

# Perceptions and Attitudes of Patients and Their Family Caregivers on Nebulization Therapy for COPD

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**Purpose:** The aim of the survey was to evaluate attitudes and perceptions toward nebulization therapy for the management of chronic obstructive pulmonary disease (COPD) in Indian population.

**Patients and methods:** A cross-sectional, multicenter, quantitative survey was conducted from July to August 2019 among 103 COPD patients [ $>40$  years, either gender, belonging to socio-economic class (SEC) A or SEC B] and their family caregivers. One-on-one interviews were conducted telephonically via an online survey platform (KoBo data collection tool) using a structured questionnaire. Patients receiving home nebulization were included, and the usage of nebulizers, satisfaction, and benefits and concerns with nebulizers were assessed.

**Results:** Overall, 47% patients were on handheld inhalers + nebulizer, 54% used nebulizer for  $>8$  weeks, and 27% used nebulizers daily for home maintenance. Majority of the patients (77%) were satisfied with nebulization therapy. Around 70% family caregivers opined that the quality of life of COPD patients improved post-nebulization therapy. The benefits of nebulizers perceived by patients were easier breathing (89%), feeling of well-being (86%), and ease of use (86%), while family caregivers reported reduced hospitalization (76%) and easier breathing (75%). Among those with prior experience with inhalers, 72% felt nebulizers gave long-term relief, while 65% perceived having immediate relief compared to inhaler. Overall, 61% opined that benefits with nebulizers outweighed the inconvenience associated with its use. Key concerns regarding nebulizers cited by patients were time-consuming procedure (50%), feeling of dependency (49%), and social embarrassment (48%), while family caregivers highlighted social embarrassment (45%) and multiple daily use (45%) as major concerns. Majority of the patients (73%) were compliant with their recommended frequency of the nebulizer.

**Conclusion:** This first-of-its-kind survey highlights that the majority of patients and family caregivers were satisfied with nebulizers and reported improvements in symptoms and reduced hospitalizations with nebulizer therapy. The patients preferred nebulized therapy to inhalers.

**Keywords:** nebulization, quality of life, home nebulization, nebulizer device, quantitative survey, satisfaction, patient perception, patient attitude

## Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive disease that is characterized by an irreversible obstructive ventilatory pattern, which may lead to chronic respiratory failure.<sup>1,2</sup> The 2020 Global Burden of Disease data reported an increase of 39.8% in the prevalence of chronic respiratory disease compared with its prevalence in 1990, with a disease burden of 544.9 million people globally. The global prevalence rate of COPD is 55.1% and 54.8% of all chronic respiratory diseases among males and females, respectively.<sup>3</sup> The COPD burden in India is estimated to be 55.3 million, with the prevalence rate varying from 2% to 22% in males and 1.2% to 19% in females.<sup>4,5</sup>

The current management modalities for COPD incorporate mitigation of the disease progression and alleviation of symptoms. The major drug classes used for COPD include short- and long-acting bronchodilators, corticosteroids, mucolytics, phosphodiesterase-IV inhibitors, and antibiotics during acute exacerbations.<sup>6-8</sup> Bronchodilators and steroids are the

mainstay of treatment, and are given through inhalation devices, which includes dry powder inhalers (DPIs), pressurized metered dose inhalers (pMDIs), and nebulizers. The choice of a particular device depends on various factors including, but not limited to, device/drug availability, portability, patient age, ability to use device correctly, convenience of device usage, availability, cost, durability, ease of dose preparation, rapid medication administration, and physician and patient preference.<sup>9–11</sup>

Patients with COPD represent a medically diverse population with varying lung function, comorbidities, and lifestyle; these factors impact the patients' ability to use a specific inhaler device correctly.<sup>12</sup> Additionally, cognitive impairment also leads to low treatment adherence and impacts the proper use of a specific inhalational device due to improper inhaler technique in patients with COPD.<sup>13</sup> The commonly used pMDIs and DPIs are associated with certain drawbacks such as needing hand-breath coordination, minimum inspiratory flow, the ability to perform a rapid and deep inspiration (to achieve adequate drug delivery with DPIs), and non-suitability for elderly and hospitalized patients.<sup>8,12,14,15</sup> Maintenance therapy with nebulizers is being increasingly used, especially for the elderly patients who are unable to use inhaler devices, in those patients who possess limited motor and cognitive functions, and those with recurrent exacerbations.<sup>16</sup> Nebulizers do not need a special breathing technique as the drug is delivered over tidal breathing and can be taken over multiple breaths; however, they need longer time for the administration of drugs, have device portability limitation, and the device needs cleaning and maintenance.<sup>12,14</sup>

Patients with COPD often have members of their family acting as informal caregivers, and they form an important part of the decision-making process for the patients.<sup>17</sup> Hence, the perceptions and attitudes of patients as well as caregivers toward a particular inhalational therapy device are important.<sup>18</sup> While the inhaled forms of therapies have proven as effective modes of drug delivery,<sup>14</sup> there is limited evidence regarding the patient's and family caregiver's perspectives toward these inhaler devices in the Indian scenario.<sup>19</sup>

Therefore, the present survey was conducted with the aim to evaluate the attitudes and perceptions toward nebulization therapy for the management of COPD in Indian adult COPD patients and their family caregivers.

## Methods

### Survey Design and Population

A cross-sectional, multicenter, quantitative survey was conducted between July and August 2019 in 13 cities across the 4 zones (North, South, East, and West) of India. The survey included 103 patients with COPD and their family caregivers. The patient sample was distributed across geographies, gender and socio-economic class (SEC) to eliminate biases. The minimum sample required for analysis was considered at each cut, which was 30. The sample was selected randomly from IQVIA database, and respondents were then identified and recruited based on a series of screening questions. The eligibility criteria for patients included adult patients with COPD aged >40 years; having COPD for >2 years; received home nebulization for COPD in the last 3 months (>3 weeks); should have used other forms of inhalation therapy like, pMDI, or DPI; patients belonging to SEC A and B. Any patient who agreed to be a part of the recruitment and was eligible as per the screening criteria was recruited for the interview. Beyond screening (inclusion/exclusion criteria), there was no other bias involved. The SEC were classified according to Market Research Society of India guidelines<sup>20,21</sup> and defined based on the criteria of education, occupation of the chief wage earner (CWE) along with the predefined list of items owned by any member of the family. SEC A and B included patients who had a minimum of higher secondary certificate (HSC) qualification, were businessmen with more than 1 employee, shop owners, self-employed professionals, and supervisors or executive (junior, middle, and senior levels). All the family caregivers included in the survey were of the patients with aforesaid eligibility criteria. The family caregivers answered questions around the patients, including their nature and frequency of symptoms, usage of inhalers, nebulizers, etc. The family caregivers were also identified based on their gender, SEC, whether they lived with the patients, their relationship with the patients, duration of providing caregiving activity, hours dedicated per week, and type of activities they were involved with.

## Ethical Considerations

The study was approved by the Conscience Independent Ethics Committee, Ahmedabad, Gujarat, India (Registration Number: ECR/233/Indt/GJ/2015/RR-18). Written informed consent was obtained from the patients and their family caregivers for their participation in the survey prior to the commencement of the study. The research adhered to the tenets of the Declaration of Helsinki and ethics approval of the survey was obtained from an independent external ethics committee to eliminate any possible bias. The survey was conducted in accordance with the Market Research Society's Code of Conduct,<sup>20,21</sup> and the participants were compensated for their time based on patient's SEC level and the length of interview.

## Data Collection

One-on-one interviews with patients and their family caregivers were conducted telephonically via an online survey platform (KoBo data collection tool) using a structured questionnaire. Links were sent to the respondents; however, responses were filled by the interviewer in the link provided by asking the questions on phone to the respondents. The patients and the family caregivers were interviewed independently. The overall duration of the interview was less than 30 minutes. The following information was collected from the patients: usage of home nebulization therapy for the management of COPD in different situations; frequency and duration of use; and benefits and concerns while using nebulizers. The patient's satisfaction level for home nebulization therapy was assessed using a 10-point scale, where 1 denoted "not satisfied" and 10 denoted "extremely satisfied". The satisfaction rating with activity done by family caregivers and compliance with nebulization therapy in patients with COPD were also determined. The following information was collected from the family caregivers: their key role in assisting patients with COPD, in terms of accompanying patients to healthcare providers, assembling the nebulizer and air compressor, cleaning of nebulizer, cleaning the nebulizers as advised by healthcare professional (HCP); number of years they have been involved in assisting patients; the number of hours in a week they spent in assisting; impact of COPD patient burden on family caregivers' quality of life (QoL); opinion on nebulization therapy in terms of frequency and duration; benefits and concerns while using nebulizers for patients with COPD.

## Statistical Analysis

The responses of the interviews were scrutinized, and 30% of the responses were backchecked. The patients and their family caregivers were contacted only once during their participation in the survey. However, to cross-check the responses and data, around 30% of the responses were backchecked by randomly calling them. The collected data were analyzed in simple proportions. The data were segregated into different themes such as patient profile; use of nebulization therapy; benefits and concerns; satisfaction with current therapy—each parameter was considered for both patients and their family caregivers. Further, subgroup analysis of patients with COPD, using nebulizers daily for home maintenance (for more than 3 weeks), was also performed. Concordance/discordance analysis was performed among the responses of the patients and family caregivers for the common questions, including severity of breathlessness, factors motivating use of nebulizers, concerns while using nebulizers, type of activities, which family caregivers were involved in, and compliance related to nebulization.

## Results

### Profile of Patients and Family Caregivers

#### Patient Demographics

A total of 103 patients aged 40 to 80 years (mean age =  $56 \pm 11.36$  years) were included in the survey. The proportion of male and female patients were 53% and 47%, respectively. Overall, 54% patients were from SEC A group, while 46% patients were from SEC B group. [Table 1](#) provides the demographics of patients with COPD.

#### Patient Profile

Overall, 46% of the patients suffered from COPD symptoms for more than 5 years (mean duration of COPD =  $6 \pm 3.83$  years). Further, 30% and 29% of the patients reported episodes of breathlessness once a week and once daily,

**Table 1** Demographics of Patients Included in the Survey

Characteristics	Subcategory	Patients
Gender	Male	53%
	Female	47%
Age (years)	40–50	36%
	51–60	23%
	61–70	31%
	71–80	10%
SEC	SEC A	54%
	SEC B	46%
Education of CWE of the household	Graduate/postgraduate – general	51%
	SC/HSC	21%
	Graduate/postgraduate – Professional	14%
	College, but not graduate	13%
Occupation of the CWE	Shop owners	27%
	Officer/executives: middle/seniors	17%
	Officer/executives: juniors	14%
	Businessmen/industrialist (with 1 to 9 employees)	13%

**Abbreviations:** CWE, chief wage earner; SC, secondary certificate; HSC, higher secondary certificate; SEC, socio-economic class.

respectively. The children (son/daughter) (40%) and spouse (36%) emerged as the main family caregivers for the patients with COPD. Overall, the highest proportion of key influencers were doctors (41%), followed by spouse (23%).

### Profile of Family Caregivers

Overall, 33%, 30%, and 21% of the family caregivers were spouse, parents, and children of the patient, respectively. Majority (85%) of the family caregivers had spent more than 6 months as family caregivers. Overall, 50% of the family caregivers mentioned that patients had symptoms even after walking for 100 meters or after a few minutes. Twenty-eight percent of male patients reported a higher severity of breathlessness (28%), as compared to that reported by family caregivers (16%). Among female patients, the claimed severity was lesser (20%) than that reported by family caregivers (35%). [Table 2](#) represents the patient and family caregiver profiles in the overall and subgroup population.

### Usage of Nebulization Therapy

Overall, 47% of the patients were prescribed medications to be taken via inhaler in addition to nebulization, while 28% of the patients were prescribed oral medications along with inhalers and nebulization. Further, 53% of the patients used nebulization therapy both for emergency purposes and for maintenance/regular use. Overall, 54% of the patients were using nebulizers for home nebulization for >8 weeks (>2 months), while 27% of the patients used nebulizers on a daily basis for home maintenance nebulization. The majority of the patients (83%) had been prescribed inhaler therapy in the past. Nearly 77% of the patients demonstrated satisfaction with the nebulization therapy. Higher satisfaction with nebulizer therapy was observed in the SEC B group (86% vs 69% in SEC A) and male patients (79% vs 74% in female patients).

**Table 2** Overall and Subgroup Profile of the Patients and Family Caregivers

Patient Profile	Trends	Overall (%)	SEC A (%)	SEC B (%)	Male (%)	Female (%)
Duration of COPD symptoms	More than 5 years	46	38	55	40	52
	3–5 years	25	26	24	35	14
Frequency of episodes of breathlessness	Once daily	29	23	37	39	18
	Once a week	30	31	29	21	40
Breathlessness with activity	Walking for 100 m or after few minutes	50	43	57	51	48
	Hurrying or walking 2 steps slight uphill	26	34	16	21	32
Key influencer	Recommended by doctor	41	38	45	32	52
	Spouse	23	19	29	33	12
	Children	15	21	8	11	20
Relationship with family caregiver	Children	40	43	37	33	48
	Spouse	36	30	43	49	20
<b>Family Caregiver Profile</b>						
Relationship with patient	Spouse	33	27	40	20	44
	Parents	30	31	29	38	23
Duration as a family caregiver	More than 6 months	85	81	91	78	91
	3–6 months	9	13	4	14	5
Breathlessness reported with activity	Walking for 100 m or after few minutes	50	44	60	56	46
	Rest or feeling too breathless to leave the house	26	26	27	16	35
Number of hours invested in COPD care	Between 5–10 hours per week	37	45	27	28	37
	Between 16–20 hours per week	13	6	22	14	12
	More than 20 hours per week	24	24	24	20	28

**Abbreviation:** COPD, chronic obstructive pulmonary disorder.

Overall, DPI was the most preferred inhaler used by the patients in the past (54%) followed by pMDI used by 27% patients. Among patients prescribed any inhaler therapy earlier, the majority of the patients (72%) felt that nebulizer therapy gave long-term relief compared to their previous inhalers, 65% of the patients felt nebulizer therapy gave more immediate relief compared to inhaled therapy, while 64% felt comfortable and reported having control over their symptoms with nebulizer use. Around 70% of the family caregivers opined that QoL of the patients improved post nebulization therapy. [Table 3](#) details the drugs used for nebulization therapy. The most used drugs were formoterol + budesonide (46%), budesonide (31%), levosalbutamol + ipratropium (29%), levosalbutamol (20%), and salbutamol (19%). [Table 4](#) represents the overall and subgroup trends in the usage of nebulization therapy.

## Benefits and Concerns with Use of Nebulizers

The majority of the patients (61%) opined that benefits with nebulizers outweighed the inconvenience associated with their use. Overall, 89% of the patients reported better control of symptoms with the use of nebulizers compared with previously used inhaler devices as the patients could breathe more easily. Furthermore, 86% of the patients reported ease

**Table 3** Overall and Subgroup Trends for Drugs Used in Nebulization Therapy

Drugs	Overall (in %)	SEC A (in %)	SEC B (in %)	Male (in %)	Female (in %)
Formoterol + Budesonide	46	52	39	45	46
Budesonide	31	33	24	26	34
Levosalbutamol + Ipratropium	29	33	24	34	26
Levosalbutamol	20	20	18	19	22
Salbutamol	19	19	18	19	18
Levosalbutamol + Budesonide	3	2	4	4	2
Glycopyrrolate	3	6	0	6	0
Salmeterol + Fluticasone Propionate	2	2	2	4	0

**Table 4** Overall and Subgroup Trends in Usage of Nebulization Therapy

Parameter	Trend	Overall (%)	SEC A (%)	SEC B (%)	Male (%)	Female (%)	Patients Using Nebulizer Daily at Home as Maintenance Therapy
<b>Type of therapy currently prescribed</b>	Inhalers + Nebulizers	47	47	47	47	46	39
	Oral Medication + Nebulizers + Inhalers	28	26	31	25	32	39
<b>Situations for use of nebulization therapy</b>	Both in emergency situations and as maintenance/regular use	53	52	55	56	50	43
	Solely for maintenance or on a regular basis	24	26	22	33	14	54
<b>Duration of nebulized therapy at home</b>	>8 weeks (>2 months)	54	60	47	54	54	43
	>3–4 weeks (1 month)	34	26	43	33	34	43
<b>Frequency of nebulizer usage</b>	In emergency/SOS situations only	35	34	35	25	46	0
	Everyday/daily basis	27	28	27	32	22	100
	Once a week	32	33	31	33	30	0
<b>Frequency of nebulizer usage per day</b>	Once daily	55	44	69	44	73	57
	2–3 times per day	45	56	31	56	27	43
<b>Inhaler therapy used in the past</b>	Yes	83	84	82	81	84	86
	No	17	16	18	19	16	14
<b>Satisfaction with the inhaler therapy</b>	-	83	78	90	78	88	79
<b>Satisfaction with the nebulization therapy</b>	-	77	69	86	79	74	86

(Continued)

Table 4 (Continued).

Parameter	Trend	Overall (%)	SEC A (%)	SEC B (%)	Male (%)	Female (%)	Patients Using Nebulizer Daily at Home as Maintenance Therapy
Inhaler device used currently or previously	DPI	54	48	62	60	49	
	pMDI	27	32	20	30	25	
Family caregiver perception on improvement in QoL of COPD patients post nebulization therapy	-	70	69	71	64	75	
Frequency of emergency hospital visits with ongoing nebulization therapy	Once a month	24	18	34	14	33	
	More than once a month	21	27	14	28	16	
	Once in 3 months	33	34	31	38	28	

**Abbreviations:** DPI, dry-powder inhaler; QoL, quality of life; pMDI, pressurized metered-dose inhaler; SEC, socio-economic class; SOS, Si Opus Sit (if needed).

of use with nebulizer, 86% of the patients had a feeling of personal well-being associated with nebulizer use, and 85% of the patients mentioned that nebulization provided better control than inhalers over overall symptoms.

For the subgroup of patients using nebulizers daily at home as maintenance therapy (n = 28), 93% confirmed that breathing was easier with nebulized therapy, while 75% reported feeling of personal well-being. Overall, 82% and 86% of the patients opined that nebulized therapy provides better control on overall symptoms and reduced hospitalization, respectively.

Majority (76%) of the family caregivers reported reduced hospitalization visits using nebulizer, 75% reported easier breathing by the patients, 73% observed better overall symptom control of the patients by nebulization, and 70% reported that they felt nebulizer was easy to use.

The overall key concerns were related to the procedure being time-consuming (takes ~15 mins/use) (50%), feeling of dependency (49%), embarrassing to use in front of strangers (48%), device being bulky or non-portable (45%), and device being noisy (43%).

Among those in the subgroup of patients using nebulizers daily for home maintenance, similar trends were observed. Major concerns were embarrassment of using the device in front of strangers (54%), feeling of dependency (46%), and non-portability of device (50%). The family caregivers perceived that the patient was embarrassed to use the nebulizers among non-family members (45%), required multiple uses per day (45%), and developed feeling of dependency by using nebulizers (43%). Table 5 represents the benefits and concerns related to the use of nebulizers in COPD. Figure 1 depicts the pictorial representation of the key findings of benefits and concerns from the patients' and family caregivers' perspectives, while Figure 2 demonstrates the comparison between the overall group and patients receiving nebulization daily.

## Satisfaction and Compliance

The majority of the patients (73%) were compliant with the usage of the nebulizer regimen. A high level of satisfaction (95%) was observed by patients for the activities done by family caregivers.

Most of the family caregivers (69%) were involved in major roles, including nebulizer assembly, administering of the treatment, cleanup, and doctor visits. Overall, 89% of the family caregivers were involved in nebulizer-related cleaning and 87% in accompanying the patients for doctors' visits. Moderate compliance (69%) to the nebulizer therapy was reported by the family caregivers (compliance was captured on a scale of 1 to 10, where 1 means no influence at all and 10 means extremely influential; top 3 box % was assessed to evaluate the compliance). A negative impact on the QoL

**Table 5** Benefits and Concerns with Nebulized Therapy in COPD

Benefits/Concerns	Overall (%)		SEC A (%)		SEC B (%)		Male (%)		Female (%)	
	Pat	FCG	Pat	FCG	Pat	FCG	Pat	FCG	Pat	FCG
<b>Benefits</b>										
<b>Can breathe more easily</b>	89	75	84	74	94	77	88	72	90	78
<b>Feeling of personal well-being</b>	86	NA	81	NA	92	NA	82	NA	89	NA
<b>Provides better control on overall symptoms</b>	85	73	81	67	90	81	86	66	84	79
<b>Reduced hospitalization</b>	81	76	72	69	92	86	75	66	88	85
<b>Easy to use</b>	86	70	83	67	90	73	84	65	88	74
<b>Chest feels more comfortable</b>	84	70	79	67	90	73	82	66	86	73
<b>Fewer doctor visits are needed since its use</b>	82	69	79	59	86	83	79	60	86	78
<b>Requires less training</b>	84	NA	83	NA	86	NA	88	NA	80	NA
<b>Concerns</b>										
<b>Use is time-consuming</b>	50	41	57	35	43	49	55	38	46	44
<b>Feeling of dependency</b>	49	43	55	40	43	47	46	48	52	39
<b>Feels embarrassing to be used in front of outside people or strangers</b>	48	45	57	39	40	53	44	48	52	42
<b>Requires multiple uses per day</b>	NA	45	NA	35	NA	58	NA	54	NA	37
<b>Device is bulky/immobile/non-portable</b>	45	40	36	31	55	53	46	42	44	39
<b>Makes a lot of noise while being used</b>	43	NA	40	NA	47	NA	40	NA	46	NA
<b>Requires a lot of cleaning and care to be taken</b>	41	42	34	37	49	49	42	46	40	39
<b>Not convenient</b>	37	39	29	32	47	49	40	44	34	35
<b>Good effects do not last enough</b>	44	40	34	35	55	47	46	48	42	33

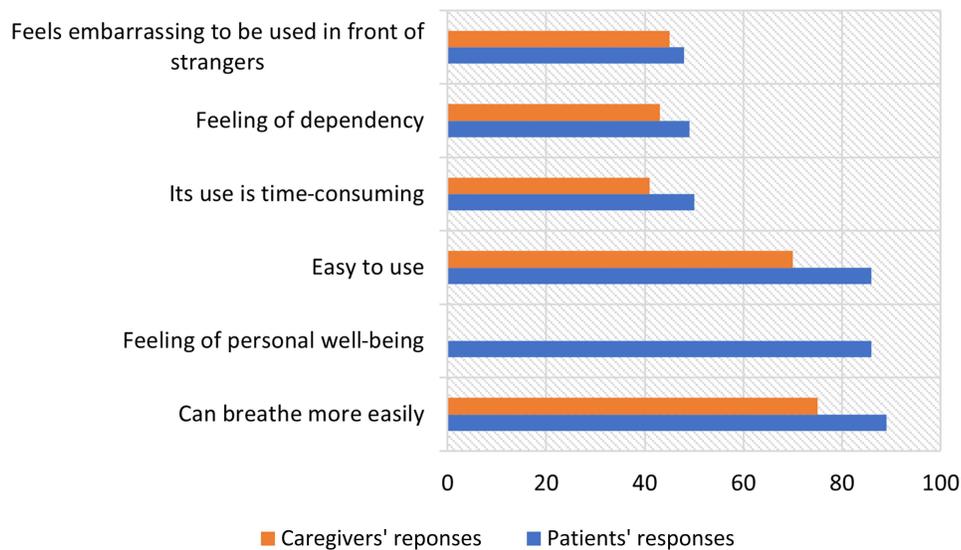
Abbreviations: FCG, family caregiver; NA, not applicable; Pat, patient SEC, socio-economic class.

was observed in 60% of the family caregivers, with anger and sadness being the major impact (a scale of 1–10 was used to evaluate the QoL where 1 was no negative impact and 10 was extremely negative impact; top 3 box % was used to determine the QoL value). Table 6 provides an overall picture of the satisfaction and compliance aspects along with factors impacting the QoL of the family caregivers.

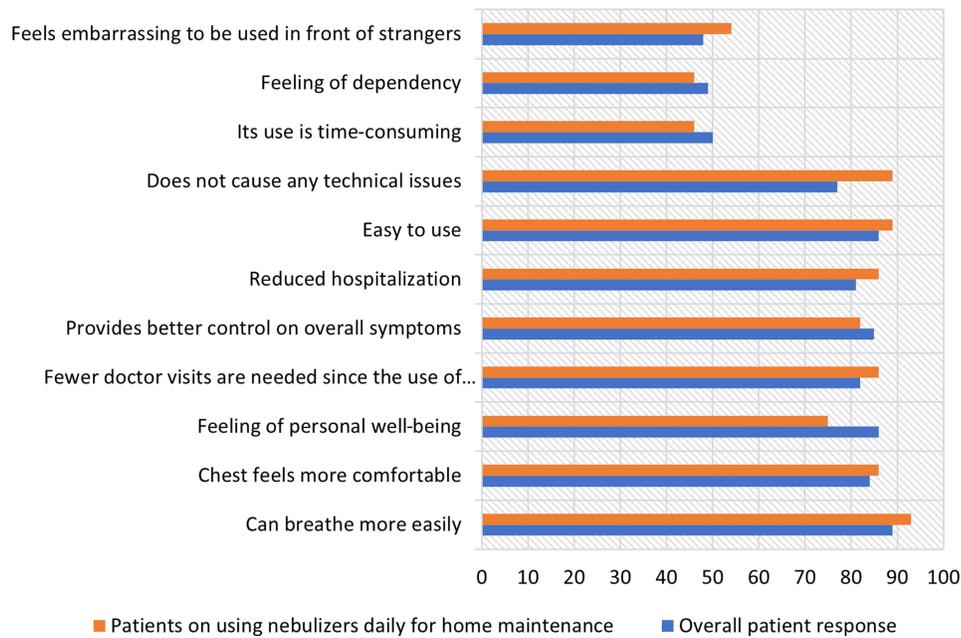
## Discussion

The use of nebulizers has been recognized as an effective alternative to the conventionally available inhalers in specific subgroups of COPD patients.<sup>6</sup> Further, as per the consensus document by the National Allergy Asthma Bronchitis Institute (NAABI) and Chest Research Foundation (CRF), India, the use of nebulizers has been encouraged for maintenance therapy in COPD patients who are not able to use inhalers effectively.<sup>22</sup> However, there is a dearth of data on the use of nebulizers in patients with COPD in India. Hence, this first-of-its-kind survey assessed both the patients' and the family caregivers' attitudes and perceptions towards nebulization therapy.

Based on a comprehensive structured questionnaire, it was observed that patients reported long-term relief, were more comfortable, and had a better control over symptoms with nebulization therapy compared with other inhalers. Overall, 77% of the patients preferred nebulizer therapy. This was further validated by the family caregivers who affirmed that the nebulizer therapy was instrumental in improving overall COPD outcomes in terms of easier breathing, feeling of personal well-being,



**Figure 1** Benefits and concerns with nebulization therapy: a comparison of patients' and family caregivers' responses.



**Figure 2** Comparison of benefits and concerns cited by overall patient population and patients using nebulization daily as home maintenance therapy.

reduced doctor visits, and hospitalization. However, patients raised concerns regarding nebulizers being non-portable, time-consuming, and requiring effective cleaning. Similar trends have been observed globally with respect to the usage of nebulization therapy. In a global survey by Sharafkhaneh et al, 79% of the patients and 85% of the caregivers favored the use of nebulizers since the benefits outweighed the difficulties. It was observed from the study that 91% of the patients and 95% of the caregivers perceived easier breathing, while 85% of the patients and 88% caregivers perceived control over COPD symptoms with the use of nebulization therapy.<sup>18</sup> Another study by Barta et al, which evaluated patient's perception toward nebulization therapy, observed that 53% of the patients found it easier to breathe after using nebulizer therapy compared with inhalers, 59% patients perceived control over COPD symptoms, and improved confidence (58%).<sup>23</sup> In another survey by Melani et al, the patients raised concerns regarding the correct usage of the device and the lack of adequate trainings being

**Table 6** Satisfaction and Compliance with the Nebulizer Therapy

Parameters		Overall (%)	SEC A (%)	SEC B (%)	Male (%)	Female (%)
<b>Role of a family caregiver</b>	Major role	69	74	62	68	70
	Moderate Role	28	23	36	30	26
	Minor Role	3	3	2	2	4
	Satisfaction rating with level of activities done by family caregivers	95	91	100	96	94
<b>Compliance with nebulization therapy</b>	Patient compliance with the recommended frequency of use of nebulization therapy	73	71	76	76	70
	Rating for family caregiver influence on patient compliance to nebulization therapy	69	67	72	68	71
<b>Negative impact on QoL of family caregivers</b>	The burden of caring for COPD patient negatively impacted the QoL of family caregivers	60	53	69	62	58
<b>Factors causing negative impact on QoL of family caregivers</b>	Becoming easily angered	57	56	58	48	64
	Makes me feel sad or worried	43	50	36	39	47
	Low energy levels, often gets tired and exhausted	41	44	36	42	39
	Gain/loss of weight	35	39	30	33	36
	Losing interest in hobbies/social activities	35	31	39	33	36
	Trouble sleeping or sleeping too much	22	28	15	24	19

**Abbreviations:** QoL, quality of life; SEC, socio-economic class.

provided to them.<sup>24</sup> In an online survey designed by the American Thoracic Society and conducted by Harris Insights & Analytics, Rochester, New York, about 70% of the respondents backed the use of small-volume nebulizers compared with inhalers.<sup>25</sup> While it has been established that nebulization therapy is effective as maintenance therapy in patients with moderate-to-severe COPD in improving symptomatology and quality of life, it also plays an essential role in emergency care or as rescue therapy to relieve bronchospasm, humidify airways, prevent respiratory complications, and promote expectoration.<sup>16,26,27</sup> The results derived from the current survey corroborate the findings from previously established global surveys and studies. However, the current study also expands the findings in terms of different subgroups of patients included such as the SEC A and B groups and provides unique information on the patients using nebulization daily for maintenance therapy, and their family caregivers in the Indian context. SEC A and SEC B groups were selected to identify and understand the differences among these groups in terms of using nebulization therapy and their perceptions towards it, thereby providing an in-depth analysis of the scenario.

The uniqueness of the current real-world survey lies in its pan-India coverage of patients with COPD and their family caregivers who use nebulization therapy and exploring both their perspectives on the role of nebulizers in the management of COPD. Further, the perception on improvement of QoL of the patients with COPD post-nebulization therapy was also an important parameter, which was considered during the survey.

However, we do acknowledge certain limitations to our survey, which includes the absence of clinical examination and lack of pulmonary findings to establish the diagnosis of COPD. Screening bias might be considered as a limitation of the study. Additionally, it is possible that the result might have been affected owing to the factors such as severity and duration of COPD and synergistic effects of other medicines taken along with nebulized therapy. Further, a high-order statistical analysis for the direct correlation between the nebulization therapy and improvement in patient conditions was also missing. The impact of education regarding the use of nebulization provided to the patients and family caregivers

was not included. The validation of the data entered into the database was also not conducted to confirm the completion and appropriate filling of the online survey. Rate of hospitalization prior to nebulization therapy was not checked in the survey. Although there was good concordance between patients and caregivers, limited analysis was done for this because different sets of questions were asked to patients and family caregivers. The overall findings were subjective in nature; however, future studies are warranted to address these limitations.

## Conclusion

The current survey is unique and the first-of-its-kind in India wherein both the patients' and family caregivers' perceptions and attitudes toward the use of nebulization therapy have been captured. The survey demonstrates that the majority of patients with COPD as well as their family caregivers reported satisfaction with nebulization therapy. The majority of patients and family caregivers reported better symptom control and reduced hospitalization, along with associated comfort with the nebulizer therapy compared with inhalers.

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## Disclosure

Dr Meena Lopez and Dr Jaideep Gogtay are the employees of Cipla Ltd. The other authors have no conflict of interest to declare in this work.

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