

## Paid employment in subjects with and without chronic obstructive pulmonary disease in five Latin American cities: the PLATINO study

M. Montes de Oca,\* R. J. Halbert,<sup>†</sup> C. Talamo,\* R. Perez-Padilla,<sup>‡</sup> M. V. Lopez,<sup>§</sup> A. Muiño,<sup>§</sup> J. R. B. Jardim,<sup>¶</sup> G. Valdivia,<sup>#</sup> J. Pertuzé,<sup>\*\*</sup> D. Moreno,\* A. M. B. Menezes<sup>††</sup> and the PLATINO team<sup>‡‡</sup>

\*Servicio de Neumonología, Hospital Universitario de Caracas, Facultad de Medicina, Universidad Central de Venezuela, Caracas, Venezuela; <sup>†</sup>University of California Los Angeles School of Public Health, Los Angeles, California, USA; <sup>‡</sup>Institute of Respiratory Diseases, Tlalpan, Mexico City, Distrito Federal, Mexico; <sup>§</sup>Facultad de Medicina, Universidad de la República, Hospital Maciel, Montevideo, Uruguay; <sup>¶</sup>Federal University of São Paulo, Largo Senador Raul Cardoso, São Paulo, Brazil; <sup>#</sup>Departamento de Salud Pública, and <sup>\*\*</sup>Catedra de Neumología, Facultad de Medicina, Pontificia Universidad Católica de Chile, Santiago de Chile, Chile; <sup>††</sup>Faculdade de Medicina, Universidade Federal de Pelotas, Pelotas, Rio Grande do Sul, Brazil

### SUMMARY

**BACKGROUND:** Chronic obstructive pulmonary disease (COPD) is a costly condition that frequently causes permanent work disabilities. Little information exists regarding the impact of COPD on work force participation and the indirect costs of the disease in developing countries.

**OBJECTIVE:** To examine the frequency of paid employment and factors influencing it in a Latin-American population-based study.

**METHODS:** Post-bronchodilator FEV<sub>1</sub>/FVC < 0.70 (forced expiratory volume in 1 s/forced vital capacity) was used to define COPD. Information regarding paid work was assessed by the question 'At any time in the past year, have you worked for payment?'

**RESULTS:** Interviews were conducted with 5571 subjects; 5314 (759 COPD and 4554 non-COPD) subjects underwent spirometry. Among the COPD subjects,

41.8% reported having paid work vs. 57.1% of non-COPD ( $P < 0.0001$ ). The number of months with paid work was reduced in COPD patients ( $10.5 \pm 0.17$  vs.  $10.9 \pm 0.06$ ,  $P < 0.05$ ). The main factors associated with having paid work in COPD patients were male sex (OR 0.33, 95%CI 0.23–0.47), higher education level (OR 1.05, 95%CI 1.01–1.09) and younger age (OR 0.90, 95%CI 0.88–0.92). COPD was not a significant contributor to employment (OR 0.83, 95%CI 0.69–1.00,  $P = 0.054$ ) in the entire population.

**CONCLUSIONS:** Although the proportion of persons with paid work is lower in COPD, having COPD appears not to have a significant impact on obtaining paid employment in the overall population of developing countries.

**KEY WORDS:** chronic obstructive pulmonary disease; epidemiology; indirect costs; economic burden

CHRONIC obstructive pulmonary disease (COPD) is a common chronic disease and a major cause of morbidity and mortality worldwide.<sup>1,2</sup> It is also a costly chronic medical condition that frequently causes permanent work disabilities and represents a large economic burden to society.<sup>2–11</sup>

Different studies have shown that COPD is associated with high health care system costs.<sup>2–11</sup> Although much of the focus has been on direct COPD costs (those associated with medical management of the illness), indirect costs (i.e., the financial consequences

of productivity losses due to sickness, absence and incapacity to work) are also substantial and are important in determining the overall economic burden of the disease.

The impact of COPD on work force participation is an underexplored area associated with the indirect cost of the disease.<sup>6,12–15</sup> The Confronting COPD International Survey, a study conducted in North America and Europe, indicated that COPD was associated with a high economic burden in all countries studied.<sup>6</sup> Their analysis of US data found that although inpatient hospitalisations accounted for the majority of costs, indirect costs (e.g., lost productivity) accounted for 27% of the total cost of COPD. Using data from the National Health and Nutrition Examination

<sup>‡‡</sup>PLATINO team: M Márquez, P Hallal, M Blanco, F Rosa, A Camelier; Advisory Committee: S Buist, W Vollmer; Executive Committee: C Torres, J Luna, C Lisboa.

Survey (NHANES) III, Sin et al. determined the relationship between COPD and its severity and labour force participation in the community.<sup>13</sup> Their study found that COPD was associated with a 3.9% reduction in the work force participation rate in the community. These data suggest that COPD, particularly moderate to severe COPD, leads to significant unemployment in the United States.

There is little information available regarding paid employment among COPD patients in low- and middle-income countries. Furthermore, the factors most closely associated with having paid work among COPD patients are still unclear.

The aims of this study were 1) to assess the frequency of paid employment in the Proyecto Latinoamericano de Investigación en Obstrucción Pulmonar (PLATINO) population with and without COPD, 2) to explore the main factors that influence having paid work in COPD subjects, and 3) to determine if having COPD has an important impact on obtaining paid employment in the population overall.

## MATERIALS AND METHODS

Complete details of the methodology, descriptions of participation rates and sample characteristics of the PLATINO study have been published elsewhere.<sup>16,17</sup> Briefly, a two-stage cluster sampling method was used in each of five large Latin American cities to obtain a probability sample of households. All adults aged  $\geq 40$  years living in the households selected were invited to participate. Approval was obtained from the ethical committees of the institutions involved in the study, and written informed consent was obtained from each subject.

Information was collected on several factors potentially associated with COPD, including demographics, smoking habits, years of formal education, respiratory symptoms, use of respiratory medication and prior spirometric testing. Data on self-reported exacerbations were also obtained. A simple comorbidity score was calculated by counting the number of comorbid conditions (heart disease, hypertension, stroke, diabetes, ulcer and asthma) reported by each subject.

A portable, battery operated, ultrasound transit-time based spirometer (Easy-One™, ndd Medical Technologies, Chelmsford, MA, USA, and Zürich, Switzerland) was used to perform pulmonary function testing. Subjects performed up to 15 forced expiratory manoeuvres (average 5–6) to obtain three American Thoracic Society (ATS) acceptable manoeuvres, with forced vital capacity (FVC) and forced expiratory volume in the first second (FEV<sub>1</sub>) reproducible within 150 ml.<sup>18</sup> Albuterol 200 µg was then administered by inhalation through a 500 ml spacer, and the test was repeated 15 min later (average 4–5 manoeuvres).

We used the definition of COPD proposed by the

Global Initiative for Chronic Obstructive Lung Disease (GOLD): a ratio of the post-bronchodilator (BD) FEV<sub>1</sub> over FVC  $< 0.70$ .<sup>19</sup> COPD severity was assessed using the GOLD staging criteria. We also used the lower limit of normal (LLN) post-bronchodilator for FEV<sub>1</sub>/FVC criteria to diagnose COPD.

Information regarding employment was assessed using the following questions:

- 1 At any time in the past 12 months, have you worked for payment? (yes/no)
- 2 How many months in the past 12 months have you worked for payment?
- 3 During the months that you worked, how many days per week did you work for payment?
- 4 What is the usual number of hours per day you work for payment?
- 5 During the past 12 months, did your health problems stop you from working for payment? (yes/no)

### Statistical analyses

Descriptive analyses included group comparisons using Pearson's  $\chi^2$  test (adjusted for survey design) for nominal variables, the Mann-Whitney test and ordered logistic regression (adjusted for survey design) for ordinal variables, and the Wald test (adjusted for survey design) for continuous variables. Between-country differences in employment were evaluated using the Wald test (adjusted for survey design) and then adjusted for age, sex and educational level. Logistic regression models (adjusted for survey design) were used to evaluate multivariable relationships. All analyses were performed using the STATA statistical software package (STATA version 10.1, STATA Corporation, College Station, TX, USA).

## RESULTS

Interviews of 5571 subjects from a total of 6711 eligible individuals were conducted; spirometry was performed in 5314 subjects. In total, 759 subjects had post-BD FEV<sub>1</sub>/FVC  $< 0.70$ , while 4554 individuals had a post-BD FEV<sub>1</sub>/FVC  $\geq 0.70$ .

Tables 1 and 2 show the proportions of subjects with and without COPD reporting paid work in the past year, and the work intensity, respectively. Among persons with COPD, 41.8% reported having paid work in the past year compared with 57.1% of subjects without COPD. Among subjects reporting paid work, the number of months in paid employment was significantly reduced in subjects with COPD. No significant differences were observed between the groups in number of days per week and hours per day dedicated to paid work. Limitation of work due to health problems was significantly different between COPD and non-COPD subjects, but this difference was attributable to differences in missing responses.

**Table 1** Employment within the previous 12 months by COPD status

Variables	No COPD (n = 4554) n (%)	COPD (n = 759) n (%)	P value*
Paid work in the previous 12 months			
Yes	2602 (57.1)	317 (41.8)	<0.0001
No	1952 (42.9)	442 (58.2)	
Work less due to health problem			
Yes	196 (4.3)	27 (3.6)	<0.0001
No	2399 (52.7)	289 (38.1)	
No response	1960 (43.0)	443 (58.4)	

\*Statistical tests: Pearson's  $\chi^2$  (adjusted for survey design), Mann-Whitney test.  
COPD = chronic obstructive pulmonary disease.

**Table 2** Work intensity in subjects reporting paid work in the previous 12 months, by COPD status

Variable	No COPD (n = 2598) mean $\pm$ SE	COPD (n = 316) mean $\pm$ SE	P value*
Months with paid work	10.9 $\pm$ 0.06	10.5 $\pm$ 0.17	0.0235
Days per week with paid work	5.71 $\pm$ 0.03	5.85 $\pm$ 0.08	0.0872
Hours per day dedicated to paid work	8.75 $\pm$ 0.06	8.97 $\pm$ 0.17	0.2303

\*Statistical test: Wald test (adjusted for survey design).  
COPD = chronic obstructive pulmonary disease; SE = standard error.

The analysis was performed using LLN for COPD diagnosis (Appendix Tables A.1 and A.2).<sup>\*</sup> As expected, overall numbers of persons with and without COPD have changed, as have the number of persons employed. However, the proportion of employed persons in both groups was quite similar.

Subjects with COPD are described by paid employment in the past year in Table 3. Employed subjects were more likely to be male, younger, have a higher education level, fewer comorbidities and self-reported exacerbations within the past year, were more likely to be current smokers, and were less likely to report respiratory symptoms (wheezing and dyspnoea). Subjects with paid work had higher absolute values for post-BD FEV<sub>1</sub> and FVC, but these differences were not reflected in the percentage of predicted values. No differences were observed in COPD severity (GOLD stages), ethnicity, body mass index (BMI) and use of respiratory medication between the two groups. Analyses using LLN show similar findings (Appendix Table A.3).

Table 4 describes subjects without COPD by paid employment in the previous 12 months. Employed subjects were more likely to be younger, have a higher education level, lower BMI, fewer comorbidities,

**Table 3** Description of subjects with COPD by employment in the past year

Variable	Without paid work (n = 442) n (%) or mean $\pm$ SE	With paid work (n = 317) n (%) or mean $\pm$ SE	P value*
Age, years	69.3 $\pm$ 0.52	56.9 $\pm$ 0.55	<0.0001
Sex			
Male	192 (43.4)	205 (64.7)	<0.0001
Female	250 (56.6)	112 (35.3)	
BMI, kg/m <sup>2</sup>	26.8 $\pm$ 0.23	26.9 $\pm$ 0.27	0.6202
Ethnicity			
White	290 (65.6)	199 (62.8)	0.4477
Non-White	152 (34.4)	118 (37.2)	
Education, years	5.92 $\pm$ 0.24	7.77 $\pm$ 0.29	<0.0001
Smoking, pack-years	19.7 $\pm$ 1.37	19.0 $\pm$ 1.27	0.6994
Smoking status			
Never	167 (37.8)	72 (22.7)	<0.0001
Former	146 (33.0)	101 (31.9)	
Current	129 (29.2)	144 (45.4)	
Respiratory symptoms			
Cough	131 (29.6)	107 (33.8)	0.2218
Phlegm	124 (28.1)	91 (28.7)	0.8284
Wheeze	152 (34.4)	143 (45.1)	0.0022
Dyspnoea	236 (54.8)	143 (45.1)	0.0134
Any symptom	318 (72.0)	244 (77.0)	0.1304
Any respiratory medication	68 (15.4)	45 (14.2)	0.6316
Any bronchodilator	64 (14.5)	43 (13.6)	0.7087
Any corticosteroid	25 (5.7)	17 (5.4)	0.8604
Comorbidity score	1.28 $\pm$ 0.05	1.02 $\pm$ 0.06	0.0006
GOLD stages			
Stage 1	257 (58.1)	194 (61.2)	0.2923
Stage 2	150 (33.9)	106 (33.4)	
Stage 3 and 4	35 (7.9)	17 (5.4)	
Any exacerbation within the past year	41 (9.3)	19 (6.0)	0.0925
Number of exacerbations within the past year	4.06 $\pm$ 1.63	0.33 $\pm$ 0.13	0.0234
FEV <sub>1</sub> , l, post-BD	1.92 $\pm$ 0.03	2.40 $\pm$ 0.04	<0.0001
FEV <sub>1</sub> , % predicted	79.7 $\pm$ 1.2	78.7 $\pm$ 1.2	0.5530
FVC, L post-BD	3.10 $\pm$ 0.05	3.82 $\pm$ 0.06	<0.0001
FVC, % predicted	98.3 $\pm$ 1.2	98.7 $\pm$ 1.1	0.7735
FEV <sub>1</sub> /FVC post-BD	61.5 $\pm$ 0.41	62.7 $\pm$ 0.46	0.0607

\*Statistical tests: nominal variables, Pearson  $\chi^2$  (adjusted for survey design); ordinal variables, Mann-Whitney test; continuous variables, Wald test (adjusted for survey design).  
COPD = chronic obstructive pulmonary disease; SE = standard error; BMI = body mass index; GOLD = Global Initiative for Chronic Obstructive Lung Disease; FEV<sub>1</sub> = forced expiratory volume in 1 s; FVC = forced vital capacity; BD = bronchodilator.

were more likely to be current smokers, and were less likely to report respiratory dyspnoea. Subjects with paid work had higher absolute values for post-BD FEV<sub>1</sub> and FVC, but these differences were not reflected in the percentage of predicted values. No differences were observed in ethnicity, BMI and use of respiratory medication between the two groups.

The multivariate analysis of persons with COPD showed that having paid work in the past year was mainly associated with male sex, lower age and higher education (Table 5). In the entire population, multivariate analysis showed that having paid work

\*The Appendix is available in the online version of this article at <http://www.ingentaconnect.com/content/iautld/ijtd/2011/00000015/00000009/art00022>.

**Table 4** Description of subjects without COPD by employment in the previous 12 months

Variable	Without paid work (n = 1952) n (%) or mean ± SE	With paid work (n = 2602) n (%) or mean ± SE	P value*
Age, years	60.2 ± 0.35	51.1 ± 0.18	<0.0001
Sex			
Male	405 (20.8)	1299 (49.9)	<0.0001
Female	1547 (79.3)	1303 (50.1)	
BMI, kg/m <sup>2</sup>	28.8 ± 0.15	27.9 ± 0.11	<0.0001
Ethnicity			
White	1044 (53.7)	1344 (51.8)	0.2582
Non-White	900 (46.3)	1249 (48.2)	
Education, years	6.51 ± 0.14	8.67 ± 0.17	<0.0001
Smoking, pack-years	7.88 ± 0.41	9.93 ± 0.34	0.0001
Smoking status			
Never	1032 (52.9)	990 (38.1)	<0.0001
Former	508 (26.0)	712 (27.4)	
Current	411 (21.1)	899 (34.6)	
Respiratory symptoms			
Cough	395 (20.3)	475 (18.3)	0.0810
Phlegm	327 (16.8)	452 (17.4)	0.5806
Wheeze	411 (21.1)	562 (21.6)	0.6420
Dyspnoea	967 (50.5)	1063 (41.0)	<0.0001
Any symptom	1224 (62.7)	1480 (56.9)	0.0001
Any respiratory medication	108 (5.5)	119 (4.6)	0.1633
Any bronchodilator	99 (5.1)	106 (4.1)	0.1384
Any corticosteroid	27 (1.4)	33 (1.3)	0.7125
Comorbidity score	1.17 ± 0.03	0.85 ± 0.02	<0.0001
Any exacerbation within the past year	86 (4.4)	110 (4.2)	0.7819
Number of exacerbations within the past year	0.34 ± 0.19	0.22 ± 0.14	0.6044
FEV <sub>1</sub> , l, post-BD	2.36 ± 0.01	2.97 ± 0.01	<0.0001
FEV <sub>1</sub> , % predicted	98.5 ± 0.47	98.2 ± 0.32	0.6797
FVC, L post-BD	2.95 ± 0.02	3.67 ± 0.02	<0.0001
FVC, % predicted	99.8 ± 0.48	100.5 ± 0.32	0.1391
FEV <sub>1</sub> /FVC post-BD	80.1 ± 0.12	80.9 ± 0.10	<0.0001

\*Statistical tests: nominal variables, Pearson's  $\chi^2$  (adjusted for survey design); ordinal variables, Mann-Whitney test; continuous variables, Wald test (adjusted for survey design).

COPD = chronic obstructive pulmonary disease; SE = standard error; BMI = body mass index; FEV<sub>1</sub> = forced expiratory volume in 1 s; FVC = forced vital capacity; BD = bronchodilator.

**Table 5** Multivariate analysis of factors associated with having paid work in the past year in subjects with COPD (n = 758)

Variable*	95%CI			P value
	OR	Low	High	
Age (per additional year)	0.90	0.88	0.92	<0.001
Female sex	0.33	0.23	0.47	<0.001
Education (per additional year)	1.05	1.01	1.09	0.020

\*Other variables tested but not included in the final model: FEV<sub>1</sub> % predicted, SF-12 physical and mental subscales, cough, phlegm, wheeze, dyspnoea, any respiratory symptom, GOLD severity stages, any exacerbations within past year, number of exacerbations within past year, smoking status. COPD = chronic obstructive pulmonary disease; OR = odds ratio; CI = confidence interval; FEV<sub>1</sub> = forced expiratory volume in 1 s; SF = short-form; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

**Table 6** Multivariate analysis of factors associated with having paid work in the past year, all subjects (n = 5242)

Variable*	95%CI			P value
	OR	Low	High	
COPD	0.83	0.69	1.00	0.054
Age (per additional year)	0.92	0.91	0.92	<0.001
Female sex	0.24	0.21	0.29	<0.001
Education (per additional year)	1.06	1.04	1.07	<0.001
MRC dyspnoea score (per 1-unit change)	0.85	0.75	0.96	0.010
Comorbidity score (per additional comorbid condition)	0.93	0.87	1.00	0.044

\*Other variables tested but not included in the final model: FEV<sub>1</sub> % predicted, SF-12 physical and mental subscales, cough, phlegm, wheeze, any respiratory symptom, any exacerbations within past year, number of exacerbations within past year, smoking status.

COPD = chronic obstructive pulmonary disease; OR = odds ratio; CI = confidence interval; MRC = Medical Research Council; FEV<sub>1</sub> = forced expiratory volume in 1 s; SF = short-form.

in the past year was mainly associated with male sex, higher education, lower age and less comorbidity (Table 6). Dyspnoea had a negative impact on paid employment, and having COPD showed only a trend in the same direction. Inclusion of FEV<sub>1</sub> % predicted, SF-12 (short-form survey) physical and mental subscales, cough, phlegm, wheeze, any respiratory symptom, any exacerbations within the past year and the number of exacerbations within the past year did not significantly alter the baseline models. No significant changes in the models were found when analyses were performed using the LLN for COPD diagnosis (Appendix Tables A.4 and A.5).

## DISCUSSION

In the PLATINO study, 41.8% of COPD subjects and 57.1% of those without COPD reported having paid work in the past year. The main factors associated with having paid work in COPD were male sex, higher education and lower age. In the population overall, COPD did not have a significant impact on obtaining paid employment after adjustment for other factors.

Different studies have shown that COPD is associated with high direct and indirect costs.<sup>2-11</sup> The indirect costs of COPD are more difficult to assess; for this reason, fewer studies have evaluated this component, and results obtained have varied widely.

Using data from a population-based study of adults aged  $\geq 18$  years, Eisner et al. examined the impact of self-reported asthma, COPD and other non-respiratory chronic conditions on work disability.<sup>12</sup> They found that COPD had a much greater impact than asthma and other non-respiratory chronic conditions on absence from work, perceived inability to work and perceived limitation in type or amount of work. The prevalence of current employment was 46.5% among COPD patients, 66.2% for other chronic conditions, 67.6% for asthma and 71.1% for

no chronic health conditions. COPD was also associated with a lower likelihood of current employment compared with no chronic health conditions (odds ratio [OR] 0.41), experiencing a prolonged absence from work (OR 2.92) and perceived inability to work (OR 12.90). Sin et al. indicated that self-reported COPD was associated with a 3.9% reduction in the adjusted probability of being in the work force.<sup>13</sup> Another study from the United States reported that persons with COPD were significantly less likely to report current employment at the time of interview or at age 65 than those without chronic conditions (31% for COPD vs. 56% no chronic condition).<sup>15</sup>

To our knowledge, no previous study has examined the indirect cost of COPD in low- and middle-income countries. The findings of the present study are sufficiently robust and complement the previous work published by others.<sup>13</sup> Our results indicate that the proportion of subjects with COPD reporting paid work was significantly lower than that reported by subjects without COPD. The number of months with paid employment was also significantly reduced in subjects with COPD. Although our findings are in line with those reported by others, methodological differences (source of populations studied, sample size and type of COPD diagnosis) among studies make it difficult to make comparisons with our results.

There is limited information regarding the factors associated with having paid work among COPD patients.<sup>13,14</sup> Sin et al. indicated that men had 18.2% higher work force participation than women, whereas Blacks and other racial groups had 9.6% and 12.5% lower work force participation than Whites.<sup>13</sup> They also found that younger age, being married, having a higher education level, urban residence and less airflow obstruction were associated with workforce participation among COPD sufferers. Other authors found in a selected COPD population that subjects with paid work were more likely to be younger, male and have a better quality of life.<sup>14</sup> They did not report significant differences in FEV<sub>1</sub> % predicted, FEV<sub>1</sub>/FVC (%), BMI, smoking history, smoking status, recent exacerbations, use of bronchodilators, comorbid conditions or educational level between the employment status subgroups.

Our results show that the main factors associated with having paid work in COPD are similar to those of the general population (male sex, higher education level and lower age). These findings are in line with those reported by others,<sup>13,14</sup> and suggest that in COPD, as in the general population, the more highly educated young men have a greater probability of being employed. Although comorbidity score, the proportion of subjects reporting respiratory symptoms (wheezing and dyspnoea) and the number of self-reported exacerbations within the past year were significantly higher in the COPD group without paid work, inclusion of these variables did not add predic-

tive power to the multivariate model. Moreover, ethnic differences have been associated with employment status in COPD; in PLATINO this was not an important factor, probably due to the marked differences in ethnic origin distribution among the sites.<sup>17</sup>

A remarkable finding of the present study was that no differences in COPD severity were observed between subjects with and without paid work. This finding is in agreement with the results of Orbon et al.,<sup>14</sup> but in contrast to those reported by Sin et al.<sup>13</sup> Differences among the studies can probably be explained by the source of the populations studied; PLATINO included subjects identified from a survey of a general population aged  $\geq 40$  years, whereas Sin et al.<sup>13</sup> included patients from a population-based study with a different age range. There were also important differences in COPD diagnostic methodologies. Sin et al. used self-reported COPD,<sup>13</sup> whereas the GOLD spirometric definition of COPD was used for the PLATINO study.

As mentioned above, most studies on the economic burden of COPD have been conducted in industrialised countries.<sup>1,2</sup> Although studies of direct costs may be less relevant to the developing world, it could be hypothesised that the indirect burden of COPD in developing countries can be substantial and important. As health care sectors in most of these countries do not usually provide long-term supportive care services for severely disabled people, COPD may force affected individuals to leave the workplace, and other family members to stay at home to care for them. Thus, in terms of productivity lost, COPD can represent a double burden for low-income countries. Unfortunately, due to the design of the PLATINO study, this type of analysis could not be performed, and future studies are necessary to evaluate the contribution of these factors, as human capital is often the most important asset for developing nations.

Our study has several limitations. We only assessed information on paid work; no information about the type of employment was recorded, and information on other issues, such as full- or part-time status, individual earnings, household earnings and employment history/experience was not collected. We recognise that this is a narrow analysis of work force participation of COPD patients in comparison with other methods, such as the calculation of indirect costs based on human capital using days off work. The latter method has been criticised for the lack of inclusion of subgroups that are not integrated in the labour market, such as the elderly, women in the home, etc. We consider that, for the purposes of the present study, information on overall paid employment represents important data that could help us to partly understand the indirect costs of COPD in developing nations.

In summary, this study indicates that although the proportion of employed persons is lower among

COPD sufferers, having COPD appears not to have a significant impact on obtaining paid employment in the overall population of developing countries. The main factors associated with having paid work in persons with COPD are similar to those of the general population. Understanding the impact of work force participation among COPD patients is important in determining the indirect costs and the overall economic burden of the disease.

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## APPENDIX

**Table A.1** Employment within the previous 12 months by COPD status\*

Variable	No COPD (n = 4573) n (%)	COPD (n = 604) n (%)	P value†
Paid work in the previous 12 months			
Yes	2578 (56.4)	281 (46.5)	<0.0001
No	1995 (43.6)	323 (53.5)	
Work less due to health problem			
Yes	23 (0.5)	7 (1.2)	<0.0001
No	1968 (43.0)	315 (52.2)	
No response	2582 (56.5)	282 (46.7)	

\*Defined using lower limit of normal.

†Statistical tests: Pearson's  $\chi^2$  (adjusted for survey design), Mann-Whitney test.

COPD = chronic obstructive pulmonary disease.

**Table A.2** Work frequency in subjects reporting paid work in the previous 12 months by COPD status\*

Variable	No COPD (n = 2573) mean $\pm$ SE	COPD (n = 281) mean $\pm$ SE	P value†
Months with paid work	10.9 $\pm$ 0.06	10.8 $\pm$ 0.16	0.5218
Days per week with paid work	5.71 $\pm$ 0.03	5.87 $\pm$ 0.08	0.0643
Hours per day with paid work	8.76 $\pm$ 0.07	8.99 $\pm$ 0.18	0.2016

\*Defined using lower limit of normal.

†Statistical test: Wald test (adjusted for survey design).

COPD = chronic obstructive pulmonary disease; SE = standard error.

**Table A.3** Description of subjects with COPD by employment in the past year\*

Variable	Without paid work (n = 323) n (%) or mean $\pm$ SE	With paid work (n = 281) n (%) or mean $\pm$ SE	P value†
Age, years	65.2 $\pm$ 0.70	54.4 $\pm$ 0.53	<0.0001
Sex			
Male	128 (39.6)	205 (58.7)	<0.0001
Female	195 (60.4)	116 (41.3)	
BMI, kg/m <sup>2</sup>	26.5 $\pm$ 0.29	26.7 $\pm$ 0.29	0.6633
Ethnicity			
White	197 (61.0)	171 (60.9)	0.9730
Non-White	126 (39.0)	110 (39.1)	
Education, years	6.21 $\pm$ 0.26	8.16 $\pm$ 0.30	<0.0001
Smoking, pack-years	20.9 $\pm$ 1.68	18.9 $\pm$ 1.27	0.3427
Smoking status			
Never	119 (36.8)	62 (22.1)	<0.0001
Former	90 (27.9)	76 (27.1)	
Current	114 (35.3)	143 (50.9)	
Respiratory symptoms			
Cough	105 (32.5)	97 (34.5)	0.6112
Phlegm	105 (32.5)	86 (30.6)	0.6037
Wheeze	131 (40.6)	128 (45.6)	0.1948
Dyspnoea	178 (55.8)	127 (45.2)	0.0133
Any symptom	240 (74.2)	219 (77.9)	0.2972
Any respiratory medication	56 (17.3)	44 (15.7)	0.5683
Any bronchodilator	53 (16.4)	42 (15.0)	0.6182
Any corticosteroid	21 (6.5)	15 (5.3)	0.5476
Comorbidity score	1.18 $\pm$ 0.06	0.99 $\pm$ 0.06	0.0124
GOLD stages			
Stage 1	162 (50.5)	172 (62.8)	0.0021
Stage 2	129 (40.2)	86 (31.4)	
Stages 3 and 4	30 (9.4)	16 (5.8)	
Any exacerbation within the past year	28 (8.7)	19 (6.8)	0.3792
Number of exacerbations in the past year	5.42 $\pm$ 2.24	0.37 $\pm$ 0.15	0.0256
FEV <sub>1</sub> post-BD, l	1.89 $\pm$ 0.04	2.41 $\pm$ 0.05	<0.0001
FEV <sub>1</sub> , % predicted	75.0 $\pm$ 1.2	77.8 $\pm$ 1.1	0.0891
FVC post-BD, l	3.13 $\pm$ 0.06	3.84 $\pm$ 0.07	<0.0001
FVC, % predicted	95.7 $\pm$ 1.2	98.7 $\pm$ 1.0	0.0617
FEV <sub>1</sub> /FVC post-BD	59.8 $\pm$ 0.52	62.4 $\pm$ 0.50	0.0003

\*Defined using lower limit of normal.

†Statistical tests: nominal variables, Pearson's  $\chi^2$  (adjusted for survey design); ordinal variables, Mann-Whitney test; continuous variables, Wald test (adjusted for survey design).COPD = chronic obstructive pulmonary disease; SE = standard error; BMI = body mass index; GOLD = Global Initiative for Chronic Obstructive Lung Disease; FEV<sub>1</sub> = forced expiratory volume in 1 s; BD = bronchodilator; FVC = forced vital capacity.

**Table A.4** Multivariate analysis of factors associated with having paid work in the past year in subjects with COPD ( $n = 600$ )\*†

Variable	OR	95%CI	P Value
Age, years	0.91	0.89–0.93	<0.001
Female sex	0.38	0.25–0.57	<0.001
Education, years	1.06	1.02–1.11	0.007
Never smoker	1.00	Reference	
Current smoker	1.50	0.96–2.34	0.073
Former smoker	1.58	0.95–2.62	0.077
Wheeze	1.10	0.76–1.59	0.611
Dyspnoea	0.66	0.44–1.01	0.053
Comorbidity score (per additional comorbid condition)	1.01	0.83–1.22	0.917

\*Other variables tested but not included in the final model: FEV<sub>1</sub> % predicted, SF-12 physical and mental subscales, cough, phlegm, any respiratory symptom, MRC dyspnoea scale, GOLD severity stages, any exacerbations in the past year, and number of exacerbations in the past year.

†Defined using lower limit of normal.

COPD = chronic obstructive pulmonary disease; OR = odds ratio; CI = confidence interval; FEV<sub>1</sub> = forced expiratory volume in 1 s; SF = short-form; MRC = Medical Research Council; GOLD = Global Initiative for Chronic Obstructive Lung Disease.

**Table A.5** Multivariate analysis of factors associated with having paid work in the past year in the overall population ( $n = 5115$ )\*

Variable	OR	95%CI	P value
COPD†	0.78	0.63–0.95	0.016
Age, years, per additional year	0.92	0.91–0.93	<0.001
Female sex	0.25	0.22–0.29	<0.001
Education, years, per additional year	1.06	1.04–1.07	<0.001
MRC dyspnoea score, per 1-unit change	0.84	0.74–0.95	0.006
Comorbidity score, per additional comorbid condition	0.94	0.87–1.00	0.068
Never smoker	1.00	Reference	
Current smoker	1.18	1.01–1.38	0.043
Former smoker	1.05	0.89–1.25	0.537

\*Other variables tested but not included in the final model: FEV<sub>1</sub> % predicted, SF-12 physical and mental subscales, cough, phlegm, wheeze, any respiratory symptom, any exacerbations in the past year, and number of exacerbations in the past year.

†Defined using lower limit of normal.

COPD = chronic obstructive pulmonary disease; OR = odds ratio; CI = confidence interval; MRC = Medical Research Council; FEV<sub>1</sub> = forced expiratory volume in 1 s; SF = short-form.



## R É S U M É

**CONTEXTE :** La bronchopneumopathie chronique obstructive (BPCO) est une affection coûteuse qui provoque fréquemment des incapacités permanentes de travail dans les pays en développement. On dispose de peu d'informations concernant l'impact de la BPCO sur la participation aux forces de travail et sur les coûts indirects de la maladie.

**OBJECTIF :** Examiner en Amérique Latine la fréquence des occupations rémunérées et les facteurs qui l'influencent dans une étude basée sur la population.

**MÉTHODES :** On a utilisé le FEV<sub>1</sub> (volume expiratoire maximum seconde)/FVC (capacité vitale forcée) < 0,70 après bronchodilatateur pour définir la BPCO. L'information concernant le fait d'avoir une occupation rémunérée a été évaluée par la question suivante : « A un moment quelconque de la dernière année, avez-vous travaillé pour gagner de l'argent? »

**RÉSULTATS :** On a pu compléter les interviews chez 5571 sujets et réaliser la spirométrie chez 5314 d'entre eux

(759 BPCO et 4554 non-BPCO). Parmi les sujets BPCO, 41,8% ont signalé avoir une occupation rémunérée vs. 57,1% dans le groupe non-BPCO ( $P < 0,0001$ ). Le nombre de mois avec occupation rémunérée est diminué chez les patients BPCO ( $10,5 \pm 0,17$  vs.  $10,9 \pm 0,06$ ;  $P < 0,05$ ). Les facteurs principaux en association avec l'existence d'une occupation rémunérée chez les patients BPCO sont le sexe masculin (OR 0,33; IC95% 0,23–0,47), un niveau plus élevé d'éducation (OR 1,05, IC 95% 1,01–1,09), ainsi qu'un âge moins avancé (OR 0,90; IC95% 0,88–0,92). La BPCO ne contribue donc pas significativement à l'emploi (OR 0,83, IC95% 0,69–1,00;  $P = 0,054$ ) pour l'ensemble de la population.

**CONCLUSIONS :** Bien que la proportion de sujets ayant une occupation rémunérée est plus faible chez les sujets BPCO, le fait d'être atteint de BPCO semble ne pas avoir un impact significatif sur l'obtention d'une occupation rémunérée dans l'ensemble de la population de pays en développement.

## R E S U M E N

**MARCO DE REFERENCIA:** La enfermedad pulmonar obstructiva crónica (EPOC) es costosa y causa con frecuencia incapacidad laboral. Existe poca información sobre participación laboral en EPOC y sus costos indirectos en países en desarrollo.

**OBJECTIVO:** Evaluar la frecuencia de trabajo remunerado y los factores que influyen sobre este en un estudio epidemiológico latinoamericano.

**MÉTODOS:** Se utilizó la relación VEF<sub>1</sub> (volumen espiratorio forzado del primer segundo)/CVF (capacidad vital forzada) < 0.70 post-broncodilatador para definir EPOC. La información sobre trabajo remunerado se evaluó mediante la pregunta: 'En cualquier momento en el último año, tuvo un trabajo remunerado?'

**RESULTADOS:** Se entrevistaron 5571 sujetos y se obtuvieron 5314 espirometrías (759 EPOC y 4554 no-EPOC).

En los sujetos con EPOC, 41,8% reportaron tener trabajo remunerado comparado con 57,1% en los no-EPOC ( $P < 0,0001$ ). El número de meses con trabajo remunerado fue menor en EPOC ( $10,5 \pm 0,17$  vs.  $10,9 \pm 0,06$ ;  $P < 0,05$ ). Los factores asociados con trabajo remunerado en EPOC fueron sexo masculino (OR 0,33; IC95% 0,23–0,47), mayor nivel educativo (OR 1,05; IC95% 1,01–1,09) y menor edad (OR 0,90; 95%IC 0,88–0,92). La EPOC no fue un determinante significativo de tener empleo en la población general (OR 0,83; IC95% 0,69–1,00;  $P = 0,054$ ).

**CONCLUSIONES:** Aunque la proporción de personas con trabajo remunerado fue menor en EPOC, padecer este problema no parece ser un contribuyente de tener trabajo remunerado en la población general de países en desarrollo.