asthma drug utilization, compared with the international GINA-adherence literature, tend to be more descriptive: what drug classes were used, by what route, in what combination, rather than an explicit scoring of guideline concordance.

A few single-centre studies illustrate the point. A drug utilization evaluation from a tertiary teaching hospital in Tamil Nadu found that combined beta-2 agonist and glucocorticoid therapy delivered by inhalation predominated, though a fair minority of prescriptions still relied on the oral route.[22] A study from a tertiary hospital in northern India found salbutamol to be the most frequently prescribed single anti-asthma drug, with an ICS-LABA fixed-dose combination the most common combination product.[23] Another South Indian tertiary teaching hospital reported an average of just over five drugs per asthma prescription, with more than half of patients receiving four or more medications, and noted that a fair share of the drugs prescribed did not even appear on the institution's own essential medicines list, which raises its own questions about prescribing rationality and cost.[22]

Retrospective work on acute exacerbation management, one such study from Bengaluru, found near-universal use of systemic corticosteroids, usually hydrocortisone, during hospitalisation, alongside inhaled and nebulised bronchodilators. That reflects fairly standard acute-care practice, but it says little about whether maintenance prescribing at discharge actually aligns with GINA's stepwise recommendations.[24] Other cross-sectional Indian studies have characterised drug classes and combinations in similar detail without directly checking concordance against a specific GINA track.[22,23]

Two things stand out from this body of work, and both matter for how future evaluations should be designed. First, most published Indian studies pre-date, or simply do not reference, the 2019 revision and what came after it, which changed the very definition of guideline-concordant reliever therapy; so their conclusions about “rational” or “appropriate” prescribing may not hold up against the current Track 1/Track 2 framework.[22-24] Second, the existing work clusters in a handful of states,

Maharashtra, Karnataka, Uttar Pradesh, Tamil Nadu, with very little from Puducherry and the surrounding Union Territory, despite the presence of tertiary teaching hospitals well placed to do this kind of research.[22-24] A temporal gap and a geographic gap, together, are really the central evidence gap this review is arguing needs to be filled.

7. Overuse of SABA and Oral Corticosteroids: A Persistent Concern

If there is one finding that keeps coming up across this literature, it is the continued overuse of short-acting beta-agonists. The multinational SABINA programme, drawing on Swedish national registry data for more than 365,000 patients, found that about 30% of asthma patients qualified as SABA overusers (three or more canisters a year), and that the risk of both exacerbation and death rose in step with how much SABA a patient used.[12] Taiwanese data, from a pay-for-performance programme covering more than 200,000 patients, found a lower but still substantial overuse rate of roughly 16%, again with a clearly elevated risk of severe exacerbation and death among overusers compared with patients not on SABA at all.[13]

A systematic review and meta-analysis pooling studies from six continents backs this up at a broader level: SABA overusers had close to double the risk of acute exacerbation compared with appropriately treated patients, along with higher all-cause mortality and healthcare use in several of the pooled cohorts.[15,16] This gives real weight to what the 2019 GINA revision was already warning about, that SABA-only treatment is not simply suboptimal, it can be actively harmful for a meaningful share of patients.[3,15]

Oral corticosteroid overuse is a related, but separate, problem. A nationwide Portuguese analysis of prescribing and dispensing data found that high cumulative OCS exposure and SABA overuse tended to travel together with inadequate controller prescribing, suggesting these three patterns cluster in the same patients rather than occurring independently.[14] That clustering matters clinically, because prescribers often treat a short OCS course as low-risk simply because it is brief, when in fact the cumulative, dose-dependent risks, osteoporosis, cataract, adrenal suppression, weight gain, metabolic disease, build up with repetition in ways that are easy to lose track of in routine practice.[14]

For a retrospective drug utilization evaluation, this has a fairly direct methodological consequence. Recording a single OCS course, or the SABA canisters dispensed at one visit, does not capture cumulative exposure in the way that has actually been shown to matter. Where hospital records allow it, tallying cumulative SABA canisters and OCS courses across the whole observation period, rather than taking a single-encounter snapshot, is likely to give a more clinically meaningful picture of guideline-discordant prescribing and the risk that comes with it.[12-14]

8. DETERMINANTS OF NON-ADHERENCE: PATIENT, PROVIDER AND SYSTEM-LEVEL FACTORS

Guideline-discordant prescribing shows up too consistently, across too many different settings, to have a single cause. It seems to operate at several levels at once, and they interact.

Take providers first. A primary-care survey built around the Knowledge-to-Action framework found that most physicians actually knew the key asthma guideline recommendations well enough; what varied was their motivation to apply them and how useful they judged specific recommendations to be, with time and resource constraints the barrier cited most often.[28] A separate study of providers serving an inner-city population found that low provider self-efficacy and low outcome expectancy, essentially, doubting that following the guideline would change anything for a given patient, predicted non-adherence more strongly than simple unfamiliarity with the guideline itself.[30] A cross-sectional study from Bahrain found broadly similar structural and attitudinal barriers among primary care physicians there.[32] None of this suggests that simply distributing guidelines more widely will close the gap; clinician confidence, how well a guideline fits into daily workflow, and whether it is seen as clinically relevant all seem to matter just as much.[28-32]

On the patient side, how well someone sticks to their prescribed therapy, and whether they use their inhaler correctly, matters just as much as what was actually prescribed. Using the Systems Engineering Initiative for Patient Safety (SEIPS) framework, one analysis identified poor inhaler technique as a major driver of poor adherence, alongside gaps in patients' understanding of their condition and a fairly common misconception, that improved symptoms mean treatment can safely stop.[33] Hospital-based studies from Tanzania and Bangladesh reported very high rates of inhaler non-adherence, over 60% in one cohort and as high as 86% in the other, with lack of health insurance, fear of side effects, inconvenience, and poor technique all coming up as independent predictors.[37,38] A Spanish multicentre observational study found similar patterns: more than a third of patients referred to specialist asthma care had been prescribed inadequate therapy, more than three-quarters showed low adherence, and about one in six made critical inhaler-technique errors, each of these independently limiting disease control.[35]

Then there is the system itself, cost, insurance coverage, which inhaler devices and formulations are actually available, whether electronic decision support is built into the clinical workflow. All of these have been flagged as barriers to putting updated GINA recommendations into everyday practice, particularly where resources are constrained.[29,31] In Indian tertiary care, similar constraints, limited access to newer ICS-formoterol combination inhalers, patients' sensitivity to cost, are plausible contributors to guideline-discordant prescribing, though this has not yet been formally documented through local research.[22-24]

9. INHALER TECHNIQUE AND MEDICATION ADHERENCE

Even a perfectly guideline-concordant prescription only helps if the patient can actually use the device correctly. Across metered-dose inhalers, dry powder inhalers and soft-mist inhalers alike, a substantial share of patients make at least one critical technique error, not exhaling fully before inhaling, not holding the breath afterward, or failing to coordinate actuation with inhalation are the usual culprits.[33,34] A Japanese study that looked at ICS adherence and inhaler handling errors side by side found both independently affected asthma control, a useful reminder that adherence and technique, while related, are not the same thing and are worth assessing separately.[34]

Newer electronic monitoring devices, some combining adherence tracking with real-time technique feedback, have shown promise in small studies for improving both actual medication-taking and technique accuracy, though they remain largely unavailable in routine Indian tertiary care.[34,36] For a retrospective evaluation based on hospital records, directly assessing inhaler technique is generally not possible, it needs an observed demonstration, not a chart entry. Still, this body of work is worth keeping in mind when interpreting any prescribing pattern that emerges: a patient on paper-perfect, guideline-concordant therapy can still have poorly controlled asthma if their technique or day-to-day adherence is lacking, and that is a limitation worth stating plainly in any retrospective study of this kind.[33-36]

10. METHODOLOGICAL CONSIDERATIONS IN DRUG UTILIZATION EVALUATION STUDIES

Drug utilization studies, or drug use evaluations when the focus is appropriateness rather than sheer volume, are essentially concerned with how medicines are prescribed, distributed and used in a population, and what clinical and economic consequences follow.[22] Within respiratory disease specifically, this kind of study helps identify how much of a drug is being used, spot variability between regions or institutions, and point to where prescribing might be improved.[24]

Retrospective designs, reviewing records after the fact rather than collecting data prospectively, are common in this field for practical reasons: they are efficient, they avoid the risk of prescribers changing their behaviour because they know they are being watched, and they can draw on realistically large samples from routine hospital records.[11,24] Their main weakness is that they depend entirely on how complete and accurate the existing documentation is, which often does not capture things like patient-reported symptom control, adherence, or inhaler technique.[11] Where a study specifically aims to assess guideline concordance, rather than just describe prescribing, it helps to define concordance in advance, classifying each prescription against the GINA Track and Step that applied at the time of the encounter, using the year-specific GINA report actually in force during the study period.[3,5,6]

Reporting quality is worth a mention too. Several of the stronger recent GINA-adherence studies followed the STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology), which set minimum standards for how study design, population, variables and statistical methods are reported.[11] Given how consistently SABA overuse, OCS overuse and controller under-prescription cluster together, a thorough drug utilization evaluation would ideally track cumulative medication exposure across the whole observation period rather than a single prescription, alongside the usual descriptive variables: demographics, asthma severity, comorbidities, and prescriber specialty, each of which has come up as a possible correlate of prescribing pattern in the literature discussed above.[12-14,22-24]

11. RESEARCH GAP AND RATIONALE

Three things stand out from everything covered so far. First, GINA-guideline adherence, where it has actually been measured, remains incomplete across a range of healthcare settings; Track 1 ICS-formoterol therapy in particular is still underused relative to how strongly it is recommended, and SABA and OCS overuse continue to show up at clinically meaningful rates.[7-16] Second, the published Indian drug utilization literature on asthma, useful as it is for describing broad prescribing patterns, is largely descriptive, concentrated outside Puducherry, and rarely benchmarked against the current GINA track-based framework.[22-24] Third, the reasons behind guideline-discordant prescribing operate at the patient, provider and system level

simultaneously, so a local evaluation really ought to capture not just what was prescribed but the context around it that might explain the deviations.[28-38]

Put together, these three points make a reasonably strong case for a retrospective, GINA-anchored drug use evaluation of asthma medication utilization at a tertiary care hospital in Puducherry. Such a study would add to the existing Indian literature in three ways: by explicitly classifying prescribing against current GINA tracks and steps, by measuring cumulative rather than single-encounter exposure to SABA and OCS, and by looking at patient-, provider- and system-level correlates of guideline-discordant prescribing in a South Indian tertiary care population that this literature has, so far, largely overlooked.

12. CONCLUSION

Asthma management has changed a great deal over successive GINA updates, away from SABA-only treatment and toward early, consistent anti-inflammatory therapy delivered through a stepwise, track-based framework. The global evidence, though, suggests this shift has only partly made it into everyday prescribing: preferred Track 1 therapy remains underused, and SABA and oral corticosteroid overuse continue to be linked to measurably higher exacerbation and mortality risk. Indian data broadly echo these international patterns but remain limited in volume, unevenly spread across the country, and rarely tied to the current GINA framework, leaving a clear gap in settings such as Puducherry. A retrospective drug utilization evaluation, measured explicitly against contemporary GINA recommendations and attentive to the patient-, provider- and system-level factors discussed in this review, offers a practical and scientifically sound way to characterise how closely asthma prescribing in a South Indian tertiary care hospital actually follows current guidance, with the eventual aim of improving asthma pharmacotherapy and patient outcomes locally.

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