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# Use of respiratory medication in five Latin American cities: The PLATINO study

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ABSTRACT

*Background:* There is scanty information regarding respiratory medication prescription pattern in Latin America. We examined the use of bronchodilators and corticosteroids in a population-based study conducted in five Latin American cities.

*Methods:* Medication use was derived from questions regarding the use of medication "to help breathing" within the previous 12 months, type of medicine, and frequency of use. To minimize the possibility of overdiagnosis, we used postbronchodilator $FEV_1/FVC < 0.70$ plus $FEV_1 < 80\%$ as the definition of obstruction.

*Results:* Interviews were completed in 5571 subjects from 6711 eligible individuals, and spirometry was performed in 5314 subjects. There were 360 (6.5%) treated subjects and 5211 not treated. Treated subjects were more likely to be older, women, unemployed, have higher tobacco consumption, higher body mass index, higher $FEV_1$ reversibility and airway obstruction. They were also more likely to report prior spirometry, prior diagnosis of COPD, asthma or tuberculosis, and more respiratory symptoms. Over half of treated subjects had neither obstruction nor $FEV_1$ reversibility, and approximately 30% reported no prior diagnosis of asthma or COPD. Prior respiratory diagnoses and wheezing were more strongly associated with treatment than objective measures of airway obstruction.

*Conclusions:* The use of bronchodilators and/or corticosteroids is common in the general population aged 40 years or older, with over one-half of treated subjects using them without being obstructed.



## 1. Introduction

Chronic obstructive pulmonary disease (COPD) and asthma are major health problems and the worldwide number of patients with these diseases continues to rise [1–7]. International efforts demonstrate the global necessity to improve the diagnosis and management of COPD and asthma. Despite the availability of several guidelines for these diseases [8–11], epidemiologic evidence suggests that COPD and asthma are frequently confused with other conditions (such as congestive heart failure, rhinosinusitis, pulmonary fibrosis, bronchiectasis, vocal cord dysfunction, obliterative bronchiolitis, etc.), leading to inappropriate treatment and suboptimal patient outcomes. In addition, tobacco consumption and the presence of respiratory symptoms have been interpreted as having COPD or asthma by many clinicians without documenting the presence of airway obstruction.

We have previously reported that COPD misdiagnosis is a frequent problem in the Proyecto Latinoamericano de Investigacion en Obstrucción Pulmonar (PLATINO). Among 237 subjects with a prior medical diagnosis of COPD, only 86 subjects (36.3%)

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had postbronchodilator $FEV_1/FVC < 0.70$ and 151 had no airway obstruction [12]. In the latter group, 17.9% showed a spirometric restrictive pattern and 47.7% were smokers with respiratory symptoms [12]. The presence of symptoms consistent with COPD (phlegm, cough, wheezing, and dyspnea) was common in all subjects [12]. This suggests that respiratory symptoms are being used as the primary diagnostic consideration by many physicians, and that patients are not being properly evaluated with functional assessment. This practice potentially has important therapeutic consequences, such as the inappropriate treatment of the real cause of symptoms.

Current evidence indicates that both developed and developing countries are experiencing inappropriate and unnecessary use of different drugs in their health care facilities [13–17]. Despite the importance of this problem, limited information exists in the field, in particular regarding the respiratory medication prescription pattern in Latin America [18,19]. The aim of this study was to investigate the use of bronchodilators and corticosteroids and the factors associated with their use in a population-based study conducted in five Latin American cities, with a particular focus on persons without evidence of chronic respiratory disease.

## 2. Methods and materials

PLATINO was an epidemiologic study performed in São Paulo (Brazil), Santiago (Chile), Mexico City (Mexico), Montevideo (Uruguay), and Caracas (Venezuela) [2]. Methodological details have been published previously [20]. In summary, a two-stage cluster sampling method was used at each site in order to obtain a probability sample of households. All adults aged 40 or older living in selected households were invited to participate. Approval of the ethical committees and written informed consent from each subject were obtained.

Information about factors potentially associated with COPD (age, sex, ethnicity, smoking habits, education level, employment, respiratory symptoms, etc.) was collected. Copies of the questionnaires used at each site are available at the website (http://www.platino-alat.org). A portable, battery operated, ultrasound transit-time based spirometer (Easy-One™; NDD Medical Technologies, Chelmsford, MA and Zürich, Swizerland) was used to perform spirometry.

In prior work, PLATINO used the definition of COPD and severity classification proposed by the Global Initiative for Chronic Obstructive Lung Disease (GOLD): a ratio of the postbronchodilator $FEV_1/FVC < 0.70$ [9]. This is consistent with the directives of the American Thoracic Society (ATS) and the European Respiratory Society (ERS) [8]. However, because this definition has been criticized for potential COPD overdiagnosis in older subjects, and because GOLD recommends treatment only for symptomatic patients in this stage, we defined obstruction as a postbronchodilator $FEV_1/FVC < 0.70 + FEV_1 < 80\%$ of predicted (stage II or higher COPD) for this analysis in order to minimize the chance of including patients for whom treatment was not indicated. $FEV_1$ reversibility was defined as a postbronchodilator $FEV_1$ change of 200 ml or more and a change of at least 12% from the baseline value. Spirometric restrictive pattern was defined as $FEV_1/FVC$ of 0.70 or greater with an FVC less than 80% of the predicted value.

Prior diagnostic label was determined using a self-reported prior diagnosis of emphysema, chronic bronchitis, COPD, asthma, or tuberculosis. Medication use was derived from questions regarding the use of medication "to help breathing" within the 12 months prior to interview, type of medicine, and frequency of use. Information regarding the use of respiratory medication was based on the following questions:

- Have you taken any medicine to help with your breathing in the last 12 months?
- Is the medicine taken on most days, even when you do not have symptoms, or just when you have symptoms?
- When you are taking the medication, how many days each week do you take it?
- When you are taking the medication, how many months in the last year have you taken it?

Medication types were recorded and coded later as "any medication", "any bronchodilator", and "any corticosteroid." In the present study, respiratory treatment was defined as the use of any bronchodilator or corticosteroid.

### 2.1. Statistical analyses

Descriptive analyses were performed using Pearson $\chi^2$ tests (for categorical variables) and two-sided *t*-tests (for continuous variables) to compare groups. Multivariate logistic regression was aimed at identifying variables associated with the use of respiratory medication (as defined above), and included an adjustment for survey design. All analyses were performed using the STATA statistical software package (STATA version 9.2; STATA Corporation; College Station, TX).

## 3. Results

Descriptions of participation rates and sample characteristics of the PLATINO study have been reported [2,12,21–23]. Complete interviews were achieved in 5571 subjects from a total of 6711 eligible individuals. Among the 5571 studied subjects, 360 had used a bronchodilator and/or corticosteroid within the past 12 months while 5211 were not treated. Spirometry was completed in 5314 subjects. Among these, there were 308 subjects with COPD stage II or higher and 5006 individuals with a postbronchodilator $FEV_1/FVC \geqslant 0.70$ (no obstruction) or $FEV_1/FVC < 0.70$ plus $FEV_1 > 80\%$ predicted (stage I COPD). Characteristics of the study population are presented in Table 1. Subjects using respiratory medication were significantly more likely to be older, female, unemployed, had higher tobacco consumption (pack-years), higher body mass index (BMI), higher $FEV_1$ reversibility and airway obstruction ($FEV_1/FVC < 0.70 + FEV_1 < 80\%$ predicted) had more respiratory symptoms, and were more likely to report prior spirometry, COPD, asthma or tuberculosis diagnosis. They also had lower mean FVC, $FEV_1$, and $FEV_1/FVC$ values.

Table 2a shows that over 70% of treated subjects were receiving bronchodilators and/or corticosteroids without having airway obstruction or $FEV_1$ reversibility. A sub-analysis of treated subjects with no obstruction or reversibility is shown in Table 2b. Prior TB history was reported in 6.9% of these subjects and 92.6% reported any respiratory symptom (cough, phlegm, wheeze, or dyspnea). Only 7.2% had taken corticosteroids longer than 3 months of the previous year.

Table 3a shows the distribution of subjects receiving respiratory medications according to diagnostic considerations (prior COPD or asthma diagnosis). Approximately, 30% of treated subjects reported no prior diagnosis of asthma or COPD. A sub-analysis of treated subjects without prior COPD or asthma diagnosis is shown in Table 3b. TB history was reported in 5.5% of the subjects and any respiratory symptom in over 90%. Only 4.1% had taken corticosteroids longer than 3 months.

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**Table 1**
Description of the study population

| Variables | Categories | No treatment ($n = 5211$) | Any treatment ($n = 360$) | $p$-Value |
|---|---|---|---|---|
| | | $n$ (%) | $n$ (%) | |
| Age (years) (mean ± S.D.) | | 56.5 ± 11.8 | 58.4 ± 13.2 | 0.009 |
| Gender | Male | 2088 (95.3) | 104 (4.7) | <0.0001 |
| | Female | 3123 (92.4) | 256 (7.6) | |
| BMI (kg/m$^2$) (mean ± S.D.) | | 28.0 ± 5.5 | 28.8 ± 5.9 | 0.013 |
| Race | White | 2806 (93.2) | 206 (6.8) | 0.240 |
| | Nonwhite | 2387 (93.9) | 154 (6.1) | |
| Education (years) (mean ± S.D.) | | 7.51 ± 4.74 | 7.84 ± 4.95 | 0.219 |
| Employment | No | 2370 (92.6) | 190 (7.4) | 0.007 |
| | Yes | 2840 (94.4) | 170 (5.7) | |
| Smoking (pack-years) (mean ± S.D.) | | 10.3 ± 18.5 | 12.9 ± 23.0 | 0.039 |
| Smoking status | Never | 2255 (94.0) | 144 (6.0) | 0.139 |
| | Former | 1427 (92.5) | 116 (6.0) | |
| | Current | 1526 (93.9) | 100 (6.2) | |
| Cough | No | 4214 (95.8) | 187 (4.3) | <0.0001 |
| | Yes | 994 (85.2) | 173 (14.8) | |
| Phlegm | No | 4327 (95.7) | 196 (4.3) | <0.0001 |
| | Yes | 881 (84.3) | 164 (15.7) | |
| Wheezing | No | 4145 (97.6) | 103 (2.4) | <0.0001 |
| | Yes | 1066 (80.6) | 257 (19.4) | |
| Dyspnea | No | 2881 (97.3) | 81 (2.7) | <0.0001 |
| | Yes | 2271 (89.5) | 267 (10.5) | |
| Self-reported diagnosis: COPD | No | 5055 (95.1) | 260 (4.9) | <0.0001 |
| | Yes | 156 (60.9) | 100 (39.1) | |
| Self-reported diagnosis: asthma | No | 4745 (97.1) | 142 (2.9) | <0.0001 |
| | Yes | 465 (68.1) | 218 (31.9) | |
| Self-reported diagnosis: tuberculosis | No | 5106 (93.9) | 332 (6.1) | <0.0001 |
| | Yes | 104 (78.8) | 28 (21.2) | |
| Prior spirometry (ever) | No | 4703 (95.4) | 225 (4.6) | <0.0001 |
| | Yes | 506 (78.9) | 135 (21.1) | |
| Obstructive pattern | No | 4740 (94.7) | 266 (5.3) | <0.0001 |
| | Yes | 234 (76.0) | 74 (24.0) | |
| Restrictive pattern | No | 4542 (93.6) | 313 (6.5) | 0.637 |
| | Yes | 432 (94.1) | 27 (5.9) | |
| $FEV_1$ reversibility | No | 4524 (94.2) | 281 (5.9) | <0.0001 |
| | Yes | 330 (87.3) | 48 (12.7) | |
| FVC (l) (mean ± S.D.) | | 3.39 ± 0.94 | 3.06 ± 0.91 | <0.0001 |
| $FEV_1$ (l) (mean ± S.D.) | | 2.65 ± 0.76 | 2.22 ± 0.80 | <0.0001 |
| $FEV_1$/FVC (mean ± S.D.) | | 78.4 ± 8.02 | 72.1 ± 13.3 | <0.0001 |
| $FEV_1$ reversibility (ml) (mean ± S.D.) | | 85.3 ± 178.7 | 117.0 ± 143.8 | <0.0001 |

FVC, forced vital capacity; $FEV_1$, forced expiratory volume in one second; S.D., standard deviation. Obstructive pattern = $FEV_1$/FVC <0.70 and $FEV_1$ <80% predicted; restrictive pattern = $FEV_1$/FVC ⩾0.70 and FVC <80% predicted; $FEV_1$ reversibility = postbronchodilator change of >200 ml and >12% of baseline.

**Table 2a**
Distribution of treated subjects by obstruction and $FEV_1$ reversibility[a]

| | No obstruction $n$ (%) | Obstruction $n$ (%) | Total $n$ (%) | $p$-Level |
|---|---|---|---|---|
| No reversibility | 231 (70.2) | 50 (15.2) | 281 (85.4) | |
| Reversibility | 27 (8.2) | 21 (6.4) | 48 (15.6) | |
| Total | 258 (78.4) | 71 (21.6) | 329 (100) | <0.001 |

[a] Treatment = any bronchodilator or corticosteroid in the previous 12 months; obstruction = postbronchodilator $FEV_1$/FVC <0.70 and $FEV_1$ <80% predicted; reversibility = postbronchodilator $FEV_1$ change >200 ml and >12% of baseline value.

**Table 2b**
Subgroup of treated subjects with no obstruction or reversibility ($n = 231$)[a]

| Variables | $n$ (%) |
|---|---|
| Cough | 99 (42.9) |
| Phlegm | 91 (39.4) |
| Wheeze | 159 (68.8) |
| Dyspnea | 164 (73.5) |
| Any respiratory symptom | 214 (92.6) |
| Any bronchodilator | 209 (90.5) |
| Chronic bronchodilator[b] | 44 (21.2) |
| Any corticosteroid | 56 (24.2) |
| Chronic corticosteroid[b] | 15 (7.2) |
| History of TB | 16 (6.9) |
| Restrictive pattern[c] | 19 (8.2) |

[a] Treatment = any bronchodilator or corticosteroid in the previous 12 months; obstruction = postbronchodilator $FEV_1$/FVC <0.70 and $FEV_1$ <80% predicted; reversibility = postbronchodilator $FEV_1$ change >200 ml and >12% of baseline value.
[b] Chronic treatment = treatment for over 3 months in the previous 12 months.
[c] Restrictive pattern = $FEV_1$/FVC ⩾0.70 and FVC <80% predicted.

The distribution of selected characteristics in the total population by country is shown in Table 4. There were significant differences among countries in the use of respiratory medications, lung function, self-reported respiratory diagnoses, respiratory symptoms, and prior spirometry. People residing in Santiago were most likely to receive any bronchodilator and/or corticosteroid

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than persons in other cities (14.7%), whereas residents of Montevideo showed the lowest use of these medications (1.4%). The use of any corticosteroid was higher in Santiago and Caracas.

Table 5 shows the results of a multivariate logistic regression examining factors associated with the use of any bronchodilator or steroid. COPD and asthma diagnoses were more strongly associated with receipt of breathing medication than objective measures such as obstruction ($FEV_1/FVC$ <0.70+$FEV_1$ <80% pred.), prebronchodilator $FEV_1$, or $FEV_1$ reversibility (not included in the final model). Although prior asthma diagnosis and spirometry were independently associated with a higher likelihood of treatment, persons with both (i.e., asthma diagnosis and spirometry) were less likely to receive treatment. The presence of wheezing and, to a lesser degree dyspnea, was associated with increased likelihood of treatment. In Santiago, persons were significantly more likely to receive treatment than were people in other cities (after adjustment for other factors). However, prior diagnosis of COPD had significantly less impact on the likelihood of receiving treatment than in other countries. Persons residing in Montevideo were significantly less likely to receive treatment than persons in other cities (after adjustment for the other factors). Much of this difference could be explained by the fact

**Table 3a**
Distribution of treated subjects by prior self-reported diagnosis of COPD and asthma[a]

| | No asthma *n* (%) | Asthma *n* (%) | Total *n* (%) | *p*-Level |
|---|---|---|---|---|
| No COPD | 110 (30.6) | 150 (41.7) | 260 (72.2) | |
| COPD | 32 (8.9) | 68 (18.9) | 100 (27.8) | |
| Total | 142 (39.4) | 218 (60.6) | 360 (100) | 0.073 |

[a] Treatment = any bronchodilator or corticosteroid within previous 12 months.

**Table 3b**
Subgroup of treated subjects without prior history of COPD or asthma ($n = 110$)[a]

| Variables | *n* (%) |
|---|---|
| Cough | 38 (34.6) |
| Phlegm | 37 (33.6) |
| Wheeze | 63 (57.3) |
| Dyspnea | 74 (70.5) |
| Any respiratory symptom | 99 (90.0) |
| Any bronchodilator | 100 (90.9) |
| Chronic bronchodilator[b] | 18 (18.4) |
| Any corticosteroid | 20 (18.2) |
| Chronic corticosteroid[b] | 4 (4.1) |
| History of TB | 6 (5.5) |
| $FEV_1$ reversibility[c] | 12 (11.7) |
| Restrictive pattern[d] | 8 (7.6) |

Prior diagnoses were based on patient self-report.
[a] Treatment = any bronchodilator or corticosteroid within previous 12 months.
[b] Chronic treatment = treatment for over 3 months in the previous 12 months.
[c] $FEV_1$ reversibility = postbronchodilator change of >200 ml and >12% of baseline
[d] Restrictive pattern = $FEV_1/FVC \geqslant 0.70$ and FVC <80% predicted.

**Table 5**
Factors associated with receipt of bronchodilators or steroids within past 12 months ($n = 5311$)

| Variables | OR | 95% CI | | *p*-Value |
|---|---|---|---|---|
| | | Low | High | |
| Age (years) | 1.00 | 0.98 | 1.01 | 0.826 |
| Obstruction ($FEV_1/FVC$ < 0.70+$FEV_1$ <80% pred.) | 1.58 | 0.96 | 2.58 | 0.070 |
| Self-reported COPD diagnosis | 3.34 | 2.01 | 5.54 | <0.0001 |
| Self-reported asthma diagnosis | 7.73 | 5.43 | 10.99 | <0.0001 |
| Prior spirometry | 4.53 | 2.97 | 6.91 | <0.0001 |
| Interaction: Asthma diagnosis × Spirometry | 0.46 | 0.25 | 0.84 | 0.011 |
| Phlegm | 1.36 | 0.99 | 1.87 | 0.054 |
| Wheezing | 4.15 | 3.10 | 5.56 | <0.0001 |
| Dyspnea | 1.57 | 1.17 | 2.11 | 0.003 |
| $FEV_1$ (prebronchodilator) | 0.67 | 0.52 | 0.86 | 0.002 |
| Santiago (Chile) | 2.50 | 1.60 | 3.90 | <0.0001 |
| Interaction: Santiago × COPD diagnosis | 0.46 | 0.23 | 0.95 | 0.035 |
| Mexico City (Mexico) | 0.78 | 0.45 | 1.37 | 0.392 |
| Montevideo (Uruguay) | 0.33 | 0.12 | 0.92 | 0.035 |
| Interaction: Montevideo × Wheezing | 0.22 | 0.06 | 0.88 | 0.032 |
| Caracas (Venezuela) | 1.31 | 0.83 | 2.05 | 0.243 |

**Table 4**
Distribution of selected variables by country in the total population

| Variables | Sao Paulo *n* (%) | Santiago *n* (%) | Mexico City *n* (%) | Montevideo *n* (%) | Caracas *n* (%) |
|---|---|---|---|---|---|
| Therapy | | | | | |
| Any treatment[a] | 50 (5.0) | 178 (14.7) | 35 (3.3) | 13 (1.4) | 84 (6.2) |
| Any bronchodilator[a] | 44 (4.4) | 171 (14.2) | 31 (2.9) | 4 (0.4) | 79 (5.8) |
| Any corticosteroids[b] | 10 (1.0) | 43 (3.6) | 8 (0.8) | 9 (1.0) | 36 (2.7) |
| Lung function | | | | | |
| Obstruction[a] | 58 (6.0) | 74 (6.3) | 27 (2.7) | 69 (7.8) | 80 (6.2) |
| Restrictive pattern[a] | 113 (11.7) | 31 (2.6) | 96 (9.6) | 61 (6.9) | 158 (12.2) |
| $FEV_1$ reversibility[a] | 85 (9.3) | 48 (4.2) | 71 (7.4) | 88 (10.0) | 86 (6.7) |
| Self-reported diagnosis | | | | | |
| Self-reported asthma[a] | 101 (10.1) | 253 (20.9) | 53 (5.0) | 132 (14.0) | 144 (10.6) |
| Self-reported COPD[b] | 53 (5.3) | 72 (6.0) | 57 (5.4) | 23 (2.4) | 51 (3.8) |
| Symptoms | | | | | |
| Cough[a] | 224 (22.4) | 349 (28.9) | 148 (13.9) | 200 (21.3) | 246 (18.1) |
| Phlegm[a] | 173 (17.3) | 310 (25.7) | 164 (15.4) | 142 (15.1) | 256 (18.9) |
| Wheezing[a] | 235 (23.5) | 423 (35.0) | 182 (17.1) | 232 (24.6) | 251 (18.5) |
| Dyspnea[a] | 344 (34.7) | 621 (52.9) | 555 (52.5) | 375 (40.0) | 643 (48.1) |
| Prior spirometry[a] | 101 (10.1) | 216 (17.9) | 73 (6.9) | 138 (14.6) | 113 (8.3) |

Any treatment defined as any bronchodilator or corticosteroid in the previous 12 months.
[a] $p<0.0001$ (Pearson $\chi^2$).
[b] $p<0.001$ (Pearson $\chi^2$).

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that a person with wheezing was significantly less likely to receive treatment in Montevideo. We tested models including variables such as gender, BMI, race, cough, and prior diagnosis of tuberculosis, but none of these added any predictive power to the model.

## 4. Discussion

In previous work, we have examined the problem of underuse of respiratory medication in person with COPD [22]. The present study focuses on the use of bronchodilators or corticosteroids in persons with little evidence of chronic respiratory disease. We observed that a substantial number of subjects were using bronchodilators or corticosteroids with significant differences among the countries. No evidence of objective or prior diagnostic consideration of airway obstruction was present in a large proportion of the treated subjects. Prior respiratory diagnoses and the presence of wheezing were more strongly associated with the use of breathing medication than were objective measures of airway obstruction.

Several studies have shown that COPD is widely undertreated not only in its early stages, but also when lung function is severely impaired [18,22,24–26]. Earlier results from the PLATINO study found that, among the entire COPD population, only 24.7% of the diagnosed individuals were treated [22]. Despite the general undertreatment of COPD, there also appears to be use of respiratory medication in subjects incorrectly diagnosed as COPD. Less attention has been paid to this problem.

Limited information exists regarding the use of respiratory medications and the factors influencing their use in population-based studies. Simoni et al. assessed the habitual up-take of medicines in subjects with respiratory symptoms/diseases or impaired lung function in general population samples. They found that only prior diagnosis of asthma was significantly associated with the use of specific respiratory drugs [18]. In the PLATINO study, 65/151 subjects (43%) with a prior incorrect COPD diagnosis were receiving any medication for breathing and only 12/151 had $FEV_1$ reversibility. The present study found that 6.5% (360/5571) of the entire study population had used any bronchodilator or corticosteroid within the past 12 months. The regression analysis indicated that prior COPD and asthma diagnoses, wheezing, dyspnea, prior spirometry, and residing in Santiago were most strongly associated with the use of bronchodilator or corticosteroid. According to the reported prevalence of adult asthma and COPD in the general population (5–10% and 9–10%, respectively) [27,28], the use of respiratory drugs should be approximately 10%; so that the results of the present study probably indicate a limited use of respiratory medication in the general population. However, a closer look at treated subjects showed that 70% of subjects were receiving bronchodilators or corticosteroids without having airway obstruction or $FEV_1$ reversibility and 30% of treated subjects reported no prior diagnosis of asthma or COPD. Chronic use of respiratory medications (i.e., longer than 3 months) was relatively uncommon in this subgroup, suggesting that acute asthma-like presentations (acute bronchitis, etc.) may explain much of this usage.

Prior COPD and asthma diagnoses were stronger predictors than objective measures of airway obstruction. These results are in agreement with those reported by Simoni et al., regarding the strong association between prior diagnosis of asthma and the use of respiratory medicines [18]. As mentioned above, prior diagnosis of COPD in the absence of airway obstruction is a frequent problem [12]. Other studies have reported that misdiagnosis is also common in asthma and may result in unnecessary therapy [29,30]. LindenSmith et al. reported that 41% of a sample of physician-labeled asthmatics showed no evidence of reversible airflow obstruction and had a negative methacholine challenge [30]. In that study, 62% of subjects that did not meet the criteria for asthma (positive symptom history, reversible airflow obstruction or bronchial hyperreactivity) were taking medications for breathing [30]. Their findings suggest a probable use of respiratory medications in persons without COPD or asthma due to an incorrect diagnosis [30].

In the present study, there was an association between receiving bronchodilator or corticosteroid with the presence of wheezing and dyspnea. Among these, wheezing was the strongest predictor. It is well accepted that asthma and COPD are common diseases presenting with wheezing, therefore it would be most unwise not to consider these conditions in patients suffering this symptom. In addition to bronchospasm, other problems can cause wheezing—these include all mechanisms narrowing airway caliber. Previously, we reported that the presence of dyspnea, phlegm and wheezing were common (77.6%, 43% and 56%, respectively) in misdiagnosed COPD [12]. Therefore, it is likely that the presence of wheezing could lead to the use or prescription of respiratory medication in subjects without airway obstruction. Although wheezing can be present in asthma and COPD, Chevalier Jackson recognized 100 years ago that "all that wheezes is not asthma" and based on our results we would not be afraid to add to the old adage that is not necessarily COPD either.

We have reported that 52.3% of patients with prior correct COPD diagnosis have undergone prior spirometry [12]. This fact could probably explain the observed association between the use of respiratory medication and prior spirometry. In addition, we might speculate that those subjects that were receiving medication and who had previous spirometry were probably those who had a correct indication for being treated.

The other important finding of the study is the wide variation in the use of medication among the cities. Interestingly, people living in Santiago were significantly more likely to receive treatment than persons in other cities, even after adjustment for other factors. However, prior diagnosis of COPD had less impact on the likelihood of receiving treatment than in other cities. In addition, people in Montevideo were significantly less likely to receive treatment than persons in other cities. The possible reasons for inter-country variation are complex and difficult to explain. They are unlikely to be due to methodological issues, and probably other factors such as self-medication, air pollution, reimbursement policies, domestic pharmaceutical production, local guidelines, national socio-economical factors, and health care system resources can influence inter-country variation. Unfortunately, the design of this study did not allow us to assess these issues.

These data clearly suggest a widespread practice of prescribing respiratory medications based on the presence of symptoms alone, without documenting airway obstruction. Therefore, a major effort should be made to promote the use of spirometry as the method for the diagnostic assessment of airway obstruction.

Finally, there are limitations in the PLATINO study that have been previously discussed [2,12,20–22]. First, the definition of fixed obstruction was based on spirometry values measured at a single examination. We used the more conservative COPD stage II or higher as the definition of obstruction; however, it is possible that some patients might have changed status with a prolonged course of corticosteroids. Similarly, the determination of asthma at a single visit is problematic in the absence of a methacholine challenge, which was not possible in a house-to-house population based survey. Also, the determination of prior diagnostic status was based on subjects' report of a prior diagnosis, which is potentially subject to recall bias. However, a previous physician diagnosis of asthma is considered a specific but not very sensitive

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indicator of the disease. Therefore, it is possible that theses results could underestimate the real rate of physician diagnosis.

In summary, the results of this study indicate that bronchodilators and corticosteroids are frequently used in persons aged 40 years or older without previous diagnosis of asthma and COPD or the presence of airway obstruction. Over one-half of treated subjects were using medication for airflow obstruction without being obstructed. Prior asthma or COPD diagnosis, the presence of wheezing, prior spirometry, and residing in Santiago were more strongly associated with receiving bronchodilators and/or corticosteroids than objective measures of airway obstruction. While some of these findings probably represent the treatment of acute illnesses, they also reflect uncertainty on the part of diagnosing physicians, emphasizing the need for improving the implementation of obstructive pulmonary disease guidelines.

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AMB Menezes coordinated the PLATINO study. R. Perez-Padilla was responsible for spirometry quality control. J.R. Jardim was the principal investigator (PI) in São Paulo. R. Perez-Padilla was the PI in Mexico City. A. Muiño and M.V. Lopez were the PIs in Montevideo. G. Valdivia and Julio Pertuzé were the PIs in Santiago. M. Montes de Oca and C. Tálamo were the PIs in Caracas. R. Halbert led the data analysis. Dolores Moreno contributed with ideas for the report. The article was revised and approved by all contributors.

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