International Journal of Research in Medical Sciences
Doshi NS et al. Int J Res Med Sci. 2026 Nov;14(11):5174-5179
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20264175

Original Research Article

Clinical use of formoterol–budesonide through nebulization in asthma management: a nationwide survey of Indian pulmonologists

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Received: 18 August 2026
Revised: 19 September 2026
Accepted: 12 October 2026

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ABSTRACT

Background: Asthma is a chronic inflammatory airway disease associated with substantial morbidity and impaired quality of life. Although inhaled corticosteroid (ICS) and long-acting beta-2 agonist (LABA) combinations remain the cornerstone of therapy, use of nebulized Formoterol–Budesonide (FB) respules may provide an effective alternative for patients with poor inhaler coordination, acute exacerbations, or difficulty using handheld devices.
Methods: A nationwide, cross-sectional, questionnaire-based survey was conducted among pulmonologists across India from September 2025 to October 2025. A structured 20-item multiple-choice questionnaire was distributed to pulmonologists through a secure online platform. Data were analyzed using descriptive statistics and expressed as frequencies and percentages.
Results: A total of 358 pulmonologists participated. FB respules were prescribed frequently by 58.66% and occasionally by 33.80% of respondents. Moderate-to-severe asthma was the most common indication (42.74%). Therapy was utilized in both acute exacerbation and maintenance settings by 39.66% of respondents. Clinical efficacy was rated as excellent or good by 94.69%, while 87.15% observed improved symptom control compared with conventional inhalers. Rapid symptom relief within 30 minutes was reported by 87.15% of pulmonologists. Better or improved patient adherence was noted by 92.18%, and 85.47% reported reduced oral corticosteroid requirements. Overall tolerability was favorable in 96.09% of responses.
Conclusions: Nebulized Formoterol–Budesonide are widely used by Indian pulmonologists and are perceived as an effective, well-tolerated, and adherence-friendly therapeutic option for asthma management across acute and maintenance settings.

Keywords: Asthma, Nebulized therapy, Formoterol-budesonide, Respules, Pulmonologists

INTRODUCTION

Asthma is defined as a chronic respiratory disease characterized by persistent airway inflammation, primarily involving an accumulation of eosinophils, mast cells, and activated T-helper lymphocytes. These inflammatory cells release a wide array of mediators including cytokines, chemokines, and histamine that trigger bronchoconstriction, mucus hypersecretion, and airway remodeling.[1] Over the past several decades, the disease has shown a rising trend in global prevalence, associated morbidity, and economic impact. In India, the burden of asthma is considerable, affecting both urban and rural populations across diverse age groups. For these patients, the disease profoundly impacts their quality of life due to recurrent symptoms, activity restrictions, and psychological stress, making it a major public health concern.[2,3]

The combination of inhaled corticosteroids (ICS) and long-acting beta-2 agonists (LABAs) has become the cornerstone of asthma management due to their synergistic molecular interactions. Corticosteroids upregulate -receptor expression and restore receptor coupling, while LABAs enhance glucocorticoid receptor activation and nuclear translocation.[4,5] Within this class, the combination of formoterol and budesonide is highly effective. Formoterol provides rapid bronchodilation within 1–3 minutes of administration, while budesonide offers potent anti-inflammatory action with a well-established safety profile. Hence, formoterol-bedesonide combination is widely recognized as a preferred therapeutic option for both maintenance and acute symptom management.[6]

However, even the most effective medications are limited by real-world challenges, particularly inhaler technique failure. The Indian Guidelines on Nebulization Therapy note that between 28% and 68% of patients fail to use handheld inhalers correctly.7 Furthermore, the NOVA-ER (Nebulization Optimization for Management of Obstructive Airway Disorders: An Expert Review) highlights that as many as 60% of asthma patients make at least one critical error when using pressurized metered-dose inhalers (pMDIs), leading to suboptimal disease control and increased hospitalizations.

For patients with poor hand-breath coordination, those in acute care settings, or pediatric populations unable to manage conventional devices [e.g. pMDIs or dry powder inhalers (DPIs)], nebulization therapy offers an essential alternative.[8] Nebulized formoterol–budesonide respules provide the dual benefits of rapid symptom relief and anti-inflammatory action in a single, easy-to-administer formulation.

Despite the clear clinical need for nebulized therapy, real-world evidence regarding its integration into routine practice by Indian pulmonologists remains limited. While clinical guidelines provide a framework for use, there is a lack of documented data on actual prescribing patterns, preferred dosing frequencies, and clinician-reported adherence trends within the Indian healthcare context. This survey was conducted to bridge these knowledge gaps by methodically assessing the clinical practices and perceptions of pulmonologists across India. By capturing data on prescribing frequency, patient demographics, and overall clinician satisfaction, this study aims to support evidence-informed decision-making and contribute to more personalized, patient-centric asthma care in India

METHODS

This study utilized a cross-sectional, questionnaire-based survey design to evaluate clinical practices and perceptions regarding the use of Formoterol–Budesonide (FB) respules in asthma management. The survey was conducted nationwide across India from September 2025 to October 2025. The participating pulmonologists were in the age range of 40-60 years having 10-25 years of clinical experience. The pulmonologists were recruited based on their educational qualifications and clinical experience in the field of respiratory disease management. By employing a nationwide approach rather than focusing on a single institution, the study aimed to capture a representative range of professional perspectives from various academic and clinical settings.

The survey instrument consisted of a structured, 20-item multiple-choice questionnaire developed to capture data across several key therapeutic domains. These domains included prescribing frequency and preferred patient demographics, dosage strengths and administration frequency, and the primary clinical settings for nebulization, such as home-based care, emergency, and in-patient environments.

The questionnaire also assessed perceived clinical efficacy, time to symptom relief, effectiveness in managing core symptoms like breathlessness and cough, and the observed reduction in oral steroid dependence. Additional items focused on patient adherence patterns compared to conventional inhalers, overall tolerability, and real-world cost considerations.

To ensure participant confidentiality and minimize potential response bias, the questionnaire was distributed electronically via a secure online platform. As the study consisted of a real-world observational survey of healthcare professionals and did not involve any direct patient intervention or the collection of identifiable personal data, formal ethics committee approval was not required.

All survey responses were gathered and analyzed using Microsoft Excel (2021). Descriptive statistics were employed to summarize the data, with results expressed as frequencies and percentages for each response category.

RESULTS

A total of 358 pulmonologists across India participated in this cross-sectional, questionnaire-based survey. Results are presented as frequencies and percentages across five thematic sections.

Section 1: Prescribing patterns and patient demographics

Formoterol–Budesonide respules were frequently prescribed by 58.66% of pulmonologists and occasionally by 33.80%, indicating near-universal clinical adoption. The combination was most commonly prescribed across all age groups (41.34%), followed by adults (36.31%), adolescents (14.25%), and paediatric patients under 12 years (8.10%) (Figure 1). With respect to asthma severity, the majority prescribed it for moderate-to-severe cases (42.74%), followed by all severities (29.61%) and mild-to-moderate asthma (20.95%), reflecting a predominantly severity-stratified prescribing approach (Figure 2).

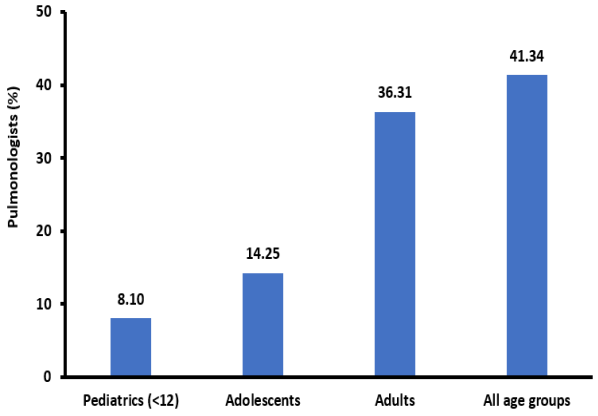

Figure 1: Distribution of nebulized Formoterol–Budesonide usage across patient age demographics.

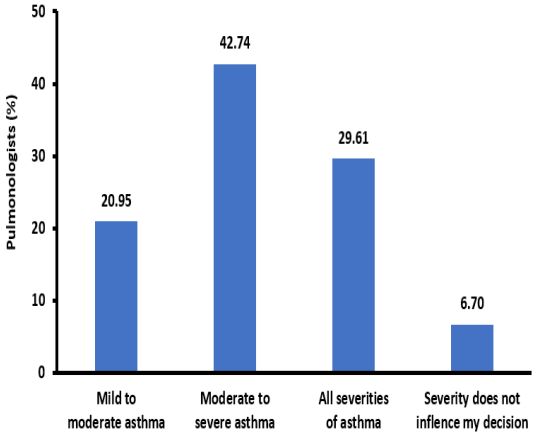

Figure 2: Asthma severity levels at the time of nebulized Formoterol–Budesonide usage.

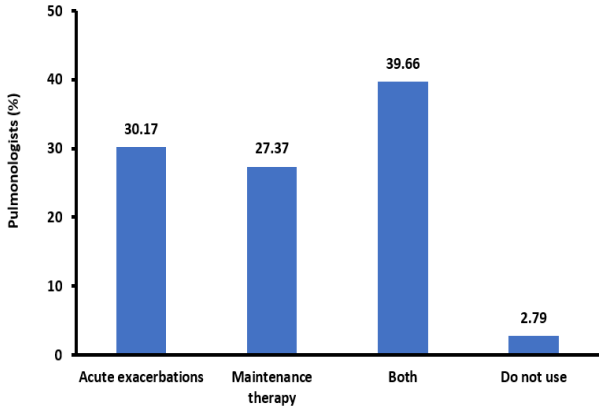

Figure 3: Clinical use settings for nebulized Formoterol–Budesonide.

Section 2: Dosing practices and clinical settings of use

In terms of dosing, the 0.5 mg formulation emerged as the preferred choice for adult patients among more than half of the respondents (53.91%), and twice-daily administration was the favoured regimen for 70.39%. Notably, nearly four in ten pulmonologists (39.66%) used the combination across both acute exacerbation and maintenance settings, while others focused on acute exacerbation alone (30.17%) or maintenance therapy alone (27.37%), underscoring its dual-purpose clinical utility (Figure 3). Home-based care was where this therapy was most frequently prescribed (30.73%), closely followed by emergency settings (28.21%), in-patient care (23.46%), and out-patient consultations (17.60%) a spread that speaks to the therapy's adaptability across diverse care environments (Figure 4).

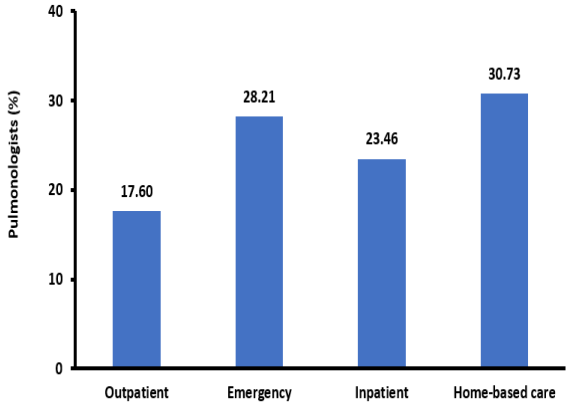

Figure 4: Distribution of primary clinical settings for nebulized Formoterol–Budesonide usage.

Section 3: Primary reasons for nebulization therapy and clinical efficacy

When asked why they chose nebulized therapy over other delivery options, nearly half of the pulmonologists (46.93%) pointed to the dual LABA + ICS pharmacological mechanism as the defining reason, while rapid symptom control (35.75%) and ease of administration (10.34%) were also frequently mentioned. The overall impression of clinical efficacy was overwhelmingly positive 94.69% of respondents rated it as either excellent (48.32%) or good (46.37%). This endorsement extended to symptomatic outcomes as well, with 87.15% reporting improved symptom control with nebulized therapy compared to conventional inhalers, either often or occasionally, reinforcing the clinical value of the nebulization route in everyday asthma care.

Section 4: Symptom control, patient adherence, and oral steroid reduction

Rapid symptom relief was a defining clinical attribute of nebulized FB therapy 47.49% of pulmonologists reported onset within 15 minutes, and a further 39.66% within 15–30 minutes, together reflecting an 87.15% rapid-response rate. Patient adherence was markedly superior with nebulization, with 53.07% observing better adherence and 39.11% noting some improvement over conventional

inhalers. Reduction in oral corticosteroid dependence was reported by 85.47% of respondents, either frequently or occasionally, underscoring a meaningful steroid-sparing effect. Notably, cough, wheeze, and breathlessness were most effectively managed together with the combination by 58.10% of respondents affirming its broad symptomatic utility. In stable patients, therapy was typically maintained for 1–2 weeks (42.46%), while exacerbation management was largely proactive, with 36.31% initiating treatment at the first sign of symptoms and 28.77% following bronchodilator failure (Table 1).

Table 1: Patient adherence, oral steroid reduction, treatment duration, and exacerbation initiation timing.

Variables	Response category	Pulmonologists (%)
Patient adherence vs. inhalers	Better adherence	53.07
	Some improvement	39.11
	Limited improvement	6.15
	No improvement	1.68
Reduction in oral steroid need	Frequently	44.1
	Occasionally	41.3
	Rarely	11.2
	Not at All	3.4
Duration of nebulized treatment	1–2 Weeks	42.46
	Depends on Response	28.77
	<1 Week	15.08
	>2 Weeks	13.69
Initiation timing in exacerbations	First sign of symptoms	36.31
	After bronchodilator failure	28.77
	On hospitalization	20.11
	After oral steroid use	11.93

Section 5: Tolerability, Safety Measures, and Patient Perceptions

On the question of safety and tolerability, the findings were reassuring 63.69% of pulmonologists found the combination to be very well tolerated and 32.40% rated it as moderately tolerated, together accounting for a strong 96.09% favourable tolerability rating. Safe practice measures were also widely observed, with 45.25% routinely advising mouth rinsing after nebulization and a further 39.66% doing so occasionally. Cost, however, remained a real-world concern, with 45.25% citing it as a frequent barrier and 39.66% as an occasional one — a gap worth addressing to improve broader accessibility. Despite these challenges, patient perception of the therapy was broadly positive: 52.79% felt that nebulized therapy was more effective than their conventional inhalers, and 33.52% found it easier to use, suggesting that patient experience aligns closely with clinical expectations (Figure 5).

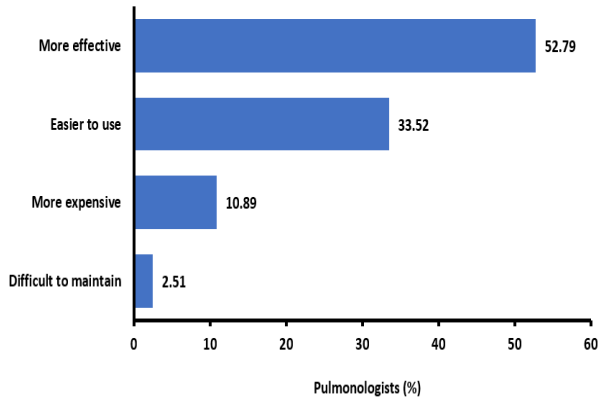

Figure 5: Patient perception of nebulized Formoterol–Budesonide therapy vs conventional inhalers.

DISCUSSION

This cross-sectional survey of 358 pulmonologists across India offers a candid, real-world picture of how nebulized Formoterol–Budesonide (FB) respules are used in everyday asthma practice. The findings, spanning prescribing patterns, clinical utility, efficacy perceptions, and tolerability, provide a useful basis for comparison with available published evidence on nebulization therapy in obstructive airway diseases.

Nebulization has an important role in asthma management, especially when inhalers are difficult to use. It does not require hand–breath coordination, making it useful for children, elderly patients, and those with severe respiratory distress or poor inhaler technique. Nebulizers can deliver medication effectively even in patients with limited lung function and can be used across home, outpatient, emergency, and inpatient settings. In India, where inhaler technique and accessibility remain challenges for many patients, nebulized therapy can offer a simple, practical, and accessible treatment option.

FB nebulization prescribing was most common across all age groups collectively (41.34%) and for adults specifically (36.31%), with considerably lower rates in adolescents (14.25%) and paediatric patients under 12 years (8.10%). This degree of caution in younger cohorts is broadly consistent with clinical guidance. The Indian guidelines on nebulization therapy position nebulized long-Acting Beta-agonists (LABA)/ICS primarily for adults, while acknowledging a specific role for paediatric patients who are unable to manage pressurized metered-dose inhalers (pMDIs).[7] The NOVA-ER expert review

similarly identifies inability to use pMDIs as one of the defined indications for nebulizer use in children.8

Asthma severity was the dominant driver of prescribing decisions, with moderate-to-severe disease accounting for the largest prescribing group (42.74%). This severity-stratified approach is well supported in the literature. NOVA-ER recommends nebulization specifically for patients experiencing acute exacerbations, severe hypoxemia, or a poor response to inhalers with spacers, Talwar and Bendre, in their Indian observational study of home nebulization in difficult-to-treat asthma, enrolled patients with precisely this level of disease severity, reinforcing that clinical seriousness is the primary trigger for this mode of delivery.[2,9]

One of the important findings was the dual therapeutic role of FB respules: nearly 40% of pulmonologists prescribed them across both acute and maintenance settings, while others used them for one or the other. The Indian guidelines describe this as a defining pharmacological strength of the combination its capacity to function simultaneously as a rescue and a controller agent, capable of replacing multiple doses of short-acting bronchodilators during acute episodes.[7] NOVA-ER reinforces this positioning, placing LABA + ICS (formoterol + budesonide) at the centre of both persistent asthma management and SOS approaches during exacerbations.8

Home-based care emerged as the most common prescription setting (30.73%), followed closely by emergency use (28.21%). The rise of home nebulization in this survey is consistent with a broader evidence-based shift. Talwar and Bendre achieved complete patient compliance (100%) with home nebulization in their difficult-to-treat asthma cohort, attributing this to the use of vibrating mesh nebulizers that require minimal inspiratory effort and no hand-breath coordination.9 The Chinese expert consensus on nebulization therapy also endorses the continuation of home-initiated nebulization during transitions from emergency to community care settings.[10]

Clinical efficacy was rated excellent or good by 94.69% of respondents a level of confidence that is well grounded in published data. Vijay et al in a prospective Indian study of FB nebulization as add-on therapy in acute exacerbation, documented significant improvements in PEFR, SpO2, and arterial blood gas values alongside a meaningful fall in mMRC dyspnea scores (3.08 to 1.37, $p<0.001$).11 In asthma specifically, Talwar and Bendre reported a 23.7% mean improvement in prebronchodilator FEV1 at 8 weeks ($p<0.001$), providing objective support for the high satisfaction levels seen here.[9] Speed of action was an equally valued attribute 87.15% of pulmonologists reported symptom relief within 30 minutes, with nearly half (47.49%) observing relief within 15 minutes. The Chinese expert consensus corroborates this, noting that budesonide achieves clinically meaningful anti-inflammatory effects within the first 1–2 hours of inhalation, faster than systemic glucocorticoids.[10]

Adherence stood out as a practical advantage of nebulized therapy, with 92.18% of pulmonologists noting better or some improvement compared to conventional inhalers. NOVA-ER reports that 60–75% of patients prefer nebulizers over inhalers, and that around half of those with residual symptoms on inhaler therapy benefit meaningfully from switching to home nebulization.8 Talwar and Bendre demonstrated this concretely, with full adherence maintained throughout their 8-week observational study.[9] These findings carry particular weight in India, inherent limitations of Inhalers leads to decrease efficacy due to poor technique, limited education, and physical or cognitive barriers continues to undermine therapeutic outcomes across a large patient population.

The steroid-sparing potential of nebulized FB was another meaningful finding: 85.47% of pulmonologists reported reduced oral corticosteroid use, either frequently or occasionally. The Chinese expert consensus provides mechanistic grounding for this, establishing that 8 mg of nebulized budesonide is clinically equivalent to 40 mg of systemic prednisolone in acute exacerbation, and that inhaled ICS can appropriately replace systemic glucocorticoids in selected patients.[10] The Indian guidelines similarly recognize this steroid-sparing benefit of nebulized ICS/ long-Acting Beta-agonists (LABA) combinations.[7] Tolerability was excellent overall, with 96.09% of pulmonologists rating the combination as very well or moderately tolerated. This is in keeping with the safety profiles reported by Vijay et al., who found adverse reactions to be predominantly moderate and non-severe, and by Talwar and Bendre, who recorded no serious adverse events in their entire cohort.[11,9] The overall advantages of FB nebulization reported by Pulmonologists in this survey are shown in Figure 6.

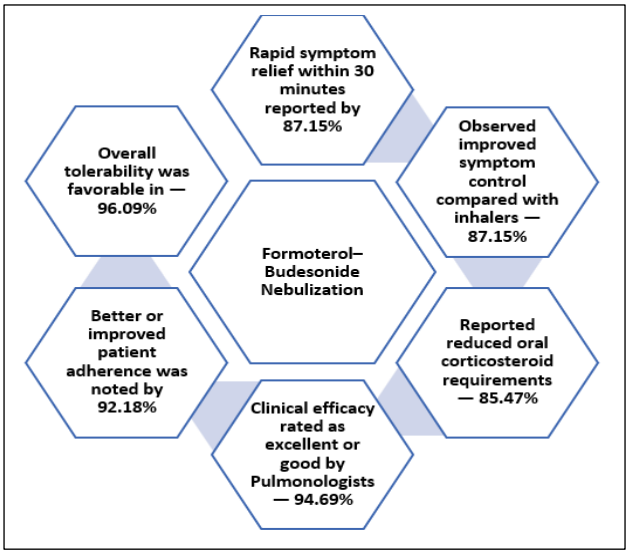

Figure 6: Overall advantages of formoterol-budesonide nebulization reported by pulmonologist.

Cost remains a meaningful barrier, cited as a frequent limitation by 45.25% of pulmonologists and as an occasional one by a further 39.66%. While this does not diminish the clinical value of the therapy, it points to a healthcare access gap that deserves policy attention particularly given that the patients most in need of nebulized therapy are often those with the most advanced disease and the least financial flexibility. NOVA-ER acknowledges that patient selection, device affordability, and sustained education are essential components of any successful home nebulization programme.[8]

This survey has some limitations worth acknowledging. Being cross-sectional and questionnaire-based, it captures physician perceptions rather than objective clinical outcomes, and response or recall bias cannot be fully excluded. The study reflects the views of pulmonologists only and does not include general practitioners or other asthma prescribers. Future prospective studies incorporating objective outcome measures and a wider prescriber mix would help to extend and validate these real-world observations.

CONCLUSION

Nebulized Formoterol–Budesonide are widely used by Indian pulmonologists and are perceived as an effective, well-tolerated, and adherence-friendly therapeutic option for asthma management across acute and maintenance settings

ACKNOWLEDGEMENTS

The authors sincerely thank all the Pulmonologists across India who participated in this survey. Their valuable time, clinical insights, and contributions were essential in shaping the findings of this study.

Funding: This study was funded by Mankind Pharma Ltd
Conflict of interest: Dr. Kunal Khobragade and Nitinkumar S. Doshi are the employees of Mankind Pharma Ltd
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Doshi NS, Natarajan S, Khobragade K. Clinical use of formoterol–budesonide through nebulization in asthma management: a nationwide survey of Indian pulmonologists. Int J Res Med Sci 2026;14:5174-9.