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Respiratory medication use in primary care among COPD subjects in four Latin American countries

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SUMMARY

OBJECTIVES: To assess respiratory medications used, factors predicting treatment and patterns of corticosteroid (CS) use in primary care in Latin America among chronic obstructive pulmonary disease (COPD) patients.

METHODS: COPD was defined as post-bronchodilator forced expiratory volume in 1 s/forced vital capacity (FEV_1/FVC) < 0.70 or previous medical diagnosis. To determine factors associated with respiratory medication use, crude and adjusted Poisson regression models were performed.

RESULTS: Of 1743 patients interviewed, 1540 completed spirometry, 309 had COPD ($FEV_1/FVC<0.70$) and 102 had a prior diagnosis of COPD. Among spirometry-defined COPD patients, 36.6% used respiratory medications: bronchodilators (BD) 24.9%, CS 13.3%, BD+CS 15.2%. In those with a previous diagnosis, 79.4% used respiratory medications: BD 64.7%, CS 37.6%, BD+CS 25.6%. A total of 81/102 (79%) patients with prior diagnosis were using CS despite not having airway obstruction or exacerbation. In spirometry-defined COPD, dyspnoea (OR 2.09, 95%CI 1.13–3.87), severe airway obstruction (OR 3.36, 95%CI 1.40–8.03) and exacerbation in the past year (OR 5.52, 95%CI 2.19–13.89) were associated with increased respiratory medication use. Among those with a previous diagnosis, use of respiratory medications was associated with cough (OR 5.31, 95%CI 1.28–22.12), severe airway obstruction (OR 29.50, 95%CI 3.18–273.30) and fewer years of schooling (OR 0.12, 95%CI 0.03–0.52).

CONCLUSIONS: In the primary care setting, undertreatment is frequent in spirometry-defined COPD patients, and there is increased use of CS (overtreatment) in patients with a previous diagnosis of COPD.

KEY WORDS: case finding; COPD; PUMA; primary care; treatment

THE DEVELOPMENT of new treatment options for chronic obstructive pulmonary disease (COPD) has meant that COPD is now a preventable and treatable disease.[1] Several COPD guidelines indicate that pharmacological treatment in COPD reduces symptoms, frequency and severity of exacerbations, improves health status and increases exercise tolerance.[1–4] However, despite the availability of guidelines with evidence-based recommendations for COPD treatment, there is a considerable gap between these recommendations and prescribing patterns for COPD in real life.[5–10] This gap may lead to suboptimal management and overtreatment of patients with COPD in primary care settings. Bourbeau et al. found that only a minority of COPD patients in primary care practice in Canada received currently recommended pharmacological treatment.[9] In the United Kingdom, COPD management does not usually follow the Global Initiative for Chronic Obstructive Lung Disease (GOLD) or local guidelines, particularly those relating to the use of inhaled corticosteroids (ICS) and long-acting bronchodilators (LABDs).[5]

There is limited information about the use of respiratory medications in COPD patients in Latin America. The Proyecto Latinoamericano de Investigacion en Obstruccion Pulmonar (PLATINO) study showed that only 24.7% of spirometry-defined COPD patients received any respiratory medication, and 13.5% had used an ICS.[11–13] Among patients with a previous medical diagnosis of COPD, 75.6% had received respiratory medications in the past year (43% inhaled medication and 36% bronchodilators [BDs]).[12] Another PLATINO subanalysis indicated that BDs or inhaled or oral CS are frequently used by persons with no previous diagnosis of asthma, COPD or the presence of airway obstruction.[13] Over half of the treated subjects were on medication without a diagnosis of airway obstruction. Respiratory medi-

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cation is also used in subjects incorrectly diagnosed as having COPD, indicating overtreatment.[13] We recently reported that undertreatment with LABDs was common in COPD patients and that the most commonly used BDs were short-acting (SABDs), either as monotherapy or combined with CS.[14] There is no information on the use of respiratory medication in general, and CS in particular, in COPD patients treated in primary care in this region.

The aim of the present study was to assess the respiratory medications used, factors predictive of treatment with respiratory medication and patterns of CS use in COPD patients attending Latin American primary care centres.

METHODS

The PUMA (Prevalence study and regular practice, diagnosis and treatment among general practitioners in populations at risk of COPD in Latin America) study was conducted in primary care settings in four Latin American countries: Argentina, Colombia, Venezuela and Uruguay. Complete details on the methodology, the selection process in the primary care centres, participants per country and the number of individuals at risk who were approached or refused to participate in the study have been published previously.[14–17] In brief, this is a multicentre, multinational, cross-sectional, non-interventional study performed in 2012. Participating sites were selected according to feasibility from a locally available database of potential principal investigators, and included primary care centres with no direct connection with respiratory medicine specialists. Sites were selected to reflect the reality of national primary care practice in terms of geographical distribution and health care sector. Subjects were enrolled during routine spontaneous or scheduled visits unrelated to the study objectives.

The ethics committees of each site approved the protocol; all participants provided written informed consent.

At risk patients with the following criteria were included in the study: age $\geqslant$40 years, current or ex-smokers ($\geqslant$10 pack-years, $\geqslant$50 pipes/year or $\geqslant$50 cigars/year) and/or exposure to biomass smoke as average hours of exposure per day multiplied by years of exposure ($\geqslant$100 hours/year). Participants completed a modified version of the PLATINO study questionnaire on factors potentially associated with COPD. Spirometry was performed using the ultrasound Easy One spirometer (ndd Medical Technologies, Zurich, Switzerland) performed at baseline and after 400 μg salbutamol.

Two COPD definitions were used: 1) post-BD forced expiratory volume in 1 s/forced vital capacity (FEV_1/FVC) ratio <0.70; and 2) post-BD FEV_1/FVC ratio < lower limit of normal (LLN; defined as the lower 5th percentile for predicted post-BD FEV_1/FVC). Severity of COPD airway obstruction was stratified using the GOLD criteria.[1] A previous diagnosis of COPD was also determined using a self-reported physician diagnosis of emphysema, chronic bronchitis or COPD.

Statistical analysis

Descriptive statistics with absolute (*n*) and relative (%) frequencies were used. All variables were considered categorical. To obtain the odds ratio (OR) for the association between independent variables and outcome, crude and adjusted logistic regression models were performed. For the adjusted models, all variables with $P < 0.2$ were included in the analysis. $P < 0.05$ using Wald or the likelihood ratio test, when appropriate, was considered statistically significant. Tests for best fitting of the models were used.

RESULTS

Participation rates in the PUMA study have been published elsewhere:[15] 1743 patients completed interviews and 1540 had acceptable spirometry results. Using the post-BD FEV_1/FVC <0.70 definition, 309 patients had COPD vs. 226 patients using the LLN definition. The baseline characteristics of the individuals with COPD (FEV_1/FVC <0.70) and any use of respiratory medication and CS during the past year are shown in Table 1. Only 36.6% of the patients (FEV_1/FVC <0.70) used any respiratory medication. Approximately one quarter (24.9%) used BD medication, 13.3% CS and 15.2% BD+CS. Similar findings were observed using the LLN definition (Appendix Table A.1).* The most frequent use of any respiratory medication and CS occurred in patients with dyspnoea, severe airway obstruction (GOLD III–IV), exacerbations or hospitalisation due to exacerbations in the past year (Table 1).

The type of medication used (any, BD, CS and BD+CS) in the past year in individuals with COPD (FEV_1/FVC <0.70), overall and by country, is shown in Figure 1A. The use of any respiratory medication in COPD patients was low for each country, ranging from 19.2% in Venezuela to 47.7% in Colombia. BD use ranged from 13.7% in Venezuela to 47.7% in Colombia, CS from 5.2% in Argentina to 32.6% in Colombia, and BD+CS from 5.5% in Venezuela to 26.5% in Argentina. Similar findings were observed using the LLN definition (Appendix Figure A.1).

The characteristics of individuals with COPD (with a previous medical diagnosis) and use of any respiratory medication and CS in the past year are shown in Table 2. Among those with a previous COPD diagnosis, 79.4% used respiratory medica-

* The appendix is available in the online version of this article, at http://www.ingentaconnect.com/content/iuatld/ijtld/2017/00000021/00000004/art00017

Table 1 Baseline characteristics of individuals with COPD (post-BD $FEV_1/FVC < 0.70$) and use of any respiratory medication and CS in the past 12 months

Variable	*n* (%)	Any respiratory medicine	Any CS use	Any BD+CS use
Sex		$P = 0.680$	$P = 0.059$	$P = 0.675$
Female	136 (44.0)	35.3	14.7	16.2
Male	173 (56.0)	37.6	12.1	14.5
Age (complete years)		$P = 0.416$	$P = 0.969$	$P = 0.995$
40–49	7 (2.3)	14.3	14.3	14.3
50–59	71 (23.0)	39.4	14.1	15.5
⩾60	231 (74.7)	36.4	13.0	15.2
Ethnicity		$P = 0.424$	$P < 0.001$*	$P = 0.002$*
White	166 (53.9)	34.3	6.0	21.1
Non-White	142 (46.1)	38.7	21.8	8.5
Schooling (complete years of formal education)		$P = 0.180$	$P < 0.001$*	$P = 0.193$
0–8	165 (53.4)	40.0	20.0	12.7
⩾9	144 (46.6)	32.6	5.6	18.1
BMI, kg/m^2		$P = 0.439$	$P = 0.270$	$P = 0.421$
<25.0	138 (44.7)	38.4	16.7	12.3
25.0–29.9	107 (34.6)	38.3	11.2	16.8
⩾30	64 (20.7)	29.7	9.4	18.8
Pack-years smoked		$P = 0.708$	$P = 0.285$	$P = 0.677$
<20	54 (18.0)	40.7	13.0	18.5
20–30	48 (16.0)	39.6	20.8	12.5
>30	198 (66.0)	35.4	12.1	14.7
Dyspnoea		$P < 0.001$*	$P < 0.001$*	$P = 0.029$*
No	104 (36.4)	20.2	2.9	8.7
Yes	182 (63.6)	44.5	19.2	18.1
Cough		$P = 0.040$*	$P = 0.085$	$P = 0.640$
No	174 (56.3)	31.6	10.3	14.4
Yes	135 (43.7)	43.0	17.0	16.3
Phlegm		$P = 0.322$	$P = 0.600$	*P = 0.716*
No	170 (55.0)	34.1	12.4	15.9
Yes	139 (45.0)	39.6	14.4	14.4
Exacerbations in past year		$P < 0.001$*	$P < 0.001$*	$P = 0.615$
No	276 (89.3)	31.5	9.8	14.9
Yes	33 (10.7)	78.8	42.4	18.2
Hospitalisations due to exacerbations in the previous year		$P < 0.001$*	$P < 0.001$*	$P = 0.257$
No	298 (96.4)	34.2	11.1	14.8
Yes	11 (3.6)	100.0	72.7	27.3
COPD severity (GOLD stage)		$P < 0.001$*	$P = 0.002$*	$P = 0.002$*
I	53 (17.2)	28.3	9.4	7.6
II	169 (54.7)	27.2	8.9	11.8
III–IV	87 (28.2)	59.8	24.1	26.4
Total	309 (100)	36.6	13.3	15.2

* Statistically significant ($P < 0.05$).
COPD = chronic obstructive pulmonary disease; BD = bronchodilator; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity; CS = corticosteroid; BMI = body mass index; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

tions, 64.7% used BD, 37.6% used CS and 25.6% used BD+CS. The highest prevalence of any respiratory medication use was among patients aged ⩾60 years, non-White, with schooling ⩽8 years, dyspnoea, cough, severe airway obstruction (GOLD stages III–IV), exacerbations and hospitalisation due to exacerbations in the past year.

The type of medication used (any, BD, CS and BD+CS) in the past year in individuals with prior COPD diagnosis, overall and by country, is shown in Figure 1B. The use of any respiratory medication ranged from 58.8% in Venezuela to 85.5% in Colombia, BD from 30.6% in Argentina to 84.2% in Colombia, CS from 0% in Uruguay to 56.6% in Colombia, and BD+CS use from 11.8% in Colombia to 55.6% in Argentina. The overall proportion of COPD patients diagnosed according to the different criteria ($FEV_1/FVC < 0.70$, LLN and prior medical diagnosis) receiving respiratory medicines by type of delivery is shown in Figure 2. The majority of the patients (>75%) reported using inhaled medication.

Logistic regression analyses (crude and adjusted) showed that dyspnoea, severe airway obstruction and exacerbation in the past year were associated with a higher likelihood of receiving any respiratory treatment among COPD individuals defined by post-BD

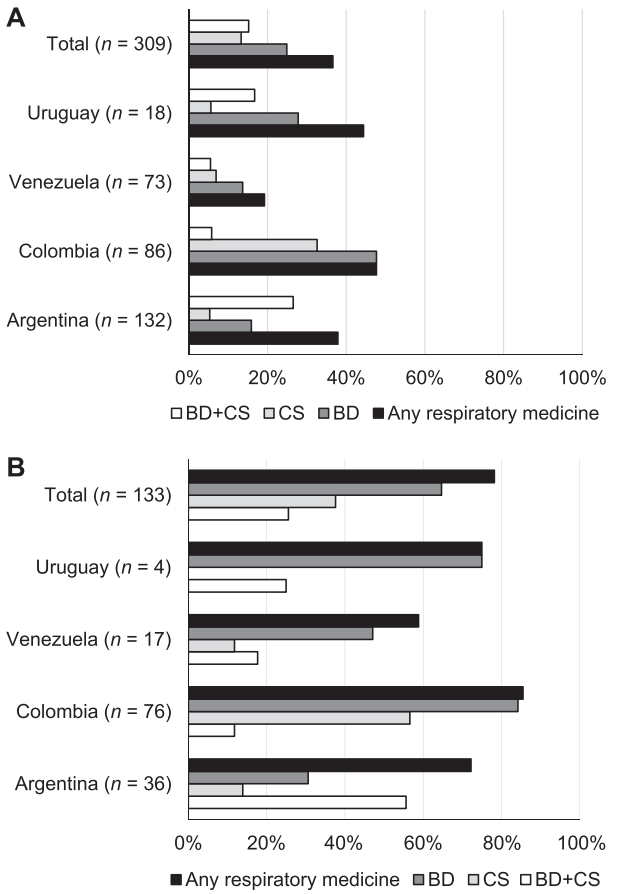

Figure 1 Type of respiratory medication used in the past 12 months in individuals with COPD based on **A)** post-BD FEV_1/FVC <0.70 definition; and **B)** previous medical diagnosis, overall and by country. BD = bronchodilator; CS = corticosteroid; COPD = chronic obstructive pulmonary disease; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity.

FEV_1/FVC <0.70 (Table 3). Similar findings were observed using the LLN definition (Appendix Table A.2). In individuals with a previous medical diagnosis, cough, severe airway obstruction and ⩽8 years of schooling were associated with higher use of respiratory treatment (Table 4).

The numbers of patients with correct and incorrect previous COPD diagnosis, exacerbations and use of CS (alone or combined with BD) are shown in Table 5. A total of 81/102 (79%) patients with prior COPD diagnosis were using CS, despite not having airway obstruction (incorrect prior diagnosis and overtreatment) or not having had an exacerbation in the past year (correct prior diagnosis with no exacerbations), suggesting overtreatment. Furthermore, in the group with a correct previous diagnosis, 50/71 (70.4%) were using CS despite not having had any exacerbations in the past year.

DISCUSSION

Our results indicate that undertreatment is frequent in spirometry-defined COPD patients attending primary care centres in Latin America, with wide variations between countries. However, in those patients with a previous medical diagnosis, only around 20% were not receiving any medication. In addition, respiratory medications were also being used in subjects incorrectly diagnosed with COPD. There is a high rate of CS use in patients with a previous COPD medical diagnosis, who do not have airway obstruction (incorrect previous diagnosis) and in those with a correct previous diagnosis but who have not had an exacerbation in the past year. Overall, patients with respiratory symptoms, a history of exacerbations and severe airway obstruction are more likely to use respiratory medication.

COPD in population-based studies is widely undertreated.[18–20] In Korea, only a minority of COPD patients received treatment: even in severe cases, two thirds of patients had not received any treatment.[18] The PLATINO study showed that while <25% of COPD patients received treatment, the treatment rate increased as disease severity worsened.[12] A low rate of treatment has also been reported in Spain (19.3%).[19] The low rate of treatment in COPD cases identified during routine screening is expected, as the majority of the patients had no previous diagnosis. Undertreatment of COPD has also been reported in the United States (>65% with no pharmacotherapy)[20] and from the Copenhagen General Population Study.[21]

Limited information is available regarding COPD management in primary care settings. Analysis from a UK primary care setting showed that 17.0% of the COPD population were not treated.[5] A study from Japan reported that 31.3% of COPD patients did not receive any clinical intervention.[22] In our study, the majority of the patients (63.4%) with spirometry-defined COPD had not used any respiratory medication in the past year, with variations between countries ranging from 52.3% in Colombia to 80.8% in Venezuela.

Our results are in contrast to primary care studies from industrialised countries, which reported that less than one third of their patients are not treated.[5,22] The inter-country variations found in our region are complex to explain, as data on the characteristics of the local health systems (health care system resources, accessibility, local regulations, domestic pharmaceutical production, reimbursement policies, socio-economic factors, etc.) were not collected. However, these findings can be partially explained by the high proportion of COPD underdiagnosis reported in Latin America.[17,23] Suboptimal adherence to continuous COPD treatment and low medical coverage for respiratory medications could be other explanations. We previously reported that patients with health insurance have a greater use of respiratory medicine than those with no health insurance.[14] The low treatment rate in patients with spirometric diagnosis could be also the result of factors

Table 2 Characteristics of individuals with COPD (based on a previous medical diagnosis) and use of any respiratory medication and CS in the past 12 months

Variable	*n* (%)	Any respiratory medicine	Any CS use	Any BD+CS use
Sex		$P = 0.856$	$P = 0.605$	$P = 0.075$
Female	57 (42.9)	79.0	35.1	33.3
Male	76 (57.1)	77.6	39.5	19.7
Age (complete years)		$P = 0.007$*	$P = 0.399$	$P = 0.992$
40–49	4 (3.0)	50.0	50.0	25.0
50–59	38 (28.6)	63.2	29.0	26.3
⩾60	91 (68.4)	85.7	40.7	25.3
Ethnicity		$P = 0.018$*	$P < 0.001$*	$P = 0.002$*
White	52 (39.7)	67.3	13.5	40.4
Non-White	79 (60.3)	84.8	53.2	16.5
Schooling (complete years of formal education)		$P = 0.002$*	$P < 0.001$*	$P = 0.032$*
0–8	83 (62.4)	86.8	53.0	19.3
⩾9	50 (37.6)	64.0	12.0	36.0
BMI, kg/m^2		$P = 0.360$	$P = 0.392$	$P = 0.141$
<25.0	60 (45.1)	75.0	43.3	18.3
25.0–29.9	42 (31.6)	85.7	35.7	35.7
⩾30	31 (23.3)	74.2	29.0	25.8
Pack-years smoked		$P = 0.278$	$P = 0.900$	$P = 0.430$
<20	28 (21.4)	67.9	39.3	17.9
20–30	24 (18.3)	79.2	41.7	20.8
>30	79 (60.3)	82.3	36.7	29.1
Dyspnoea		$P = 0.007$*	$P = 0.033$*	$P = 0.044$
No	32 (26.7)	59.4	21.9	12.5
Yes	88 (73.3)	83.0	43.2	30.7
Cough		$P = 0.046$*	$P = 0.057$*	$P = 0.402$
No	70 (52.6)	71.4	30.0	28.6
Yes	63 (47.4)	85.7	46.0	22.2
Phlegm		$P = 0.827$	$P = 0.407$	$P = 0.209$
No	62 (46.7)	79.0	33.9	30.7
Yes	71 (53.3)	77.5	40.9	21.1
Exacerbations in past year		$P = 0.003$*	$P = 0.008$*	$P = 0.451$
No	95 (71.4)	71.6	30.5	27.4
Yes	38 (28.6)	94.7	55.3	21.1
Hospitalisations due to exacerbations in past year		$P = 0.045$*	$P = 0.061$*	$P = 0.829$
No	120 (90.2)	75.8	35.0	25.8
Yes	13 (9.8)	100	61.5	23.1
COPD severity (GOLD stage)		$P = 0.012$*	$P = 0.509$	$P = 0.210$
No COPD	31 (30.4)	61.3	25.8	16.1
I	7 (6.9)	71.4	28.5	28.6
II	24 (23.5)	83.3	37.5	37.5
III–IV	40 (39.2)	92.5	42.5	37.5
Total	133 (100)	79.4	37.6	25.6

* Statistically significant ($P < 0.05$).
COPD = chronic obstructive pulmonary disease; BD = bronchodilator; CS = corticosteroid; BMI = body mass index; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

such as low prior correct COPD diagnosis, health care system differences, ability of primary care physicians to diagnose COPD, poor implementation of guidelines or the patient's financial capacity to obtain medications. In addition, approximately 80% of spirometry-defined COPD patients had mild airway obstruction and may not have been significantly symptomatic (Tables 1 and 2).

In contrast, the use of any respiratory medication in patients with a previous diagnosis of COPD was higher (79.4%), although around 20% were not treated. It is important to emphasise that a significant proportion of patients with a previous medical diagnosis with no airway obstruction were using respiratory medication (Table 5), suggesting that misdiagnosis (30.4%) and subsequent overtreatment are also frequent in the study regions.[17]

Overtreatment with ICS in COPD has been reported by others.[5,7–10,24–28] This suggests that treatment is not always consistent with guidelines.[5] Among patients receiving treatment, the majority received ICS, irrespective of the severity of airflow limitation, asthma diagnosis or exacerbation history. A low proportion of patients with spirometry-defined COPD were using BDs (24.9%); however, in those with a previous COPD diagnosis, the use of BD was

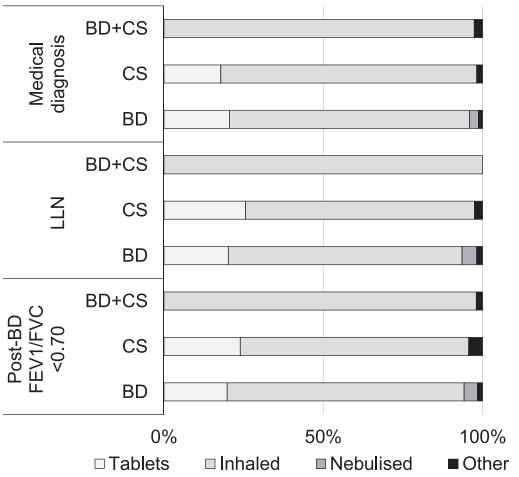

Figure 2 Overall proportion of COPD individuals receiving respiratory medicine by type of delivery. BD = bronchodilator; CS = corticosteroid; LLN = lower limit of normal; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity; COPD = chronic obstructive pulmonary disease.

higher (64.7%). We also found that a quarter of the patients diagnosed with COPD were receiving CS either alone or in combination with BD.

In contrast, 50/71 (70.4%) patients with a correct previous diagnosis of COPD were receiving CS either alone or in combination with BD despite not having experienced any exacerbations in the past year. Large variability in the use of CS and BD+CS was also observed among patients with a previous COPD diagnosis. According to GOLD and ALAT guidelines, the latter group of patients should not be receiving CS.[1,2] The main indication for ICS in COPD patients is $\geqslant 2$ exacerbations or one hospitalisation due to an exacerbation in the past year.[1,2,29] The low hospitalisation rate among COPD cases (3.6%) in our study does not support extensive use of CS treatment (Table 1). One possible explanation for the extensive use of CS is the misdiagnosis of asthma-COPD overlap by primary care physicians: 30% of the patients with a previous medical diagnosis of COPD had normal spirometry results, which rules out COPD, while the clinical symptoms would probably support asthma.

It should be noted that regression analysis clearly showed that treatment in both groups was based mainly on symptoms and disease severity. Symptom-driven diagnosis is in keeping with the fact that only 22.1% of the total PUMA population reported having prior spirometry vs. 36.9% of the COPD population (post-BD $FEV_1/FVC < 0.70$).[16] The underutilisation of spirometry would argue in favour of treatment based on symptoms rather than on spirometry. However, treatment was being provided particularly for the most severe patients. While it is expected that severe patients are more symptomatic, this does not mean that patients with mild COPD are always asymptomatic.[28] However, the value of treating diagnosed asymptomatic COPD patients is still under discussion.[30,31]

The study had some limitations. Generalisation of these results to all Latin American countries should be considered with caution, as the study was performed only in four countries. Another possible limitation is that the study design did not consider discriminating between 'pure' COPD cases and asthma patients using airway remodelling. Finally, the questionnaire was restricted to

Table 3 Logistic regression analyses (crude and adjusted) showing predictors of treatment with any respiratory medication among individuals with COPD (post-BD $FEV_1/FVC < 0.70$) ($n = 286$)*

Variable	Crude analysis OR (95%CI)	Adjusted analysis OR (95%CI)
Schooling (complete years of formal education)	$P = 0.181$	$P = 0.532$
0–8	1.00	1.00
$\geqslant 9$	0.73 (0.46–1.16)	0.84 (0.49–1.44)
Dyspnoea	$P < 0.001$	$P = 0.019$*
No	1.00	1.00
Yes	3.17 (1.81–5.56)	2.09 (1.13–3.87)
Cough	$P = 0.041$	$P = 0.171$
No	1.00	1.00
Yes	1.63 (1.02–2.60)	1.50 (0.84–2.69)
Phlegm	$P = 0.323$	$P = 0.466$
No	1.00	1.00
Yes	1.26 (0.79–2.01)	0.80 (0.44–1.46)
Exacerbations in past year	$P < 0.001$	$P < 0.001$†
No	1.00	1.00
Yes	8.07 (3.37–19.33)	5.52 (2.19–13.89)
COPD severity (GOLD stage)	$P < 0.001$	$P < 0.001$†
I	1.00	1.00
II	0.95 (0.48–1.89)	1.17 (0.52–2.65)
III–IV	3.76 (1.80–7.86)	3.36 (1.40–8.03)

* Information on all variables in adjusted analysis.
† Statistically significant ($P < 0.05$).
COPD = chronic obstructive pulmonary disease; BD = bronchodilator; FEV_1 = forced expiratory volume in 1 s; FVC = forced vital capacity; OR = odds ratio; CI = confidence interval; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

Table 4 Logistic regression analyses (crude and adjusted) showing predictors of treatment with any respiratory medication among individuals with COPD (based on previous medical diagnosis) ($n = 94$)*

Variable	Crude analysis OR (95%CI)	Adjusted analysis OR (95%CI)
Schooling (complete years of formal education)	$P = 0.003$	$P = 0.005$
0–8	1.00	1.00
⩾9	0.27 (0.11–0.64)	0.12 (0.03–0.52)
Dyspnoea	$P = 0.009$	$P = 0.571$
No	1.00	1.00
Yes	3.33 (1.35–8.20)	0.64 (0.13–3.05)
Cough	$P = 0.051$	$P = 0.022$†
No	1.00	1.00
Yes	2.40 (1.00–5.78)	5.31 (1.28–22.12)
Phlegm	$P = 0.828$	$P = 0.054$
No	1.00	1.00
Yes	0.92 (0.40–2.09)	0.23 (0.05–1.02)
Exacerbations in past year	$P = 0.010$	$P = 0.082$
No	1.00	1.00
Yes	7.15 (1.60–31.97)	5.26 (0.81–34.08)
COPD severity (GOLD stage)	$P = 0.025$	$P = 0.013$†
No COPD	1.00	1.00
I	1.58 (0.26–9.56)	1.60 (0.14–17.59)
II	3.16 (0.86–11.59)	15.49 (2.35–101.87)
III–IV	7.79 (1.94–31.20)	29.50 (3.18–273.30)

* Information on all variables in adjusted analysis.
† Statistically significant ($P < 0.05$).
COPD = chronic obstructive pulmonary disease; OR = odds ratio; CI = confidence interval; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

the previous 12 months. It is possible that the low rate of respiratory medication use among patients with previous spirometry-defined COPD could be related to non-adherence to treatment. From our perspective, the main strengths of this study are the spirometric case finding in primary care settings, high-quality spirometry techniques and diagnostic criteria performed by a highly qualified research team, the use of a validated treatment questionnaire and the sample size.

In conclusion, the results indicate that underdiagnosis and undertreatment of COPD are common in primary care settings in Latin America. They also suggest that overtreatment is common, particularly given the increased use of CS in patients with a previous COPD diagnosis but with no airway obstruction or exacerbation in the past year. This study raises two issues that need to be elucidated in the future: first, do primary care physicians have access to spirometry? If access is difficult then it is not surprising that clinicians take a symptom-driven approach with COPD patients. In this case, a simple screening tool for opportunistic COPD case finding in primary care should be used to make spirometry cost-effective.[16] Second, it highlights the need to develop strategies to promote guideline-driven treatment in primary care settings in the Latin American region.

Table 5 Numbers of patients with correct and incorrect previous COPD diagnosis, exacerbations and use of corticosteroid (alone or combined with bronchodilator)

	Patients ($n = 102$) *n/N* (%)
Incorrect diagnosis	31/102 (30.4)
No exacerbation in the past year	23 (74.2)
⩾1 exacerbation in the past year	8
1 exacerbation in the past year	1 (3.2)
2 exacerbations in the past year	3 (9.6)
3 exacerbations in the past year	2 (6.5)
⩾4 exacerbations in the past year	2 (6.5)
Correct diagnosis	71/102 (69.6)
No exacerbation in the past year	50 (70.4)
⩾1 exacerbation in the past year	21
1 exacerbation in the past year	8 (11.3)
2 exacerbations in the past year	3 (4.2)
3 exacerbations in the past year	4 (5.6)
⩾4 exacerbations in the past year	6 (8.5)

COPD = chronic obstructive pulmonary disease.

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APPENDIX

THE STUDY SAMPLE SIZE

The study sample size was calculated to investigate the prevalence of chronic obstructive pulmonary disease (COPD) at each site (estimated at 20%), with a margin of error of 3 percentage points, thus leading to a required sample of 715 individuals per site. Because the PUMA (Prevalence study and regular practice, diagnosis and treatment among general practitioners in populations at risk of COPD in Latin America) study included four sites, the total study sample size was estimated at 2860 patients. However, only Venezuela ($n = 721$) was able to recruit the required number of participants. For Argentina ($n = 454$) and Colombia ($n = 465$), the margin of error for the prevalence estimate is 3.7 percentage points due to the reduced sample size. In Uruguay ($n = 103$), the margin of error for the point estimate is 7.9 percentage points.

Although the main objective of the study was to provide precise estimates of the prevalence of COPD at each site, some risk factor analyses were run using the whole sample. In such cases, the statistical power is $\geqslant 90\%$ for detecting odds ratios of 1) $\geqslant 1.4$ for exposures affecting 20% of the disease-free population; and 2) $\geqslant 1.6$ for exposures affecting 10% of the disease-free population. For secondary objectives restricted to participants with COPD (expected number: 572), the margins of error for proportions of 10%, 20% and 50% were respectively 2.5, 3.5 and 4.2 percentage points.

Table A.1 Characteristics of individuals with COPD (according to LLN criteria) and prevalence of BD and CS use in past 12 months

Variable	*n* (%)	Any respiratory medicine	Any CS use	Any BD+CS use
Sex		$P = 0.167$	$P = 0.897$	$P = 0.913$
Female	102 (45.1)	35.3	14.7	16.7
Male	124 (54.9)	44.4	15.3	16.1
Age (complete years)		$P = 0.048$*	$P = 0.745$	$P = 0.676$
40–49	13 (5.8)	7.7	7.7	7.7
50–59	57 (25.2)	42.1	15.8	17.5
⩾60	156 (69.0)	42.3	15.4	16.7
Ethnicity		$P = 0.414$	$P < 0.001$*	$P = 0.004$*
White	115 (51.1)	37.4	6.1	23.5
Non-White	110 (48.9)	42.7	24.6	9.1
Schooling (complete years of formal education)		$P = 0.061$	$P < 0.001$*	$P = 0.283$
0–8	122 (54.0)	45.9	23.0	13.9
⩾9	104 (46.0)	33.7	5.6	19.2
BMI, kg/m^2		$P = 0.816$	$P = 0.272$	$P = 0.274$
<25.0	111 (49.1)	42.3	18.9	13.5
25.0–9.9	74 (32.7)	37.8	10.8	16.2
⩾30	41 (18.1)	39.0	12.2	24.4
Pack-years smoked		$P = 0.629$	$P = 0.705$	$P = 0.279$
<20	43 (19.4)	41.9	16.3	14.0
20–30	36 (16.2)	33.3	19.4	8.3
>30	143 (64.4)	42.0	14.0	18.9
Dyspnoea		$P < 0.001$*	$P = 0.002$*	$P = 0.019$*
No	70 (32.7)	21.4	4.3	7.1
Yes	144 (67.3)	47.9	20.8	19.4
Cough		$P = 0.026$*	$P = 0.056$	$P = 0.516$
No	127 (56.2)	33.9	11.0	15.0
Yes	99 (43.8)	48.5	20.2	18.2
Phlegm		$P = 0.218$	$P = 0.851$	$P = 0.440$
No	123 (54.4)	36.6	14.6	14.6
Yes	103 (45.6)	44.7	15.5	18.5
Exacerbations in past year		$P < 0.001$*	$P < 0.001$*	$P = 0.963$
No	196 (86.7)	34.2	10.2	16.3
Yes	30 (13.3)	80.0	46.7	16.7
Hospitalisation due to exacerbations in past year		$P < 0.001$*	$P < 0.001$*	$P = 0.316$
No	215 (95.1)	37.2	12.1	15.8
Yes	11 (4.9)	100.0	72.7	27.3
COPD severity (GOLD stages)		$P < 0.001$*	$P = 0.013$*	$P = 0.022$*
I	21 (9.6)	33.3	14.3	9.5
II	113 (51.6)	29.2	8.9	11.5
III–IV	85 (38.8)	60.0	24.7	25.9
Total	226 (100)	40.3	15.0	16.4

* Statistically significant ($P < 0.005$).
COPD = chronic obstructive pulmonary disease; LLN = lower limit of normal; BD = bronchodilator; CS = corticosteroid; BMI = body mass index; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

Table A.2 Logistic regression analyses (crude and adjusted) showing predictors of treatment with any respiratory medication among individuals with COPD, according to LLN criteria

Variable	Crude analysis OR (95%CI)	Adjusted analysis OR (95%CI)
Schooling (complete years of formal education)	$P = 0.063$	$P = 0.272$
0–8	1.00	1.00
⩾9	0.60 (0.35–1.03)	0.70 (0.37–1.32)
Dyspnoea	$P < 0.001$	$P = 0.037$*
No	1.00	1.00
Yes	3.37 (1.74–6.52)	2.23 (1.05–4.75)
Cough	$P = 0.027$	$P = 0.089$
No	1.00	1.00
Yes	1.84 (1.07–3.16)	1.78 (0.92–3.46)
Phlegm	$P = 0.219$	$P = 0.459$
No	1.00	1.00
Yes	1.40 (0.82–2.39)	0.77 (0.39–1.54)
Exacerbations in past year	$P < 0.001$	$P = 0.001$*
No	1.00	1.00
Yes	7.70 (3.00–19.80)	6.04 (2.18–16.76)
COPD severity (GOLD stages)	$P < 0.001$	$P = 0.008$*
I	1.00	1.00
II	0.83 (0.30–2.23)	1.75 (0.53–5.79)
III–IV	3.00 (1.09–8.22)	4.36 (1.28–14.80)

* Statistically significant ($P < 0.005$).
COPD = chronic obstructive pulmonary disease; LLN = lower limit of normal; OR = odds ratio; CI = confidence interval; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

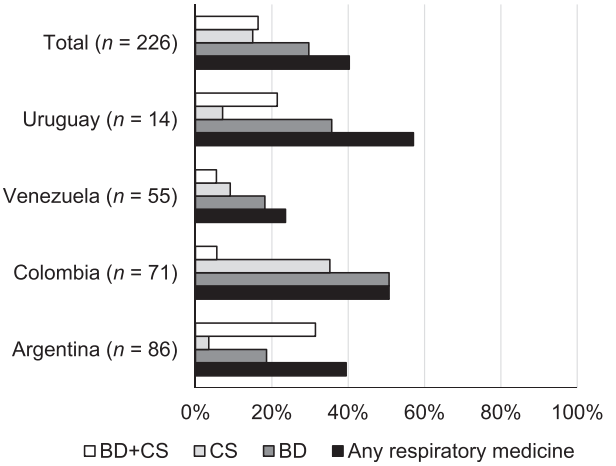

Figure A Respiratory medication use in past 12 months in individuals with COPD (according to LLN criteria), total and by country. BD = bronchodilator; CS = corticosteroid; COPD = chronic obstructive pulmonary disease; LLN = lower limit of normal.

RESUME

OBJECTIF : Evaluer la prévalence des médicaments à visée respiratoire utilisés, les facteurs prédictifs du traitement et les profils de recours aux corticostéroïdes (CS) chez les patients avec bronchopneumopathie obstructive chronique (BPCO) dans les structures de santé primaire en Amérique Latine.

MÉTHODES : La BPCO a été définie comme un rapport volume expiratoire maximum seconde/capacité vitale forcée ($VEMS_1/CVF$) < 0,70 après bronchodilatateur (BD) ou en fonction d'un diagnostic médical préalable. Nous avons utilisé les modèles de régression bruts et ajustés de Poisson afin de déterminer les facteurs associés à l'utilisation des médicaments à visée respiratoire.

RÉSULTATS : Un total de 1743 patients ont eu un entretien, 1540 ont eu une spirométrie, 309 avaient une BPCO ($VEMS_1/CVF < 0,70$) et 102 avaient déjà eu ce diagnostic. Parmi les patients avec BPCO définie par spirométrie, 36,6% avaient recours à des médicaments à tropisme respiratoire : BD 24,9%, CS 13,3%, BD+CS 15,2% ; parmi ceux qui avaient déjà eu ce diagnostic, 79,4% utilisaient ces médicaments : BD 64,7%, CS 37,6%, BD+CS 25,6%. Un total de 81/102 (79%) patients ayant eu un diagnostic de BPCO recouraient aux CS bien qu'ils n'aient pas d'obstruction des voies aériennes ni d'exacerbation. En ce qui concerne les BPCO définies par la spirométrie, une dyspnée (OR 2,09 ; IC95% 1,13–3,87), une obstruction majeure des voies aériennes (OR 3,36 ; IC95% 1,40–8,03) et une exacerbation au cours de l'année écoulée (OR 5,52 ; IC95% 2,19–13,89) ont été associées avec un recours accru aux médicaments à visée respiratoire. Pour les patients déjà diagnostiqués, le recours à ces médicaments a été associé à la toux (OR 5,31 ; IC95% 1,28–22,12), à une obstruction majeure des voies aériennes (OR 29,50 ; IC95% 3,18–273,30) et à un niveau d'instruction plus faible (OR 0,12 ; IC95% 0,03–0,52).

CONCLUSION : Dans le cadre des soins de santé primaires, le sous-traitement est fréquent chez les patients dont la BPCO a été définie par spirométrie, et inversement, un surtraitement avec recours accru aux CS concerne les patients ayant déjà eu un diagnostic de BPCO.

RESUMEN

OBJETIVOS: Evaluar la prevalencia de utilización de medicamentos para las vías respiratorias y analizar los factores pronósticos del tratamiento y el perfil de utilización de corticoesteroides (CS) en pacientes con enfermedad pulmonar obstructiva crónica (EPOC) en la atención primaria de salud en América Latina.

MÉTODOS: La EPOC se definió como un resultado posbroncodilatador (BD) del cociente del volumen espiratorio forzado en el primer segundo y la capacidad vital forzada (VEF_1/CVF) <0,70 o el antecedente de diagnóstico médico de EPOC. Se aplicaron modelos de regresión de Poisson crudos y ajustados con el fin de determinar los factores asociados con el consumo de medicamentos para las vías respiratorias.

RESULTADOS: Se entrevistaron 1743 pacientes; 1540 completaron la espirometría, 309 presentaban EPOC ($VEF_1/CVF < 0,70$) y 102 ya conocían su diagnóstico de EPOC. En el grupo de pacientes con EPOC definida por espirometría, el 36,6% utilizaba medicamentos respiratorios, a saber: BD el 24,9%, CS el 13,3% y BD+CS el 15,2%; en los pacientes con diagnóstico previo esta proporción fue de 79,4%: BD el 64,7%, CS el 37,6%, BD+CS el 25,6%. Ochenta y uno de los 102 pacientes con diagnóstico previo (79%) utilizaban CS aunque no presentaban obstrucción de las vías respiratorias ni exacerbación. En el grupo de EPOC definido por la espirometría, un mayor consumo de medicamentos se asoció con la presencia de disnea (OR 2,09; IC95% de 1,13 a 3,87), la obstrucción grave de las vías respiratorias (OR 3,36; IC95% de 1,40 a 8,03) y la exacerbación clínica durante el último año (OR 5,52; IC95% de 2,19 a 13,89). En el grupo de casos con diagnóstico previo, la utilización de medicamentos se asoció con la presencia de tos (OR 5,31; IC95% de 1,28 a 22,12), la obstrucción grave de las vías respiratorias (OR 29,50; IC95% de 3,18 a 273,30) y un menor grado de escolaridad (OR 0,12; IC95% de 0,03 a 0,52).

CONCLUSIÓN: En el entorno de la atención primaria de salud es frecuente que los pacientes con EPOC definida por espirometría reciban un tratamiento insuficiente y se observa un mayor uso de CS (exceso de tratamiento) en los pacientes con un diagnóstico médico de EPOC establecido previamente.