Inhaler use in adolescents and adults with self-reported physician-diagnosed asthma, bronchitis, or emphysema in the city of Pelotas, Brazil*

Uso de inaladores na população de adolescentes e adultos com diagnóstico médico autorreferido de asma, bronquite ou enfisema em Pelotas, RS

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Abstract

Objective: To evaluate the characteristics of users of inhalers and the prevalence of inhaler use among adolescents and adults with self-reported physician-diagnosed asthma, bronchitis, or emphysema. **Methods:** A population-based study conducted in the city of Pelotas, Brazil, involving 3,670 subjects ≥ 10 years of age, evaluated with a questionnaire. **Results:** Approximately 10% of the sample reported at least one of the respiratory diseases studied. Among those individuals, 59% reported respiratory symptoms in the last year, and, of those, only half reported using inhalers. The use of inhalers differed significantly by socioeconomic status (39% and 61% for the lowest and the highest, respectively, p = 0.01). The frequency of inhaler use did not differ by gender or age. Among the individuals reporting emphysema and inhaler use, the use of the bronchodilator-corticosteroid combination was more common than was that of a bronchodilator alone. Only among the individuals reporting physician-diagnosed asthma and current symptoms was the proportion of inhaler users higher than 50%. **Conclusions:** In our sample, inhalers were underutilized, and the type of medication used by the individuals who reported emphysema does not seem to be in accordance with the consensus recommendations.

Keywords: Metered dose inhalers; Asthma; Pulmonary disease, chronic obstructive; Bronchitis; Emphysema; Dry powder inhalers.

Resumo

Objetivo: Avaliar as características dos usuários de dispositivos inalatórios e a frequência de uso desses em adolescentes e adultos com diagnóstico médico autorreferido de asma, bronquite ou enfisema. **Métodos:** Estudo de base populacional realizado em Pelotas, RS, incluindo 3.670 indivíduos com idade ≥ 10 anos, avaliados com um questionário. **Resultados:** Aproximadamente 10% da amostra referiram pelo menos uma das doenças respiratórias investigadas. Entre esses, 59% apresentaram sintomas respiratórios no último ano, e, desses, apenas metade usou inaladores. O uso de inaladores diferiu significativamente de acordo com o nível socioeconômico (39% e 61% entre mais pobres e mais ricos, respectivamente; p = 0,01). Não houve diferença na frequência de uso de inaladores por sexo ou idade. Entre indivíduos com enfisema, o uso da combinação broncodilatador + corticoide inalatório foi mais frequente que o uso isolado de broncodilatador. Somente entre os indivíduos que referiram diagnóstico médico de asma e sintomas atuais, a proporção de uso de inaladores foi maior que 50%. **Conclusões:** Em nossa amostra, os inaladores foram subutilizados, e o tipo de medicamento usado por aqueles que referiram enfisema parece não estar de acordo com o preconizado em consensos sobre essa doença.

Descritores: Inaladores dosimetrados; Asma; Doença pulmonar obstrutiva crônica; Bronquite; Enfisema; Inaladores de pó seco.

Introduction

Inadequate management of asthma and COPD is detrimental to the quality of life of patients and generates avoidable costs to the health care system.[1,2] Among the available drugs, those administered via inhaler devices constitute the treatment of choice for the control of asthma and COPD and are indicated for all such patients, except for those who have cognitive deficits or who do not adapt to inhaler devices and opt for a nebulizer.[1,2]

In Brazil, the number of hospitalizations for asthma in adults dropped in the last decade; however, asthma is still among the leading causes of hospitalization and, in 2011, was the fourth leading cause of hospitalization among patients of all ages.[1] Another leading cause of hospitalization is COPD, and the burden of the disease on the health care system is expected to increase in the coming years.[2,3] By 2020, COPD is expected to have become the fifth leading cause of disability-adjusted life years.[3]

Although the worsening of symptoms and the frequency of exacerbations do not always indicate disease progression, they can indicate poor treatment adherence or inability to use inhalers,[4] which is aggravated by the fact that many health professionals do not have enough knowledge to instruct patients on how to use inhaler devices correctly.[5] According to data from the *Projeto Latino-Americano de Investigação em Obstrução Pulmonar* (PLATINO, Latin-American Project for the Investigation of Pulmonary Obstruction), the proportion of patients receiving inhaled medication is smaller than expected, and the form of administration and frequency of use are not in accordance with the recommendations.[6] Regarding asthma, despite advances in asthma control, the proportion of patients seeking emergency room treatment because of poor adherence to inhaled corticosteroid (IC) therapy is high.[7,8]

Studies investigating inhaler use among asthma and COPD patients are needed in order to identify shortcomings and, indirectly, assess the quality of the health care provided to such patients. However, a recent review of the literature revealed no population-based studies conducted in Brazil and primarily focusing on inhaler use.

In this scenario, the objective of the present study was to describe inhaler use among individuals with self-reported physician-diagnosed asthma, bronchitis, emphysema, or any combination of the three in the city of Pelotas, Brazil.

Methods

This was a descriptive, cross-sectional, population-based study conducted in the city of Pelotas between February and June of 2012 as part of a large population health survey. The strategy used is designated "research consortium",[9] whereby several researchers combine their questionnaires into a single instrument, thus streamlining data collection and reducing costs. The target population consisted of individuals aged 10 years or older.

Sampling was conducted in two stages: in the first stage, 130 of the 495 census sectors in the urban area were systematically selected, the probability being proportional to the number of households; because the number of households in each census sector had last been determined in 2010 by the Brazilian Institute of Geography and Statistics, we mapped the households in each sector before starting the fieldwork; in the second stage, the number of selected households was defined by the growth of the sector in relation to the 2010 count, and an average of 13 households were selected in each sector, a total of 1,722 households having been selected.

All of the residents that were in the target age group were invited to participate, institutionalized or mentally disabled individuals being excluded. Standardized questionnaires addressing demographic, socioeconomic, behavioral, and health aspects were administered by trained interviewers.

The use of inhalers was evaluated only in those who reported having any of the following physician-diagnosed respiratory diseases: asthma/wheezy bronchitis, bronchitis, emphysema, or any combination of the three. The adolescents (i.e., those in the 10-19 year age bracket) were asked only about asthma/wheezy bronchitis.

Whenever an individual gave at least one affirmative answer, the individual was asked about symptoms and inhaler use. We determined the presence of symptoms in the previous year by asking the following question: "Since (month) of last year, have you had attacks or symptoms of this/these disease(s), such as wheezing, cough, or breathlessness? (yes/no)". The interviewers were instructed to replace the word "month" with the corresponding month in the 12-month

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recollection period. For the same period, we asked about nebulizer use (yes/no) and inhaler use (yes/no), using the terms "pump, dry powder inhaler, or any other medication for inhalation/ aspiration".

Those who had used an inhaler were asked to provide the package for collection of the name(s) of the drug(s). Those who did not have the package were shown a catalog of drugs so that they could indicate the drug or drugs that they had used. The drugs were categorized by type of inhaler, i.e., metered dose inhaler (MDI) or dry powder inhaler (DPI), and type of medication, i.e., bronchodilator (BD), IC, or a combination of both (BD + IC).

Those who reported not having used an inhaler were asked why they had not, the reasons being grouped into the following categories: belief that there was no need to use an inhaler; lack of financial resources to purchase an inhaler; lack of physician recommendation; difficulty using inhalers; and fear of side effects.

Of the demographic, socioeconomic, and behavioral variables collected, the following were used in the present study: gender; age; years of completed schooling; the *Indicador Econômico Nacional* (IEN, National Economic Indicator),[10] categorized into quintiles (in ascending order by socioeconomic status, from the lowest to the highest); and smoking status, i.e., never smoker, smoker (having smoked at least one cigarette per day for more than one month), and former smoker (having smoked no cigarettes for more than one month).

Data were collected through netbooks running the Pendragon Forms 6.1 software (Pendragon Software Corporation, Libertyville, IL, USA) with the questionnaire, and the interviews were synchronized weekly to the database. For quality control, 10% of the participants answered 14 of the questions again in a visit that took place within up to 15 days after the interview. The question regarding the diagnosis of asthma/wheezy bronchitis showed a kappa statistic of 0.65.

The findings were expressed as absolute and relative frequencies, with the respective 95% CIs. We used the chi-square test for heterogeneity for nominal categorical variables and the chi-square test for linear trend for ordinal categorical variables. Data analysis was performed with the STATA statistical software package, version 12.0 (Stata Corp., College Station, TX, USA).

The participants or their legal guardians gave written informed consent, and the study project was approved by the Research Ethics Committee of the Federal University of Pelotas School of Medicine, located in the city of Pelotas, Brazil, on December 1, 2011 (Protocol no. 77/11).

Results

Of the 4,168 eligible individuals, 3,670 were included in the study sample (12.1% having been lost to follow-up or having declined to participate). Of those, 402 (11%) reported having been diagnosed with at least one of the respiratory diseases under study. The overall prevalence of asthma was 7.5% (95% CI, 6.6-8.3), the overall prevalence of bronchitis was 6.1% (95% CI, 5.2-6.9), and the overall prevalence of emphysema was 1.6% (95% CI, 1.2-2.1; Table 1). The characteristics of the study sample and the prevalence of each disease (according to the demographic characteristics, socioeconomic characteristics, and smoking status) are shown in Table 1.

Of the 402 individuals who reported having a respiratory disease, 146 (36.2%; 95% CI, 31.4-40.9) had used an inhaler device in the previous year, and 237 (59%) reported having had symptoms in the same period. Of the 237 symptomatic individuals, 120 (50.6%; 95% CI, 44.2-57.0) reported having used an inhaler. Of those who remained asymptomatic, 25 (15.2%; 95% CI, 9.7-20.8) reported having used an inhaler.

Figure 1 shows the distribution of inhaler users by IEN quintile among the individuals who reported having had respiratory symptoms in the previous year. Although the 95% CIs overlapped, a higher IEN translated to a higher frequency of inhaler use, a linear trend being observed (p = 0.010). Similar results were obtained with the use of other socioeconomic indicators, such as the Brazilian Association of Survey Firms classification[11] (data not shown). The frequency of inhaler use did not differ by gender or age in the sample as a whole or in the symptomatic individuals.

The proportion of individuals who had not used any type of inhaler was higher than 50% among those who reported having bronchitis or emphysema. Among those who had used an inhaler in the previous year, MDIs were the most widely used by patients with asthma or bronchitis, whereas there was no difference between MDI

Table 1 – Description of the sample and prevalence of self-reported physician-diagnosed respiratory disease, Pelotas, Brazil, 2012.

Variable	Sample	Respiratory disease		
		Asthma	Bronchitis	Emphysema
	n (%)	(n = 274)	(n = 178)	(n = 47)
Gender		p = 0.063	p = 0.110	p = 0.838
Male	1,562 (42.6)	6.5 (5.3-7.8)	5.2 (4.0-6.5)	1.7 (0.9-2.4)
Female	2,108 (57.4)	8.2 (7.0-9.3)	6.7 (5.5-7.8)	1.6 (1.0-2.2)
Age		p < 0.001**	p = 0.957**	p < 0.001**
10-19[a]	743 (20.3)	13.3 (10.8-15.8)	-	-
20-29	612 (16.7)	6.7 (4.7-8.7)	6.2 (4.3-8.1)	-
30-39	540 (14.7)	7.0 (4.9-9.2)	5.7 (3.8-7.7)	0.4 (0.0-0.9)
40-49	595 (16.2)	5.4 (3.6-7.2)	5.9 (4.0-7.8)	0.8 (0.1-1.6)
50-59	514 (14.0)	5.8 (3.8-7.9)	6.8 (4.6-9.0)	2.3 (1.0-3.6)
60 or older	666 (18.2)	5.1 (3.4-6.8)	5.9 (4.1-7.6)	4.2 (2.7-5.7)
Schooling[b], years		p = 0.031**	p = 0.061**	p < 0.001**
Up to 4	651 (17.8)	9.2 (7.0-11.4)	8.6 (6.2-11.0)	4.2 (2.5-5.9)
5-9	1,313 (35.8)	7.3 (5.9-8.7)	5.2 (3.7-6.7)	1.5 (0.7-2.3)
10-14	1,217 (33.2)	7.6 (6.2-9.1)	6.1 (4.7-7.6)	1.1 (0.4-1.7)
15 or more	486 (13.3)	5.1 (3.2-7.1)	5.0 (3.0-6.9)	0.2 (0.0-0.6)
IEN[c], quintiles		p = 0.094**	p = 0.477**	p = 0.010**
1st (the poorest)	735 (20.2)	8.0 (6.1-10.0)	7.0 (4.9-9.0)	2.4 (1.1-3.6)
2nd	723 (19.9)	7.9 (6.0-9.9)	6.5 (4.5-8.6)	2.2 (1.0-3.4)
3rd	732 (20.1)	7.7 (5.7-9.6)	4.6 (2.9-6.3)	1.4 (0.4-2.3)
4th	720 (19.8)	8.6 (6.6-10.7)	6.2 (4.3-8.2)	1.4 (0.4-2.3)
5th (the richest)	727 (20.0)	5.1 (3.5-6.7)	6.0 (4.1-8.0)	0.7 (0.0-1.4)
Smoking status		p = 0.726	p = 0.001	p = 0.001
Never smoker	2,397 (65.3)	7.7 (6.7-8.8)	5.1 (4.1-6.2)	0.9 (0.4-1.3)
Former smoker	634 (17.3)	6.9 (5.0-8.9)	5.5 (3.7-7.2)	2.2 (1.1-3.4)
Smoker	639 (17.4)	7.0 (5.1-9.0)	9.4 (7.1-11.7)	3.0 (1.6-4.3)
Total	3,670 (100)	7.5 (6.6-8.3)	6.1 (5.2-6.9)	1.6 (1.2-2.1)

IEN: *Indicador Econômico Nacional* (National Economic Indicator). [a]Patients in this age bracket were asked only about asthma or wheezy bronchitis. [b]3 observations ignored. [c]33 observations ignored. *Chi-square test for heterogeneity, except where otherwise indicated. **Chi-square test for linear trend.

use and DPI use among those with emphysema (Figure 2).

Regarding the drug regimen used by the symptomatic individuals, Figure 3 shows the distribution of BD use and BD + IC use. Only among those reporting emphysema was the proportion of BD + IC users higher than was that of BD-only users. Two of the respondents did not know the type of inhaler that they had used.

Of the 117 individuals who reported that they had had symptoms and had not used any type of inhaler, 38% reported nebulizer use. The most common reasons for not using an inhaler were "belief that there was no need to use an inhaler" (60.7%) and "lack of physician recommendation" (23.9%), followed by "fear of side effects", "lack

of financial resources to purchase an inhaler", and "difficulty using inhalers".

Discussion

Inhaler devices are of great importance in the treatment of respiratory diseases, having advantages such as direct deposition of the drug in the target organ and rapid effect in reducing symptoms.[12] The objective of the present study was to describe inhaler use among individuals who gave affirmative answers to questions regarding asthma, bronchitis, and emphysema. It is of note that this cannot be considered the real prevalence of inhaler use in the population, because inhalers can be indicated for other conditions or used as self-medication. Another limitation of the present study is the use of self-reported diagnosis,

which can lead to information bias. However, unlike other studies conducted in Brazil and investigating inhaler use—most of which evaluated samples of individuals selected from among those being treated at primary health care clinics or hospitals—our study evaluated a sample that was representative of the general population.
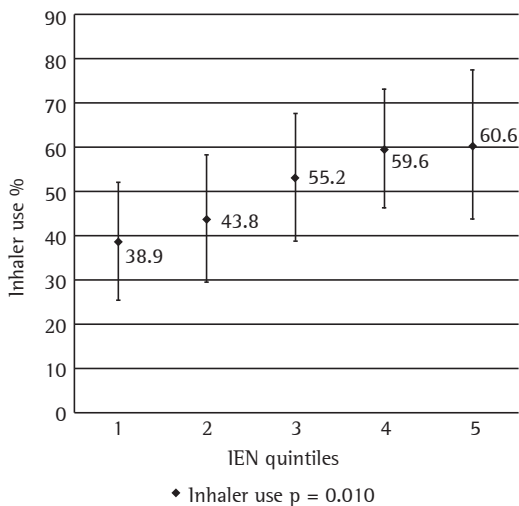

Figure 1 – Prevalence of inhaler use in those who reported symptoms in the previous year (n = 234), by *Indicador Econômico Nacional* (IEN, National Economic Indicator) quintile, Pelotas, Brazil, 2012. p = 0.01, as assessed by the chi-square test for linear trend.

The prevalence of self-reported physician-diagnosed asthma was investigated in adults (20 years of age or older) in studies conducted in the city of Pelotas in 2000[13] and 2010.[14] However, the criteria used in those studies in order to define the outcome differ from those used in the present study, and it is therefore difficult to compare the studies in terms of the reported prevalence. The prevalence of self-reported asthma in the previous year has been reported to be 4.7%[13] and 5.2%.[14] In the present study, by combining the questions regarding the diagnosis of asthma (no specific recollection period) and symptoms in the previous year, we found that 4.5% of those who were 20 years of age or older reported this condition. In addition, when analyzing that age group, we found significant differences between the genders in terms of the prevalence of asthma; this finding is consistent with those of previous studies,[13,14] the prevalence of asthma being higher among females (7.1% vs. 4.3%; p = 0.002).

In individuals in the 10-19 year age bracket, the prevalence of asthma found in the present study was similar to that found in a study conducted in the city of Santa Maria, Brazil, i.e., 14.9% for self-reported physician-diagnosed asthma ever; however, that study investigated individuals in the 13-14 year age bracket.[15] Both proportions are superior to the 7.4% prevalence of self-reported
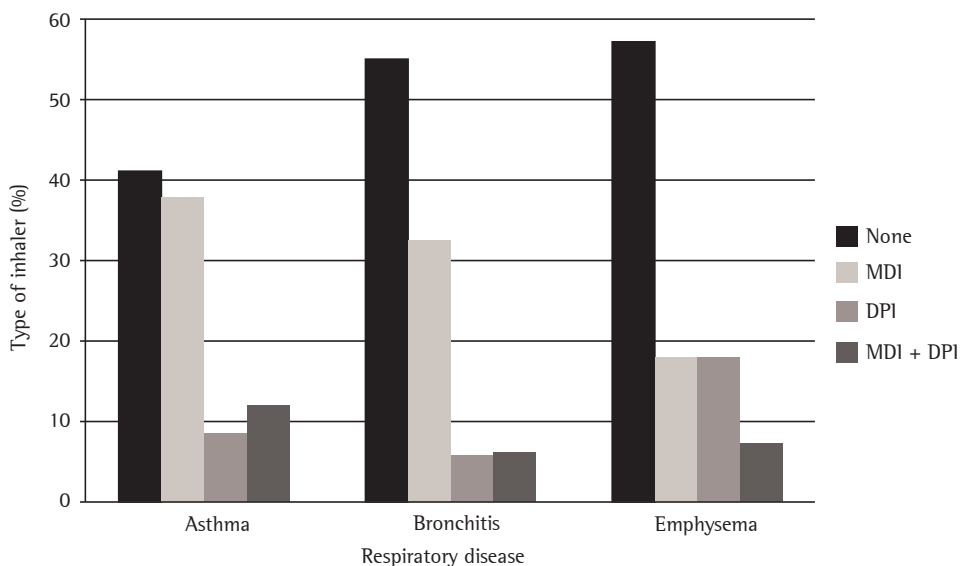

Figure 2 – Type of inhaler used in the previous year by those who reported symptoms in the previous year (n = 235), by self-reported diagnosis, Pelotas, Brazil, 2012. None: no inhaler use in the previous year; MDI: metered dose inhaler; and DPI: dry powder inhaler.
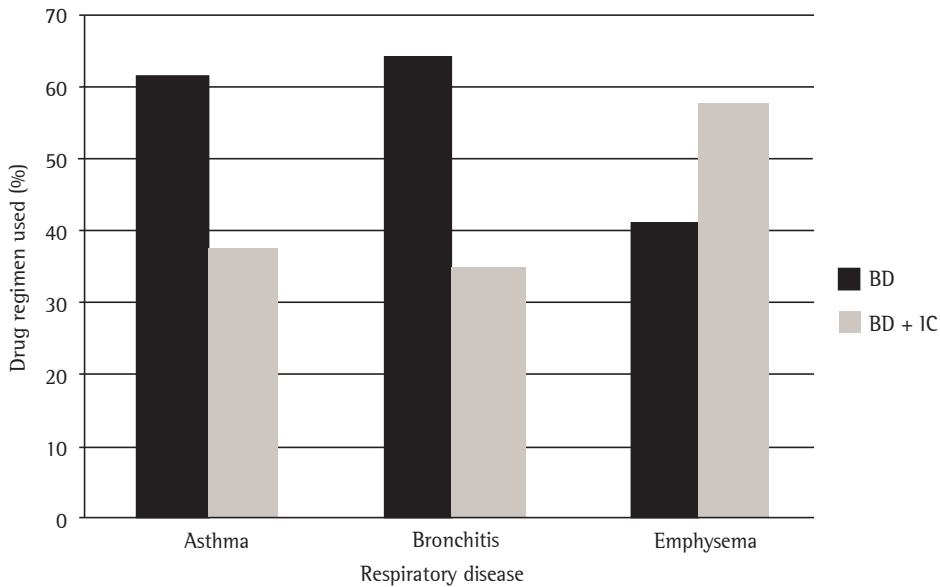
Figure 3 – Drug regimen used by those who reported symptoms in the previous year (n = 118), by self-reported diagnosis, Pelotas, Brazil, 2012. BD: bronchodilator; and IC: inhaled corticosteroid.

asthma found in individuals in the 10-19 year age bracket in southern Brazil in 2008.[16]

The questions regarding bronchitis and emphysema were asked only to adults (20 years of age or older) because COPD affects individuals over 40 years of age.[2] Because the term "bronchitis" is used by asthma and COPD patients alike, we believe that the prevalence found in the present study refers to both conditions. It is likely that the smokers or former smokers over 40 years of age reporting bronchitis have COPD. The proportion of individuals with self-reported bronchitis was highest among current smokers.

Regarding emphysema, data from the PLATINO[17] showed that the prevalence of self-reported physician-diagnosed emphysema in the city of São Paulo, Brazil, in 2003 was 1.2%. We found a higher prevalence in individuals 20 years of age or older (i.e., 1.6%) and in those 40 years of age or older (i.e., 2.5%), the latter age group being the target of the PLATINO.

We chose the terms "bronchitis" and "emphysema" because the population is more familiar with those terms than it is with the term "COPD". In the PLATINO,[17] the prevalence of self-reported physician-diagnosed COPD was 0.8%, whereas, in a study conducted in the city of São Paulo in the 2008-2009 period,[18] the prevalence of COPD was 4.2%, suggesting greater familiarity with the term.

Half of those who were expected to have used an inhaler (i.e., those with a self-reported diagnosis of respiratory disease and symptoms in the previous year) had. However, 38% of those who reported no inhaler use reported nebulizer use; that is, 12% of the symptomatic individuals had not used any type of inhalation treatment. It is of note that nebulizer use has disadvantages in comparison with inhaler use, including the lack of standardization of the devices regarding the emission of aerosol particles, causing uncertainty regarding the inhaled dose[19]; nebulizer use is indicated only for those who do not adapt to the inhalation of a controlled dose, such as debilitated patients or those with cognitive deficits, who fail to use the medication, even with a spacer.[1]

Each type of inhaler device has its own particularities, and the choice of inhaler to be prescribed depends on factors such as personal preferences, cost-benefit ratio, and patient cognition.[1,4,19] Of the two types of inhalers, MDIs are the most readily available in the public health care system, being the most widely used in the present study.

The main reason for not having used an inhaler was the belief that there was no need to use it. This finding might reflect treatment nonadherence in those patients. In a study[20] evaluating the treatment of eight chronic diseases, only 16% of all asthma patients were considered to have

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adhered to treatment, that proportion being the lowest proportion of treatment adherence among the diseases investigated; COPD ranked third, 38% of all COPD patients having adhered to treatment.

The lack of adherence to inhaler use has been attributed to factors such as difficulty using inhalers, little satisfaction with the benefits of inhaler use, fear of adverse effects, prolonged duration of use, periods of symptom remission, and drug costs.[21,22]

A significant number of individuals reported lack of physician recommendation as the reason for not using inhalers; this reflects a situation that is common in Brazil and other countries; that is, the medication is not prescribed as recommended in consensus guidelines.[1,2]

In a study conducted in the city of Porto Alegre, Brazil,[23] the medical records of patients treated in a pulmonology department were analyzed. Approximately 68% of the patients had received treatment that was not in accordance with the recommendations in current guidelines, and 71% of those patients had uncontrolled asthma that was not being treated with corticosteroids. In the USA, the medical records of asthma patients were investigated, and it was found that less than 40% of the patients had been prescribed short-acting β_2 agonists and that less than 10% of the patients who used BDs daily had been prescribed ICs[24]; regarding COPD, 72% of the patients with the disease had been prescribed at least one BD, and 64% of the patients with frequent exacerbations had been prescribed ICs.[25]

The individuals who, despite having reported symptoms, believed that there was no need to use an inhaler, those who reported that they feared side effects, and those who reported having difficulty using inhalers are a reflection of the need for educational activities emphasizing the importance of inhaler use.

Our analysis of the drug regimens used by the individuals in our study sample showed that the proportion of combination therapy (BD + IC) users was highest among the individuals who reported having emphysema. The use of ICs in COPD patients is controversial. A recent systematic review highlighted that ICs should be used only in those with frequent exacerbations.[26] According to the Global Initiative for Chronic Obstructive Lung Disease guidelines, ICs should be reserved for those belonging to high-risk groups.[2] In

our study, we did not evaluate the frequency or type of symptoms that can lead to an estimation of the severity of COPD; however, data from a previous population-based study showed that those for whom ICs are indicated account for only approximately 1% of all COPD patients.[6]

It is of note that inhalers are underused among socioeconomically disadvantaged populations, despite the fact that those populations have been reported as being the most affected by chronic respiratory diseases.

When the present study was conducted, the public health care system was going through a transition phase regarding inhalers provided free of charge. At the beginning of data collection, inhalers were restricted to two types of medication delivered via MDIs, and asthma patients with more severe disease had access to other inhalers.[7] In addition, the Brazilian Popular Pharmacy program[27] offered discounts of up to 90% on some of those drugs. As of June of 2012, certain types of inhalers had come to be provided free of charge under the program,[28] and, more recently, after the end of our data collection, new drugs began to be provided free of charge in the public health care system, with the objective of improving the treatment of patients diagnosed with COPD.[29] Such changes can soon translate to changes in the inhaler use scenario, expanding the possibilities at the time of prescription and improving treatment adherence.

In the evaluation of the association between low socioeconomic status and lower use of inhalers, mediators other than low income should be taken into account. The underuse of inhalers can also be due to other factors, such as the type of facility used, access to specialist consultations, and the quality of the information provided. Although no such data were collected in the present study, the abovementioned factors can influence inhaler use and therefore should be examined in future studies. Therefore, multiple factors can be addressed in the development of measures to benefit this population and reduce the numbers of emergency room visits and hospitalizations due to preventable causes.[30]

We conclude that inhaler use among individuals with self-reported physician-diagnosed asthma, bronchitis, emphysema, or any combination of the three is far from ideal, especially among those of lower socioeconomic status. A significant proportion of symptomatic individuals reported

nebulizer use only; however, this type of drug administration should not be the first choice for most individuals.[1] The type of inhaled medication recommended for individuals with emphysema also deserves attention because it does not seem to be in accordance with the recommendations.[2,26] Finally, the implementation of new policies for the free distribution of these drugs will meet the needs identified in the present study, because although few individuals reported lack of financial resources to purchase an inhaler as the reason for not using an inhaler, inhaler use is lowest among those of lowest socioeconomic status.

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