



## Early View

Research letter

# **Air quality in Mexico City during the COVID-19 lockdown possibly decreased COPD exacerbations**

Francisco Montiel-Lopez, Daniela Rodríguez-Ramírez, Maricruz Cassou-Martínez, María Cristina Miranda-Márquez, Claudia González-González, Raúl H. Sansores, María Eugenia Mayar-Maya, Rogelio Pérez-Padilla, Robinson Emmanuel Robles-Hernández, Ileri Thirion-Romero, Oliver Pérez-Bautista, Alejandra Ramírez-Venegas

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## **Air quality in Mexico City during the COVID-19 lockdown possibly decreased COPD exacerbations**

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### **Take home message**

The reduction of air pollution during the covid-19 lockdown in Mexico City possibly reduced the exacerbation rate in COPD due to biomass and tobacco patients despite that the self-isolation was not as strict as expected.

## **Keywords**

Air pollution, biomass exposure, COVID-19, tobacco smoking, COPD exacerbations.

To the editor:

## **Introduction**

During the 1<sup>st</sup> year of the COVID-19 pandemic, different authors have been reported that COPD acute exacerbations (AECOPD) were reduced [1–4]. In Mexico City, during the beginning of the pandemic, a voluntary lockdown was declared and therefore the adherence to health measures were more flexible and less stringent in the general population than in other countries [5]. However, because there was a reduction of exposure to air pollutants such as PM<sub>10</sub>, PM<sub>2.5</sub>, and total suspended particles levels during this 1<sup>st</sup> year of the pandemic, especially patients living in urban areas like Mexico City, AECOPD could be diminished as other countries have been reported [1–4]. In rural areas of Mexico, because the lack of access to clean energy, many women in these communities cook their food by burning firewood, exposing themselves to biomass smoke almost all day throughout their lives, making them more susceptible to develop COPD. Regarding COPD exacerbations due to biomass in rural areas during COVID-19 pandemic, should not decrease because the environment pollutants did not change. The primary objective of this study was to investigate if there was a reduction in AECOPD during the first year of the COVID-19 pandemic in comparison with the previous year. Because women with biomass exposure represent an important group of COPD in Mexico [6],—therefore a secondary objective was to investigate the difference in AECOPD between the COPD due to

biomass exposure (BE-COPD) and the COPD due to tobacco smoking (TE-COPD) groups.

## **Methods**

This was a cross-sectional, retrospective study made through a telephone survey to BE-COPD and TE-COPD patients during 2020 pandemic year, and a review of patients' records of a subcohort of BE-COPD and TE-COPD patients from the COPD clinic at the National Institute of Respiratory diseases in Mexico City. The study had two phases. The first one consisted in the application of a telephone survey to patients during most of the year 2020 and the first two months of 2021, and the second phase consisted in a review of AECOPD during the year 2019 from the medical records of the 210 patients that answered the survey. The surveys focused on the presence of moderate to severe COPD exacerbations during these periods. In order to establish a relationship between exacerbations and adherence to preventive health measures, patients were asked about the compliance of social distancing and self-isolation, use of face masks, and handwashing during the first year of the pandemic [7]. In order to investigate whether the levels of pollutants had changed in 2020 compared to 2021 public records of suspended particles in Mexico during 2019 to 2021 was consulted and analyzed [8].

## **Analysis**

Logistic regression analysis was performed to evaluate risk factors associated with the presence of AECOPD. Negative binomial model used to compare COPD exacerbation rates per year adjusted by sex, COPD group and age. Stata 14.0 program was used for statistical analysis.

## Results

Table 1 shows the difference between BE-COPD and TE-COPD in demographics and exacerbations characteristics. For this study, 75 (36%) patients belonged to the BE-COPD group and 135 (64%) belonged to the TE-COPD group. A higher proportion of BE-COPD patients live in rural areas than TE-COPD patients (39% vs 6%) ( $p < 0.001$ ) and have a lower socioeconomic level ( $p < 0.001$ ).

When evaluating the adherence of preventive health measures against COVID-19 contagion, including social distancing, handwashing, and the use of facemasks, 33% of all patients referred to have low adherence to these measures without a significant statistical difference between COPD groups. Regarding self-isolation, when asking if patients remained indoors during 2020, there was a higher proportion of TE-COPD patients (45%) that stayed in comparison to the BE-COPD group (30%) ( $p = 0.035$ ). However, it's worth noticing that 65% of all patients answered that they did not stay at home most of the time during this period. Regarding the number of patients that presented an AECOPD in 2019-20, 27% of them reported at least 1 moderate exacerbation whereas in 2020-2021, 17% of them did without significant difference between COPD groups. The AECOPD rate in 2019-20 was 0.47 (0.06-3.41, 95%CI) and in 2020-21 was 0.18 (0.02-1.32, 95%CI)  $p < 0.001$ ; results were adjusted by COPD group, sex, and age. There were no significant differences in the reduction of exacerbation rate nor the severity between BE-COPD and TE-COPD patients. There was no relationship between remaining indoors during the first year of the pandemic and AECOPD incidence in the total population and per groups. When we analyzed COPD group, place of residence, socioeconomic status, health measurements adherence (social distancing, handwashing, use of facemasks) and self-isolation as risk

factors for exacerbations during 2020-21, the logistic regression analysis did not show an association.

## **Discussion**

This study demonstrated a significant reduction in the number AECOPD from March 2020 to February 2021 in comparison with the same period the year before, without differences between BE-COPD and TE-COPD.

Like other authors have reported, we consider that lockdown measurements for COPD patients during the pandemic period should be a determinant factor to reduce exacerbations. Nevertheless, there was no association between remaining indoors during the first year of the pandemic and AECOPD. Because in our COPD cohort the self-isolation was not very strict and insufficient to decrease patients' risk for developing exacerbations, another important factor may explain the decrease in AECOPD rates during the COVID-19 pandemic; the decrease of environmental pollution in an urban area like Mexico City could be one of the most determinant factors that may contribute to the decrease of AECOPD in 2020. In Mexico City, there was a significant decrease in environmental pollution during that year compared with the previous year in  $PM_{10}$ ,  $PM_{2.5}$ , and total suspended particles levels ( $45\pm 21$  vs  $40\pm 21$ ,  $p=0.0017$ ;  $20\pm 10$  vs  $16\pm 7$ ,  $p<0.001$ ;  $99\pm 43$  vs  $89\pm 37$ ,  $p=0.046$  respectively) [8]. The study was unable to analyze a relationship between levels of pollutants and exacerbations. We can only point out that the time in which the levels of pollutants were measured were similar when we conducted the survey of BE-COPD and TE-COPD patients.

In urban areas in the United States, during the COVID-19 pandemic, the  $PM_{2.5}$  and  $NO_2$  levels decreased 25% during 2020 in comparison with 2017-2019 [9]. During the pandemic in China a reduction in  $NO_2$  and  $PM_{2.5}$  has been attributed to

reduced mortality including cardiovascular and pulmonary causes [10, 11]. Because environmental pollution has been demonstrated to increase respiratory symptoms [12] and mortality [12, 13], the reduction of these particles in Mexico City also produced a favorable impact on the respiratory health of COPD patients. The BE-COPD group showed a similar reduction of AECOPD as the TE-COPD group. Despite that BE-COPD patients suffer from higher socioeconomic disadvantages and lower measurements of isolations during COVID-19 pandemic, the fact that 60 % of them lived in Mexico's metropolitan area, they could be benefited in the AECOPD rate similarly than TE-COPD by the reduction of environmental pollution. Absence of statistical difference in reduction of exacerbation rate between the two groups may be due to small sample size.

### **Conclusion**

The improvement of the air quality in Mexico City during the COVID-19 lockdown, as other countries with high levels of air pollution reported, may contribute to the reduction of AECOPD equally in BE-COPD and TE-COPD groups.

### **Conflict of interest**

The authors confirm that there are no relevant financial or non-financial competing interests to report.

**Table 1.** Sociodemographic and exacerbation characteristics by COPD groups.

Variables n(%) / X±SD	BE-COPD (n=75)	TE-COPD (n=135)	Total (n=210)	p value
Age (years)	76±11	73±9	74±10	0.004
Female	67(89)	48(36)	115(55)	<0.001
Rural residence	29(39)	8(6)	37(18)	<0.001
Low socioeconomic status	67(89)	83(62)	150(71)	<0.001
Low self-reported adherence to preventive measures	28(38)	41(31)	69(33)	0.272
Strict Indoor isolation	36(30)	28(45)	64(35)	0.035
FEV <sub>1</sub> % of predicted	70±22	57±22	62±23	<0.001
2019-2020 patients with exacerbations	19(25)	37(27)	56 (27)	0.745
2020-2021 patients with exacerbations	13(17)	23(17)	36 (17)	0.956

AECOPD, COPD acute exacerbations; BE-COPD, COPD due to exposure to biomass smoke; TE-COPD, COPD due to exposure to tobacco smoke; X, mean; SD, standard deviation; FEV<sub>1</sub>, forced expiratory volume in the first second.



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