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Original Research Article

Physician perspectives on spacer device usage, prescription patterns, and clinical decision-making factors in the management of respiratory conditions: a nationwide, multicenter cross-sectional observational study

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ABSTRACT

Background: Pressurized metered-dose inhalers (pMDIs) are widely used for delivering bronchodilators and corticosteroids; however, their effectiveness is often compromised by poor inhalation techniques, leading to inadequate drug deposition in the lungs and suboptimal disease control. Spacer devices, including valved holding chambers (VHCs), are designed to overcome these challenges by improving aerosol delivery, reducing oropharyngeal deposition, and enhancing treatment adherence in patients with respiratory conditions. This survey aimed to assess physicians' perspectives on the usage, prescription patterns, and decision-making factors associated with spacer devices in respiratory conditions.

Methods: A cross-sectional survey was conducted among qualified medical practitioners using a structured questionnaire. Data on demographics, indications, and perceptions regarding spacer use were collected from 6,787 respondents.

Results: Chest physicians constituted the largest respondent group (n=3,261). Nearly 80% of clinicians reported frequently or occasionally recommending spacer devices. Spacer use was most commonly associated with asthma maintenance therapy (n=5,214), acute asthma (n=3,861), and chronic obstructive pulmonary disease (COPD) (n=4,460). Key factors influencing prescription included disease severity, patient age, and the patient's ability to use inhalers correctly. Major barriers identified were lack of patient/caregiver awareness, poor inhaler technique, and high device cost. Most respondents considered spacers more effective than nebulizers, and cylindrical spacers were the preferred design.

Conclusions: The findings demonstrate widespread acceptance of spacer devices in respiratory care, particularly in asthma and COPD management. However, gaps in patient education, inhaler technique, and accessibility remain important barriers, highlighting the need for improved awareness initiatives and user-friendly spacer designs to optimize treatment outcomes.

Keywords: Asthma, Valved holding chamber, Inhaler technique, Aerosol therapy

INTRODUCTION

Asthma and chronic obstructive pulmonary disease (COPD) are among the most prevalent obstructive airway disorders and constitute a major global public health challenge. Both diseases are associated with chronic airway inflammation, airflow limitation, recurrent respiratory symptoms, and episodic exacerbations, which collectively contribute to reduced quality of life, disease-related morbidity, and substantial healthcare expenditure.

Inhaled therapy remains central to the management of these conditions because it permits direct delivery of pharmacological agents to the respiratory tract with comparatively lower systemic exposure. pMDIs continue to be extensively prescribed for delivering bronchodilators and inhaled corticosteroids. Nevertheless, the effectiveness of pMDI-based therapy is frequently constrained by improper inhaler technique, particularly poor coordination between actuation and inspiration. Such technique-related errors can reduce the fraction of drug deposited in the lower airways, thereby limiting therapeutic benefit and contributing to inadequate disease control.[1-3]

Spacer devices, particularly VHCs, were introduced to overcome key limitations associated with pressurized metered-dose inhaler use and to enhance the efficiency of aerosolized drug delivery. These devices function as an intermediate holding chamber between the inhaler and the patient, allowing temporary retention of the aerosol plume before inhalation.[4] This design reduces dependence on precise actuation-inhalation coordination, limits inertial impaction and drug deposition within the oropharynx, and facilitates a greater fraction of respirable particles to reach the lower airways. As a result, spacers have become an important adjunct to inhaled therapy and are recognized in several national and international recommendations as a practical approach to improving inhaler performance and therapeutic outcomes. Their use is especially relevant in children, older adults, and patients with suboptimal inhaler technique, reduced inspiratory coordination, or difficulty achieving effective drug delivery using a pMDI alone.[5]

Evidence from clinical studies supports the role of spacer devices as effective adjuncts to inhaled therapy. Spacer-assisted delivery can enhance the respirable fraction of aerosolized medication reaching the lower respiratory tract, improve symptom control, reduce exacerbation frequency, and decrease drug deposition in the oropharynx, thereby limiting local corticosteroid-associated adverse effects.[6,7] By improving the consistency and efficiency of drug delivery, spacers may also contribute to better adherence and more effective use of both rescue and maintenance inhaled medications in patients with asthma and COPD. In emergency and acute care settings, pMDI therapy delivered through a spacer has been shown to achieve bronchodilator responses comparable to nebulization in appropriately selected patients, with additional advantages including greater convenience, portability, reduced administration time, and lower healthcare costs.

Although spacer devices are clinically valuable adjuncts to inhaled therapy, their integration into routine clinical practice remains inconsistent. Prescribing decisions are shaped by several interrelated factors, including patient age, severity of airway disease, ability to perform correct inhaler technique, cognitive and physical limitations, adherence patterns, and previous familiarity with inhalation devices. In addition, spacer-related characteristics such as design, chamber volume, portability, durability, ease of cleaning, inhaler compatibility, and cost may influence both physician prescribing behavior and patient willingness to use the device.[8] This multidimensional decision-making process may contribute to heterogeneity in spacer prescription patterns across specialties, healthcare settings, and clinical practice environments.

Despite guideline-based recommendations supporting spacer use with pMDIs in appropriately selected patients, implementation in routine clinical practice remains suboptimal. The persistent gap between recommendations and real-world use is likely multifactorial, reflecting inconsistent inhaler technique education, insufficient training of patients and caregivers, limited awareness of the clinical role of spacers, and heterogeneity in prescribing behavior among healthcare professionals.[9,10] Additional barriers, including patient preference, adherence challenges, cost considerations, device availability, and misconceptions about spacer efficacy, may further limit acceptance and long-term use. Addressing these factors is essential to improve the integration of spacer devices into standard inhalation therapy and to optimize treatment outcomes in obstructive airway diseases.[11,12]

While the clinical and technical advantages of spacer devices have been widely investigated, comparatively fewer studies have explored how physicians perceive their role in everyday clinical practice. Physician-related factors, including awareness, prescribing preferences, interpretation of patient needs, and perceived barriers to device use, may substantially influence whether spacers are recommended and consistently adopted. Evaluating these perspectives is therefore essential to better understand gaps between guideline recommendations and real-world implementation. Furthermore, evidence derived from controlled study settings or limited geographic regions may not fully reflect the variability in clinical practice across broader healthcare environments.

Against this background, the present nationwide, questionnaire-based, cross-sectional study was designed to assess physicians' perspectives on spacer device utilization, prescription patterns, and decision-making factors in the management of respiratory conditions. The study also sought to evaluate perceived clinical benefits, identify barriers limiting routine use, and determine potential areas for intervention to enhance spacer adoption and optimize inhalation therapy in real-world respiratory care.

METHODS

This study was designed as a descriptive, questionnaire-based cross-sectional survey conducted among qualified medical practitioners who agreed to participate and provided informed consent. A total of 6787 medical practitioners completed the questionnaire, and their responses were considered for final analysis.

The survey tool comprised eight structured, multiple-choice questions. The questionnaire was developed following initial discussions with experts in pulmonology to identify key clinical challenges and unmet needs related to spacer usage in routine clinical practice. Based on these expert inputs, the questionnaire was refined to ensure clinical relevance, clarity, and ease of completion.

The study was conducted at multiple centres in India (n=525). The study was conducted from April 2025 to March 2026. The finalized questionnaire was executed through digital platform. Responses were collected electronically and subsequently exported to Microsoft excel for data compilation and management. Data analysis was performed using descriptive statistical methods, with results expressed as frequencies and percentages to summarize the distribution of responses.

Ethical considerations

The study protocol was reviewed by an independent ethics committee, and the study was granted an ethics committee waiver, as the survey was non-interventional, anonymized, and involved no patient data. Participation was entirely voluntary, and electronic informed consent was obtained from all respondents prior to survey initiation. Confidentiality and anonymity of participants were strictly maintained throughout the study.

RESULTS

As shown in Figure 1, among the respondents (n=6787), chest physicians constituted the largest group (n=3261), followed by consultant physicians (n=1677) and pediatricians (n=1077), while general practitioners (n=574) and others (n=198) including cardiologists, otolaryngologists and surgeons represented a smaller proportion of the study population.

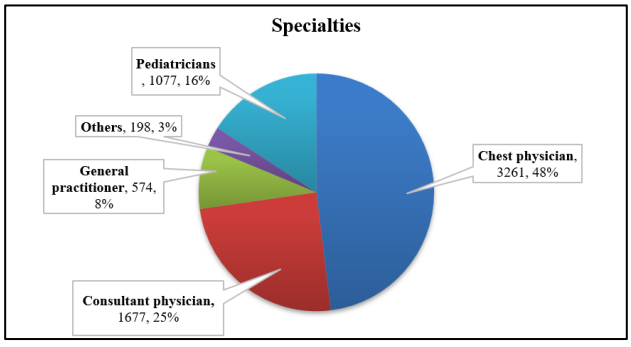

Figure 1: Specialties of participants.

Recommended usage of spacers (for both adults and children)

As depicted in Figure 2, a total of 6,787 responses were analyzed to assess the frequency of recommending spacer devices for patients across adult and pediatric populations. The findings indicate that 44.8% (n=3,039) of respondents reported frequently recommending spacer devices (for 76-100% of patients), while 35.0% (n=2,376) indicated occasional use (51-75% of patients). Additionally, 18.9% (n=1,286) of clinicians reported rarely recommending spacers (26-50% of patients).

Only a small proportion, 1.3% (n=86), stated that they never recommend spacer devices (0-25% of patients). Overall, the results demonstrate that a substantial majority of clinicians (approximately 80%) incorporate spacer devices into their practice either frequently or occasionally.

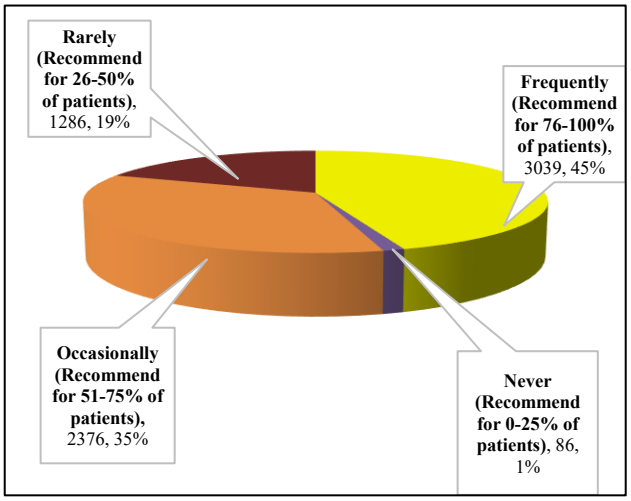

Figure 2: Frequency of recommending spacer devices.

Common conditions requiring spacer usage

For the question on conditions for which spacer devices are typically recommended, the responses indicate that spacer use is most associated with asthma management. A total of 5,214 respondents reported recommending spacers for asthma maintenance treatment, while 3,861 recommended their use for acute asthma treatment, highlighting their broad role across both chronic and acute care settings.

Additionally, 4,460 respondents indicated the use of spacers in COPD, suggesting substantial adoption beyond asthma. In contrast, a relatively lower proportion (n=1,602) reported recommending spacers for respiratory infections.

Overall, the findings demonstrate that spacer devices are predominantly utilized in asthma care, with considerable use in COPD, while their role in respiratory infections appears more limited (Figure 3).

Factors deciding use of spacer

The decision to prescribe spacer devices was strongly influenced by the severity of the condition (n=4,569) and age of the patient (n=4,511). Other important factors included the patient's ability to use inhaler devices

correctly (n=3,749) and the type of medication prescribed (n=2,911), while cost considerations (n=1,929) and parental/caregiver ability to assist (n=1,202) were less frequently reported influences, as shown in Figure 4.

Barriers to prescribing spacer devices

The most participants reported barriers to prescribing spacer devices were lack of patient or caregiver awareness/education (n=5,064) and lack of compliance or poor inhaler technique (n=4,381), followed by the high cost of the device (n=3,956). Other factors such as perceived ineffectiveness (n=2,007) and availability of alternative devices like nebulizers (n=1,635) were less frequently cited (Figure 5).

Proper usage of spacer

Regarding the observation of proper spacer usage among patients, 39.0% (n=2,633) of respondents reported that patients occasionally use spacers correctly, while 37.0% (n=2,497) observed frequent correct usage. However, 21.8% (n=1,474) indicated that proper usage is rare, and a small proportion, 2.7% (n=183), reported that it is never observed. Overall, these findings suggest that while correct spacer usage is commonly observed, there remains a notable gap in consistent and optimal technique among patients (Figure 6).

Comparison with Nebulizer

Most respondents(n=4911) believed that spacers are more effective than nebulizers indicating a clear preference for spacers among the surveyed group.

Factors influencing prescription of spacer

Among the factors influencing spacer device prescription, the patient's ability to use inhalers correctly was identified as the most important consideration by the majority of respondents (n=2706). This was followed by the severity of the respiratory condition (n=1344) and the age of the patient (pediatric vs. adult) (n=1182). In contrast, clinical guidelines and recommendations (n=132) and availability of the spacer device (n=192) were the least frequently selected factors.

Required improvement in spacer device

The most commonly identified improvement needed in spacer devices was improved design for ease of use, including simpler mechanisms and lighter weight (n=4349). This was followed by better patient/caregiver education materials (n=3780), more size options for different patient groups (n=3276), and higher durability with easier cleaning (n=3008).

In comparison, portability and compactness for travel (n=1223) and wider compatibility with inhaler devices (n=1478) were less frequently prioritized by respondents.

Choice of spacer based on shape

The cylindrical shape was the most prescribed spacer-device among respondents (n=4934), substantially exceeding the preference for conical/diamond-shaped devices (n=1853).

Marketing and educational support

Most respondents believed that spacer devices are adequately marketed and supported with educational materials for both healthcare professionals and patients (n=4917 ;72.5%). In contrast, 1038 respondents (15.3%) felt that the support was inadequate, while 832 respondents (12.3%) were uncertain about the adequacy of current marketing and educational efforts.

Overall, the findings demonstrate widespread acceptance and utilization of spacer devices in routine respiratory care, particularly in asthma and COPD management, while also highlighting the continued need for improved patient education, device usability, and accessibility to optimize clinical outcomes.

Table 1: Factors influencing spacer device prescription.

What is the most important factor you consider before prescribing a spacer device to your patients?	No. of respondents
Patient compliance with the inhalation therapy	833 (12.27%)
Cost of the spacer device	398 (5.86%)
Severity of the respiratory condition	1344 (19.80%)
Patient's ability to use inhalers correctly	2706 (39.87%)
Clinical guidelines and recommendations	132 (1.94%)
Age of the patient (Pediatric versus adult)	1182 (17.42%)
Availability of the spacer device	192 (2.83%)
Total	6787

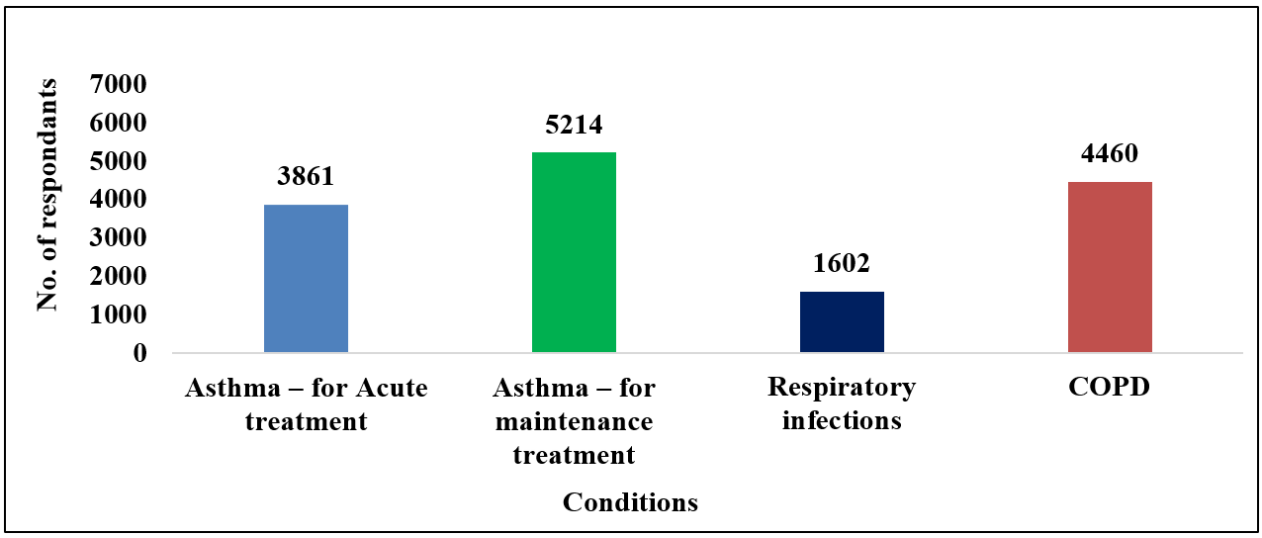

Figure 3: Conditions for which spacer devices are typically recommended.

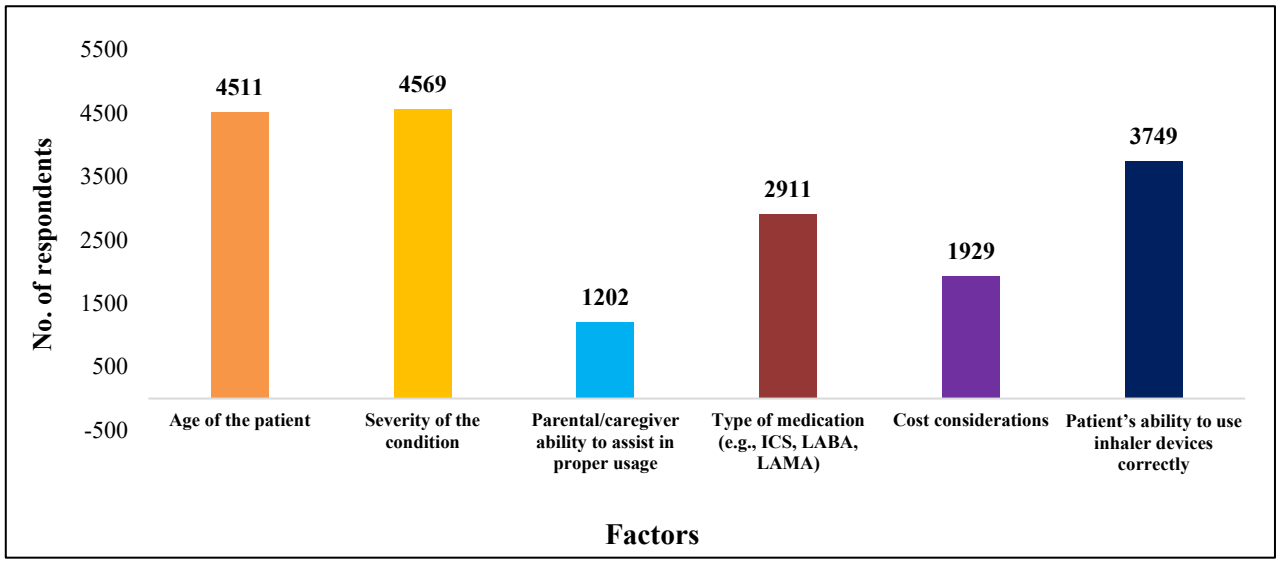

Figure 4: Factors influencing spacer device recommendations.

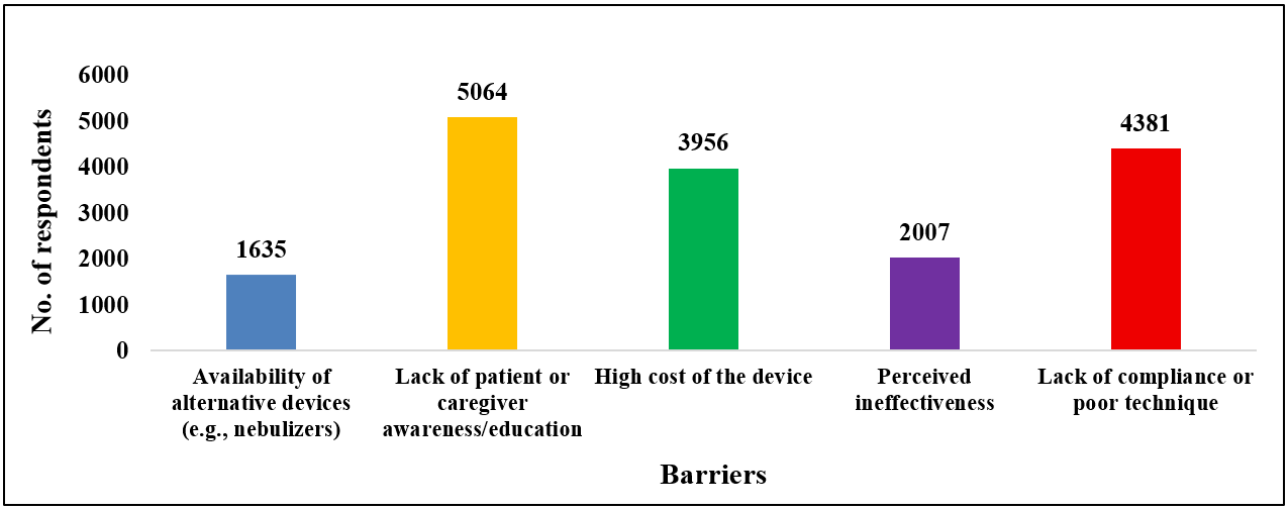

Figure 5: Barriers to prescribing spacer devices.

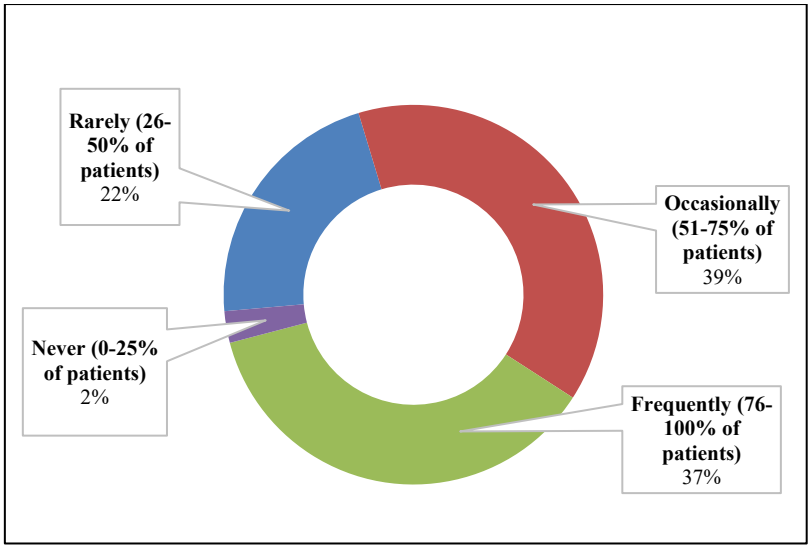

Figure 6: Percentage of patients using space correctly.

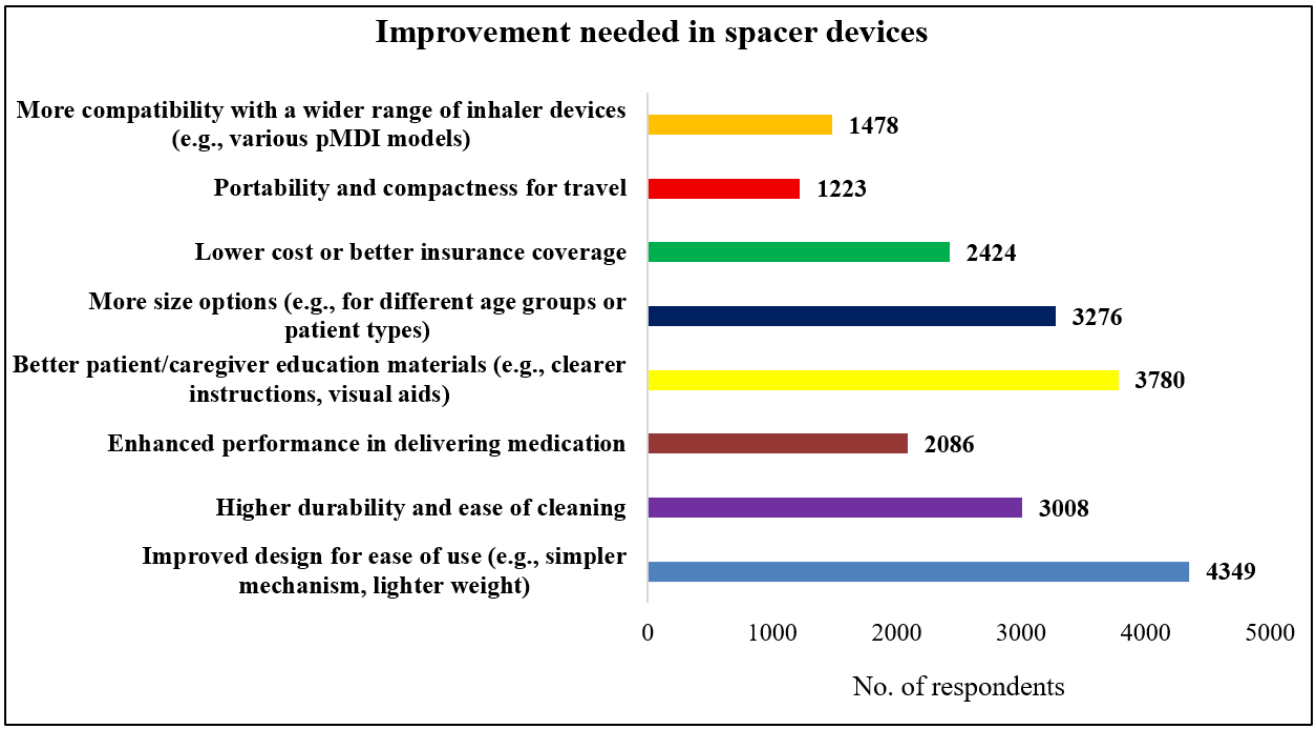

Figure 7: Improvement needed in spacer devices to enhance their use and effectiveness.

DISCUSSION

This nationwide, multicenter, cross-sectional survey provides comprehensive insights into physician perspectives, prescribing practices, and clinical decision-making factors related to spacer device use in respiratory diseases. The large sample size and inclusion of multiple specialties involved in respiratory care provide a representative overview of contemporary clinical practice. Overall, our findings demonstrate widespread acceptance of spacer devices in routine care, particularly for asthma and COPD, while also highlighting persistent challenges related to patient education, inhaler technique, device usability, and affordability.

A key finding of the present study is the high prevalence of spacer recommendation, with nearly 80% of physicians reporting frequent or occasional use. This observation is consistent with current international recommendations advocating spacer use with pMDIs, particularly among children and patients with poor inhaler coordination. The Global Initiative for Asthma (GINA) recommends spacer devices to improve pulmonary drug deposition and reduce oropharyngeal drug exposure.[11] Similarly, evidence-based

aerosol delivery guidelines recognize spacers as important adjuncts for optimizing inhaled medication delivery.[14]

Asthma was the most common condition for which spacer devices were prescribed in our survey, both for maintenance and acute management. This finding aligns with established evidence supporting spacer-assisted inhalation therapy in asthma. A Cochrane review demonstrated that pMDI-spacer therapy provides clinical outcomes comparable to nebulization for acute asthma treatment in both adults and children, while offering advantages such as lower costs and shorter treatment times.[15] Amirav and Newhouse further reported that spacer-assisted inhalation therapy represents an effective alternative to nebulizer treatment in acute asthma care.[16]

A substantial proportion of physicians also reported recommending spacers for COPD management. Although spacer use has traditionally been emphasized in asthma, many COPD patients experience difficulties with inhaler coordination and drug delivery. Melani et al demonstrated that inhaler mishandling is highly prevalent among patients with chronic respiratory diseases and is associated with poorer disease control.[17] Similarly, Rau highlighted the challenges of aerosol therapy in COPD and emphasized the importance of interventions that improve inhaler technique.[18]

In the present survey, disease severity, patient age, and inhaler technique were identified as major determinants of spacer prescription. Notably, the patient's ability to use inhalers correctly was considered the most important factor influencing prescribing decisions. This finding is consistent with previous studies showing that improper inhaler use adversely affects treatment outcomes. Giraud and Roche reported that inhaler misuse is associated with poorer asthma control, while Molimard et al observed high rates of inhaler handling errors in routine clinical practice.[19,20] Furthermore, a systematic review by Chrystyn et al confirmed that inhaler device errors remain common and contribute significantly to poor disease control in both asthma and COPD.[21]

Despite widespread acceptance of spacer devices, several barriers to their utilization were identified. Lack of patient or caregiver awareness and poor inhaler technique were the most commonly reported obstacles. Similar findings have been reported globally. Sanchis et al demonstrated that critical inhaler errors remain highly prevalent despite advances in inhaler technology and patient education.[22] Likewise, the CRITIKAL study identified a strong association between inhaler technique errors and poor asthma outcomes.[23]

The survey further revealed that correct spacer use is not consistently observed among patients. While many physicians reported frequent correct usage, a substantial proportion observed proper technique only occasionally or rarely. These findings are supported by Usmani et al who showed that inhalation errors significantly reduce drug deposition and negatively affect clinical outcomes in asthma and COPD.[3]

Cost was another important barrier identified by respondents. Although spacer devices are generally considered cost-effective because they improve medication delivery and may reduce exacerbation-related healthcare utilization, their upfront cost may limit adoption in resource-constrained settings.[15,16]

Most physicians perceived spacers to be more effective than nebulizers. This observation is supported by evidence demonstrating therapeutic equivalence between spacer-assisted pMDIs and nebulizers for many respiratory indications, with spacers offering additional advantages including portability, convenience, shorter administration times, and lower overall treatment costs.[15,16]

Spacer devices should be viewed as a practical adjunct in routine inhaled therapy because they help overcome one of the most common barriers to effective pMDI use, namely poor coordination between actuation and inhalation. By reducing oropharyngeal deposition and improving lung delivery, spacers can improve treatment efficiency, especially in patients who struggle with inhaler technique, young children, and those receiving higher-dose bronchodilator or corticosteroid therapy. Their value is not limited to asthma alone; in real-world respiratory care, spacers may also be useful in selected COPD patients when inhaler handling is suboptimal, although correct patient education and repeated technique review remain essential for sustained benefit. Cost, convenience, and ease of use further support their role, but these advantages are realized only when patients and caregivers are trained to use the device properly.[24,25]

Limitations

As a questionnaire-based cross-sectional survey, the study relied on self-reported physician perceptions and prescribing practices, which may be subject to recall bias and may not necessarily reflect actual clinical outcomes or real-world patient adherence.

CONCLUSION

To conclude, this nationwide survey highlights cefpodoxime as a widely preferred and commonly used antibiotic among pediatricians for managing pediatric infections, particularly respiratory tract infections. High perceived efficacy, favorable safety, and improved compliance driven by palatability contributed to strong clinician satisfaction, supporting cefpodoxime as an effective and practical option in routine pediatric practice.

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Ethical approval: The study was approved by the Independent Ethics Committee

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