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Overprescription of short-acting β_2 agonists: reflections from the SABINA study in Brazil

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The SABA use IN Asthma (SABINA) study in Brazil was conducted at five sites in different regions of the country: the northeastern, central-western, and southeastern regions.

ABSTRACT

Objective: To assess prescription patterns for short-acting β_2 agonists (SABAs) and other asthma medications in asthma patients treated by specialists and participating in the *SABA use IN Asthma (SABINA) study* in Brazil. **Methods:** This was an observational, cross-sectional study conducted at five sites in different regions of Brazil. The primary endpoints were to record SABA prescriptions and obtain data on over-the-counter (OTC) SABA purchases at the pharmacy. **Results:** Data on 218 asthma patients were analyzed. Of those 218 patients, 80.3% were prescribed SABAs in addition to their maintenance therapy, with a mean of 11.2 SABA canisters in the previous 12 months. Of those patients, 71.4% were prescribed ≥ 3 canisters and 42.2% were prescribed ≥ 10 canisters. None of the patients were prescribed SABA monotherapy. A total of 14.2% of the patients reported purchasing SABAs OTC at a pharmacy without a prescription. Of those, 48.4% purchased ≥ 3 SABA canisters. A fixed-dose combination of an inhaled corticosteroid and a long-acting β_2 agonist was prescribed to 95.0% of the patients. In the year before the study visit, 45.0% of the patients received at least one course of oral corticosteroid burst treatment. Asthma was well controlled in 43.1% of the patients, partly controlled in 34.9%, and uncontrolled in 22.0%. Patients reported a mean of 1.1 severe asthma exacerbations, with 49.1% experiencing 1 or more severe exacerbations. **Conclusions:** Overprescription and OTC purchases of SABAs are common in Brazil, possibly leading to the need for courses of oral corticosteroids. The health care community should collaborate to implement evidence-based recommendations and promote health education to improve asthma management in Brazil.

Keywords: Asthma; Brazil; Bronchodilator agents; Prescriptions.

INTRODUCTION

In Brazil, there are approximately 20 million patients with asthma.[1] In a study assessing data from the National Adolescent School-based Health Survey, conducted in 2012 in Brazil, it was reported that 23.2% of adolescents had asthma symptoms, and 12.4% had a previous asthma diagnosis.[2] Despite improvements in asthma diagnosis and management, the development of new therapeutic agents and targets, and updated international asthma guidelines, a large proportion of patients in Brazil remain poorly controlled.[3] Indeed, mortality rates from asthma are increasing, with data from a national database reporting that 2,488 patients died from asthma in Brazil in 2021, which equated to 7 deaths per day; moreover, there were over 120,000 hospital admissions for asthma during that year.[4]

Since 2019, following the most significant change in asthma management in three decades,[5,6] the GINA has no longer recommended the use of short-acting β_2 agonists (SABAs) without concomitant inhaled corticosteroids (ICS) for asthma patients ≥ 12 years of age.[7] Instead, on the basis of clinical evidence from randomized controlled clinical trials[8,9] and real-world studies,[10,11] the GINA now recommends a combination of low-dose ICS and the long-acting β_2 agonist (LABA) formoterol taken as needed for symptom relief for adults and adolescents with mild asthma and for those with moderate-to-severe asthma who are prescribed ICS-formoterol maintenance therapy.[7] In addition, in 2020, the Brazilian Thoracic Association (BTA) also recommended against SABA monotherapy for the treatment of asthma on the grounds of safety.[12] This decision was based on accumulating evidence that SABA monotherapy increases the risk of poorly controlled disease and severe asthma exacerbations, with the addition of ICS reducing this risk.[8,13]

There is currently limited data available on the specific patterns of and trends in asthma medication prescriptions. In particular, there is limited data on the prevalence of SABA overuse (defined as ≥ 3 canisters/year) in asthma management across Latin America. Thus, the SABA use IN Asthma (SABINA) program was developed to determine the magnitude of SABA use globally and its impact on clinical asthma outcomes

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through a real-world data analysis of harmonized large-scale observational studies. As part of this program, SABINA III, a multicenter, observational, cross-sectional study was conducted in 8,351 patients from 24 countries across five continents to describe prescription patterns of oral asthma therapies, with a particular focus on SABA prescriptions, as well as to provide an assessment of over-the-counter (OTC) SABA purchase.[14-16] This study reports results from a subanalysis of patients who participated in the SABINA III study in Brazil[14] and who were treated by different specialists, with the objective of highlighting current asthma management practices in Brazil.

METHODS

A full overview of the SABINA III methods has been published elsewhere.[14] In brief, SABINA Brazil was an observational, cross-sectional study conducted at five sites in different regions of the country (the northeastern, central-western, and southeastern regions) in private and public facilities. All patients were assessed by specialists. Recruitment occurred from March of 2019 to January of 2020. Here, we report country-specific aggregated data. The primary endpoints were to record SABA prescriptions in the 12 months preceding the study visit and obtain data on OTC SABA purchases without a prescription at the pharmacy. Prespecified patient data on asthma exacerbation history and comorbidities, as well as information on prescribed asthma medications, were collected from existing medical records by health care providers (HCPs) and collated and entered into an electronic case report form (eCRF) during a single study visit at each site. In addition, at the study visit, asthma symptom control was evaluated, and data on OTC purchases of SABAs based on patient recall were obtained directly from patients and entered in the eCRF by the investigator.

At each site, patients ≥ 12 years of age meeting the following criteria were eligible for enrollment: (i) documented physician diagnosis of asthma in their medical records; (ii) ≥ 3 previous consultations with the same HCP or practice; and (iii) medical records containing data for ≥ 12 months before the study visit. Patients with other chronic respiratory diseases, such as COPD, or an acute respiratory condition were excluded.

SABA prescriptions in the 12 months before the study visit were categorized as 0, 1-2, 3-5, 6-9, 10-12, and ≥ 13 canisters, with overprescription being defined as prescription of ≥ 3 SABA canisters/year.[14-18] Prescriptions of ICS in the previous 12 months were categorized in accordance with the prescribed average daily dose (low, medium, or high).[19] Other variables included sociodemographic characteristics, investigator-classified asthma severity (based on clinical assessment and guided by GINA 2017 treatment steps: 1-2, mild asthma; and 3-5, moderate-to-severe asthma),[19] asthma duration, and prescribed asthma treatments, including SABA monotherapy; SABAs in addition to maintenance therapy; ICS; fixed-dose combinations of ICS and LABAs; oral corticosteroid (OCS) burst treatment (defined as a short course of intravenous corticosteroids or OCSs administered for 3-10 days, or a single dose of an intramuscular corticosteroid to treat an exacerbation); and long-term OCSs (defined as any OCS treatment for > 10 days) and antibiotics. Data on pharmacy purchases of SABAs OTC without a prescription were also recorded.

Assessed asthma-related health outcomes included asthma symptom control at the time of the study visit (in accordance with the 2017 GINA definition)[19] and the number of severe asthma exacerbations 12 months before the study visit; severe asthma exacerbation was defined as a worsening of asthma symptoms resulting in hospitalization, an emergency room visit, or the need for OCS burst treatment, in accordance with the American Thoracic Society/European Respiratory Society recommendations.[20]

This study was conducted in compliance with the study protocol, the Declaration of Helsinki, and local research ethics committee approvals (CAAE no. 15624819.0.1001.5599). Written informed consent was obtained from all patients or legal guardians.

Descriptive statistics were used in order to characterize patients on the basis of their baseline demographics and clinical characteristics. Continuous variables were summarized as the number of nonmissing values, mean ± standard deviation, and median [interquartile range]. Categorical variables were summarized as frequency counts and percentages.

RESULTS

A total of 220 patients were recruited, with 219 being enrolled in the study. However, 1 patient was excluded because of the duration of asthma (i.e., < 12 months). From the five participating sites, 55.0% of the patients were recruited from the city of São Paulo or from the city of Sorocaba, both of which are located in the state of São Paulo, in southeastern Brazil; 25% were recruited from the city of Volta Redonda, located in the state of Rio de Janeiro, also in southeastern Brazil; 14.5% were recruited from the city of Salvador, located in the state of Bahia, in northeastern Brazil; and 5.5% were recruited from the city of Goiânia, located in the state of Goiás, in central-western Brazil. All participating patients were under specialist care, with 63.3% receiving treatment from pulmonologists and 36.7% receiving treatment from allergists.

Patients had a mean age of 49.0 ± 17.1 years, with the majority being female (70.6%) and never smokers (82.5%). A total of 69.3% of the patients had a BMI ≥ 25 kg/m^2, with 33.5% being classified as overweight and 35.8% being classified as obese. A total of 68.3% of the patients had a high school degree or an undergraduate/graduate degree. A little over half of the patients (51.8%) reported fully

reimbursed health care for medications and visits (Table 1).

Overall, 95.0% of the patients were classified as having moderate-to-severe asthma (GINA treatment steps 3-5) and 5.0% were classified as having mild asthma (GINA treatment steps 1-2). In this study, 41.7% of the patients were receiving GINA step 4 treatment and 37.2% were receiving GINA step 5 treatment. The mean duration of asthma was 23.2 ± 18.7 years. Patients reported a mean of 1.1 ± 1.9 severe exacerbations in the year before the study, with 49.1% experiencing 1 or more severe exacerbations. Notably, 13.5% of the patients with moderate-to-severe asthma had ≥ 3 severe exacerbations in the previous 12 months. Asthma symptom control was considered well controlled in 43.1%, partly controlled in 34.9%, and uncontrolled in 22.0%. A total of 39.0% of the patients had 1-2 comorbidities, with 45.9% reporting ≥ 3 comorbidities (Table 2).

A total of 80.3% of the patients were prescribed SABAs in addition to their maintenance therapy for symptom relief, with a mean of 11.2 ± 12.2 SABA canisters. Of those patients, 71.4% were prescribed ≥ 3 SABA canisters and 42.3% were prescribed ≥ 10 SABA canisters in the previous 12 months (Figure 1A). No prescriptions for SABA monotherapy were recorded.

A total of 14.2% of the patients reported purchasing SABAs OTC at a pharmacy without a prescription. Of those, 48.4% purchased ≥ 3 SABA canisters in the previous 12 months (Figure 1B).

A total of 34.4% of the patients received a prescription for monotherapy with ICS, with a mean of 10.5 ± 8.4 canisters prescribed in the previous 12 months. Most of the patients were prescribed high- or medium-dose ICS (49.3% and 42.7%, respectively), with only 8.0% being prescribed low-dose ICS (Table 3).

A fixed-dose combination of an ICS and a LABA was prescribed to nearly all of the patients (95.0%). Most (45.9%) received a prescription for medium-dose ICS, with 33.8% being prescribed high-dose ICS and 20.3% being prescribed low-dose ICS (Figure 1C; Table 3).

In the year before the study visit, at least one course of OCS burst treatment was prescribed to 45.0% of patients. Overall, 24.2% of the patients, most of whom had moderate-to-severe asthma, were prescribed antibiotics for their asthma.

DISCUSSION

SABINA Brazil was the first study to analyze SABA prescribing practices and OTC SABA purchases in a sample of asthma patients in different regions of Brazil;

Table 1. Demographic characteristics of the patients participating in the SABA use IN Asthma (SABINA) study in Brazil, by asthma severity.

Characteristic		Investigator-classified asthma severity		
		Mild asthma (n = 11)	Moderate-to-severe asthma (n = 207)	All patients (N = 218)
Age, years	12-17	33.9 ± 15.1	49.8 ± 16.8	49.0 ± 17.1
	≥ 18-54	35.0 [15.0-59.0]	51.0 [12.0-91.0]	51.0 [12.0-91.0]
Age group, n (%)	≥ 55	1 (9.1)	4 (1.9)	5 (2.3)
	Female	8 (72.7)	112 (54.1)	120 (55.0)
	Male	2 (18.2)	91 (44.0)	93 (42.7)
Sex, n (%)	Mean ± SD	4 (36.4)	150 (72.5)	154 (70.6)
	Median [IQR]	7 (63.6)	57 (27.5)	64 (29.4)
BMI, kg/m²	< 18.5	32.7 ± 8.4	28.5 ± 5.7	28.7 ± 5.9
	≥ 18.5-24.9	32.9 [20.6-45.7]	27.9 [18.1-47.9]	28.1 [18.1-47.9]
BMI groups, n (%)	≥ 25-29.9	0 (0.0)	1 (0.5)	1 (0.5)
	≥ 30.0	2 (18.2)	64 (30.9)	73 (30.3)
	Elementary school	3 (27.3)	70 (33.8)	348 (33.5)
	Middle school	6 (54.5)	72 (34.8)	78 (35.8)
Educational level, n (%)	High school	1 (9.1)	39 (18.8)	40 (18.3)
	College/Graduate school	1 (9.1)	26 (12.6)	27 (12.4)
	Unknown	5 (45.5)	77 (37.2)	82 (37.6)
	Not reimbursed	4 (36.4)	63 (30.4)	67 (30.7)
	Partially reimbursed	0 (0.0)	2 (1.0)	2 (0.9)
Health insurance/medication funding, n (%)	Fully reimbursed	4 (36.4)	38 (18.4)	42 (19.3)
	Unknown	4 (36.4)	32 (15.5)	36 (16.5)
	Current smoker	1 (9.1)	112 (54.1)	113 (51.8)
	Former smoker	2 (18.2)	25 (12.1)	27 (12.4)
Smoking status, n (%)	Never smoker	1 (9.1)	4 (1.9)	5 (2.3)
	Former smoker	2 (18.2)	31 (15)	33 (15.2)
	Never smoker	8 (72.7)	171 (83)	179 (82.5)

Table 2. Characteristics of asthma in the patients participating in the SABA use IN Asthma (SABINA) study in Brazil, by asthma severity.

Characteristic		Investigator-classified asthma severity		
		Mild asthma (n = 11)	Moderate-to-severe asthma (n = 207)	All patients (N = 218)
Asthma duration, years	Mean ± SD	18.3 ± 13.8	23.4 ± 19.0	23.2 ± 18.7
	Median [IQR]	15.0 [6.0-58.0]	17.0 [1.0-85.0]	17.0 [1.0-85.0]
Number of severe asthma exacerbations in the past 12 months	Mean ± SD	1.2 ± 2.0	1.1 ± 1.8	1.1 ± 1.9
Number of severe asthma exacerbations in the past 12 months by group, n (%)	0	8 (72.7)	103 (49.8)	111 (50.9)
	1	0 (0.0)	45 (21.7)	45 (20.6
	2	0 (0.0)	31 (15.0)	31 (14.2)
	3	0 (0.0)	16 (7.7)	16 (7.3)
	> 3	3 (27.3)	12 (5.8)	15 (6.9)
GINA classification, n (%)	Step 1	1 (9.1)	0 (0.0)	1 (0.5)
	Step 2	10 (90.9)	0 (0.0)	10 (4.6)
	Step 3	0 (0)	35 (16.9)	35 (16.1)
	Step 4	0 (0)	91 (44.0)	91 (41.7)
	Step 5	0 (0)	81 (39.1)	81 (37.2)
Level of asthma symptom control, n (%)	Well controlled	4 (36.4)	90 (43.5)	94 (43.1)
	Partly controlled	5 (45.5)	71 (34.3)	76 (34.9)
	Not controlled	2 (18.2)	46 (22.2)	48 (22)
Number of comorbidities, n (%)	0	0 (0.0)	33 (15.9)	33 (15.1)
	1-2	5 (45.5)	80 (38.6)	85 (39.0)
	3-4	4 (36.4)	58 (28.0)	62 (28.4)
	≥ 5	2 (18.1)	36 (17.5)	38 (17.5)

therefore, this study provides valuable information on prescribing habits for asthma at the specialist care level in Brazil. Overall, the findings show an unmet need in terms of further education, training in asthma management, and other treatment options, such as additional therapy with biologic agents, highlighting the fact that SABA overprescription is an area of notable concern in Brazil. This topic was addressed in a position statement on SABA use in asthma management in Latin America, where overreliance on the use of SABAs is a major public health concern that needs to be addressed at all levels of health care.[21]

In contrast to what was observed in many of the participating countries in SABINA III, all (100%) of the patients in Brazil were overseen by specialists at asthma referral centers; this accounts for the finding that most (95.0%) of the patients were classified as having moderate-to-severe asthma and were prescribed fixed-dose combination therapy with ICS and LABAs, with none of the patients having been prescribed SABA monotherapy. In 2020, BTA-recommended treatment steps 4 and 5 included the prescription of SABAs as rescue therapy. Because patients were seen by specialists, SABA monotherapy prescriptions were not recorded, in accordance with the guidelines. Nevertheless, it is important to emphasize that, despite receiving specialist care, nearly a quarter of the patients (22.0%) reported uncontrolled asthma in the 12 months before the study visit. Moreover, in patients who were prescribed SABAs in addition to maintenance therapy, 71.4% and 42.3% were prescribed ≥ 3 and ≥ 10 SABA canisters, respectively, in the preceding 12 months. Factors that may have contributed to these high rates of SABA prescribing include the free provision of certain asthma medications, including albuterol, to patients with asthma by the Brazilian Unified Health Care System[22] and the high cost of combined ICS-LABA inhalers.[23] Crucially, patients also obtained SABAs through unregulated sources, with 14.2% of the patients having purchased SABAs OTC without a prescription. Of those, 48.4% purchased ≥ 3 canisters. This finding reinforces patient overreliance on SABA therapy for symptom relief and is of concern because SABA purchase further increases the potential for SABA overuse.[24] Since OTC purchase of SABAs has been linked to a decrease in medical visits, an increase in emergency room visits, and low use of prescription medications, thus contributing to suboptimal treatment of asthma,[25-27] it is essential to improve accessibility to health care, make medications more affordable, and better regulate OTC SABA purchases.

The prevalence of uncontrolled asthma was lower in SABINA Brazil than in previous studies conducted in Brazil[3] and Latin America,[28-30] indicating improved asthma outcomes from specialist care. Nevertheless, the high rate of severe asthma exacerbations and the low proportion of patients with well-controlled asthma clearly illustrate a significant opportunity to further optimize asthma management. In addition,

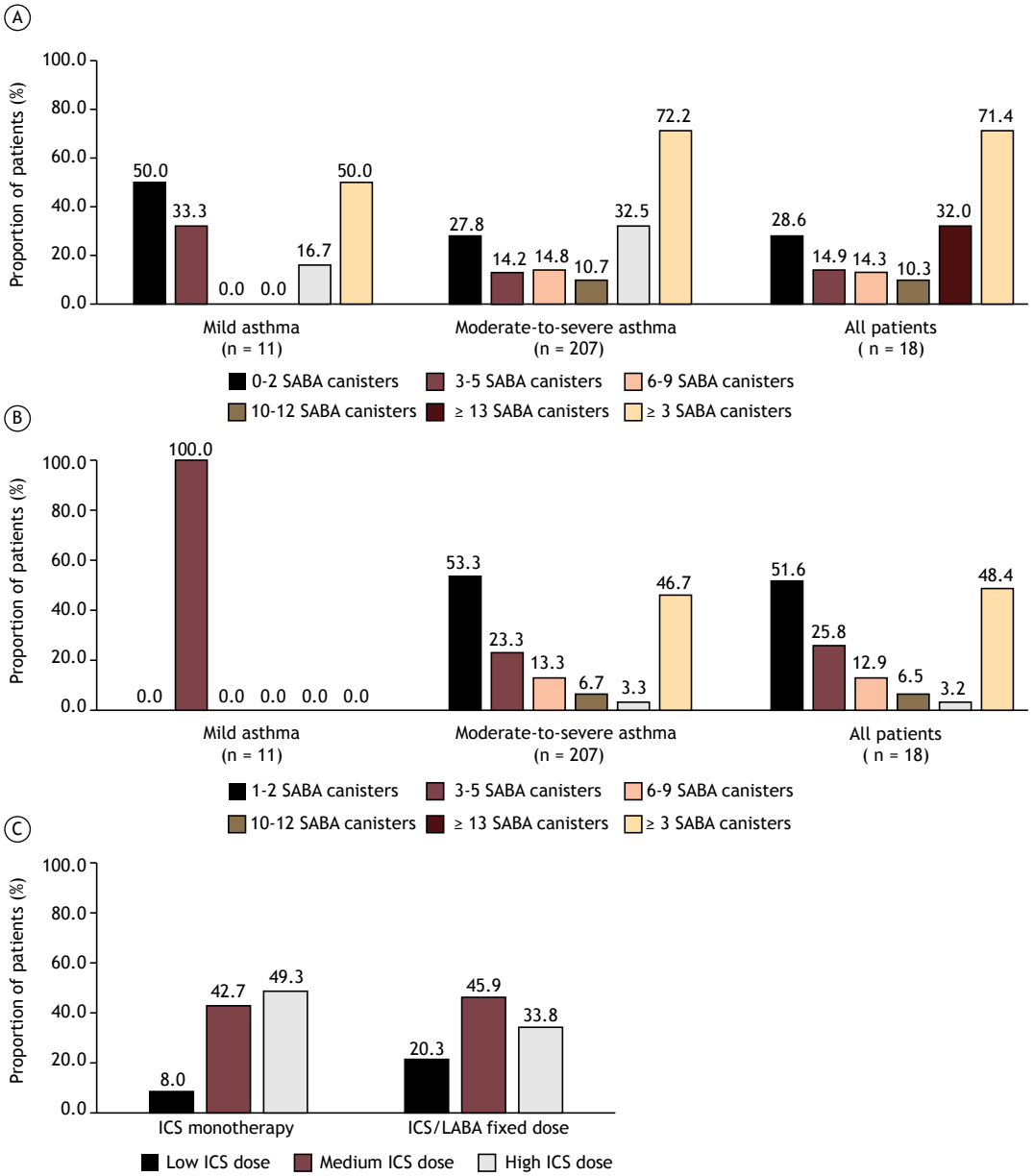

Figure 1. In A, short-acting β_2 agonist (SABA) prescriptions, by asthma severity; in B, over-the-counter (OTC) SABA purchases, by asthma severity; and in C, inhaled corticosteroid (ICS) prescriptions, by dose, in the 12 months before the study visit in the SABA use IN Asthma (SABINA) study in Brazil. LABA: long-acting β_2 agonist.

the high rates of SABA overprescription, coupled with the fact that less than 50% of the patients participating in SABINA Brazil reported well-controlled asthma, further underscore the need for strategies to overcome barriers currently limiting the attainment of asthma control across the country to decrease asthma morbidity and mortality. This is of particular importance given that increasing SABA exposure increases the risk of severe exacerbations.[14,16-18] Indeed, the SABINA I study conducted in the UK showed that the use of ≥ 3 SABA canisters per year significantly increased the risk of exacerbations and health care utilization (primary care and hospital outpatient consultations). [17] Additionally, findings from Sweden (SABINA II) showed that an increasing number of collected SABA canisters increased the risk of exacerbations, with higher SABA use being also associated with increased mortality risk.[18] Moreover, aggregated data from all 24 countries in SABINA III, as well as the Latin American cohort of SABINA III, which included 1,096 patients from Argentina, Brazil, Chile, Colombia, Costa Rica, and Mexico, indicated that, in comparison with 1-2 SABA prescriptions per year, ≥ 3 SABA prescriptions per year were associated with increasingly lower odds of controlled or partly controlled asthma and higher rates of severe exacerbations across asthma severities and primary and specialist care settings.[14,16]

Table 3. Prescription of other medications in the previous 12 months in the SABA use IN Asthma (SABINA) study in Brazil.

	Investigator-classified asthma severity		
	Mild asthma (n = 11)	Moderate-to-severe asthma (n = 207)	All patients (N = 218)
Prescription of ICS, n (%)			
No	7 (63.6)	136 (65.7)	143 (65.6)
Yes	4 (36.4)	71 (34.3)	75 (34.4)
ICS canisters or inhalers prescribed in the past 12 months			
Mean ± SD	10.0 ± 10.5	10.5 ± 8.4	10.5 ± 8.4
Median [IQR]	7.5 [1.0-24.0]	10.0 [1.0-48.0]	10.0 [1.0-48.0]
Total daily ICS dose, n (%)			
Low dose	1 (25.0)	5 (7.0)	6 (8.0)
Medium dose	2 (50.0)	30 (42.3)	32 (42.7)
High dose	1 (25.0)	36 (50.7)	37 (49.3)
Prescription of ICS/LABA fixed-dose combination, n (%)			
No	6 (54.5)	5 (2.4)	11 (5.0)
Yes	5 (45.5)	202 (97.6)	207 (95.0)
Total daily ICS dose, n (%)			
Low dose	5 (100.0)	37 (18.3)	42 (20.3)
Medium dose	0 (0.0)	95 (47.0)	95 (45.9)
High dose	0 (0.0)	70 (34.7)	70 (33.8)
Prescription of OCS burst treatment/short course, n (%)			
No	7 (63.6)	113 (54.6)	120 (55.0)
Yes	4 (36.4)	94 (45.4)	98 (45.0)
Total daily dose, mg/day			
Mean ± SD	40.0 ± 0.0	47.2 ± 68.3	46.9 ± 66.9
Median [IQR]	40.0 [40.0-40.0]	40.0 [5.0-500.0]	40.0 [5.0-500.0]
Number of days per prescription			
Mean ± SD	5.0 ± 0.0	5.5 ± 2.0	5.5 ± 2.0
Median [IQR]	5.0 [5.0-5.0]	5.0 [1.0-15.0]	5.0 [1.0-15.0]
Prescription of antibiotics for asthma, n (%)			
No	10 (90.9)	153 (73.9)	163 (75.8)
Yes	1 (9.1)	51 (24.6)	52 (24.2)

ICS: inhaled corticosteroid(s); LABA: long-acting β_2 agonist; and OCS: oral corticosteroid.

For over 50 years, as-needed SABA therapy was the preferred therapeutic approach for symptom relief. Although guidelines now endorse an ICS-containing reliever, results from several clinical studies and real-world evidence studies have documented the magnitude of SABA monotherapy.[14,16,31-35] Therefore, access to combination therapy should be prioritized, particularly because ICS-formoterol as maintenance and reliever therapy reduces exacerbation rates, thereby alleviating the burden on health care services.[36-38] These approaches should be followed by educational initiatives targeted at patients and relevant stakeholders, including physicians and pharmacists, to raise awareness and increase understanding around the latest treatment recommendations. The development of national asthma programs based on current evidence-based guidelines, which can be adapted to clinical settings and practices, together with the creation of local resources, will play an essential role in this endeavor. In addition to these measures, changes to evidence-based treatment guidelines as proposed by the GINA[6] and the BTA,[12] which now recommend ICS-formoterol as the as-needed reliever of choice for adults and adolescents across treatment steps, represent a significant step toward combating SABA overuse and reducing the risk of severe exacerbations across all severities of asthma.

Findings from this study need to be considered in the context of a number of limitations. First, although patients were recruited from different regions of Brazil, it was only possible to obtain a relatively small patient sample. Second, the number of cigarettes used by current or former smokers (in pack-years) was not collected. Third, all patients were recruited from specialist care; therefore, this population may not be representative of the entire asthma population in Brazil or provide an accurate assessment of how patients with asthma are being managed in this country. Fourth, recruitment occurred prior to the approval of biologic agents in the public health care system, and patients were under the care of a specialist in accordance with Brazilian recommendations. Fifth, it is possible that not all SABA prescriptions translated into actual use; therefore, it is entirely possible

that SABA use was actually lower. Sixth, SABA overprescription, especially in the emergency room, and the vicious cycle of OTC SABA purchase at the pharmacy, resulting in self-medication and random treatment, may have increased the potential for incorrect patient assessments. Seventh, the fact that no patients were seen by primary care physicians was a deviation from the original study design as it was specified in the protocol and may have resulted in improved prescribing practices and patient outcomes when compared with those recorded in SABINA studies in which primary care physicians participated. In addition, this precluded a comparison of results across primary and specialist care. On the other hand, the exclusion of patients managed at the primary care level in this study underscores the requirement for further education and training of general practitioners to ensure that they are able to diagnose and manage patients with complex asthma, without the need for referral centers. Finally, factors potentially contributing to SABA overuse were not investigated, and this is an area that requires further research and assessment. Despite these limitations, this study provides real-world data on SABA prescription patterns and OTC SABA purchase in Brazil, highlighting that asthma continues to exert a major social and economic burden across the country and reinforcing the need to adhere to the latest treatment guidelines to improve treatment outcomes for patients with asthma in Brazil.

In conclusion, the results of SABINA Brazil show SABA overprescription (≥ 3 canisters/year) in nearly three quarters of all patients (71%), with 42% receiving prescriptions for ≥ 10 SABA canisters. Moreover, SABA overprescription was associated with poor asthma control and an increased risk of severe asthma exacerbations, placing patients at an increased risk of adverse events and even mortality. In addition, SABA overprescription and OTC SABA purchase were common in this analysis, possibly leading to the need for courses of OCSs. The health care community should collaborate to implement evidence-based recommendations and promote health education to improve asthma management.

DATA AVAILABILITY

Data underlying the findings described in this manuscript may be obtained in accordance with AstraZeneca's data-sharing policy described at https://astrazenecagrouptrials.pharmacm.com/ST/Submission/Disclosure. Data for studies directly listed on Vivli can be requested through Vivli at www.vivli.org. Data for studies not listed on Vivli can be requested through Vivli at https://vivli.org/members/enquiries-about-studies-not-listed-on-the-vivli-platform/. AstraZeneca Vivli member page is also available, outlining further details: https://vivli.org/ourmember/astrazeneca/.

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AUTHOR CONTRIBUTIONS

MJHIB designed the study. All authors contributed to data analysis, data interpretation, and drafting and reviewing of the manuscript.

CONFLICTS OF INTEREST

MAA participated in clinical trials for AbbVie, AstraZeneca, EMS, Eurofarma, GlaxoSmithKline, Humanigen, Janssen, Novartis, Sanofi, and Veru, and received fees for conferences and consultancy activities from Abbott, Aché, AstraZeneca, Chiesi, Eurofarma, IPI ASAC, and Sanofi. ASM gives lectures and develops clinical trials for AstraZeneca and Sanofi; has a project funded by the Brazilian *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq, National Council for Scientific and Technological Development); and is an associate professor 4 at the Federal University of Bahia Institute of Health Sciences, located in the city of Salvador, Brazil. MGG develops clinical trials for AstraZeneca. AAC is a professor of medicine at the Federal University of Bahia and the executive director of the ProAR Foundation. He received honoraria for lectures and/or advisory boards from Abdi Ibrahim, AstraZeneca, Boehringer Ingelheim, Chiesi, Crossject, Eurofarma, Glenmark, GlaxoSmithKline, Mylan, Novartis, and Sanofi. LA is an employee of AstraZeneca. MJHIB was an employee of AstraZeneca at the time the study was conducted. GAZ develops clinical trials for AstraZeneca and is an assistant professor of medicine at the *Centro Universitário de Volta Redonda*, Brazil. MFR was principal investigator of clinical studies for AstraZeneca, Boehringer Ingelheim, and Eurofarma.

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