

# Impact of COVID-19 Pandemic on the Exacerbation Rates in COPD Patients in Southern India – A Potential Role for Community Mitigations Measures

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**Introduction:** The impact of the coronavirus 2 (SARS-CoV-2) pandemic and the effect of preventive health strategies on acute exacerbations of chronic obstructive pulmonary disease (AECOPD) are largely unknown. The public health model imposed during the pandemic and the lessons learnt have implications on recommending future preventive strategies for COPD care in general and exacerbations in particular.

**Aim:** This study endeavors to assess the role of preventive strategies of COVID-19 on exacerbation rates of COPD during the lockdown period compared to similar periods the previous year and assess the compliance to preventive strategies for COVID-19 among COPD patients.

**Methods:** This is a hospital-based descriptive cross-sectional study at a tertiary care center. AECOPD in patients during a period spanning five months in the pre-lockdown days was compared with exacerbation rates for a similar period during the national lockdown.

**Results:** Sixty-eight patients were recruited (mean age: 67.38) among whom 47 were males and 21 were females. There were only 7 (10.3%) reported admissions during the lockdown period of 5 months compared to 50 (73.5%) during the corresponding period pre-lockdown. Mild exacerbations reported during the lockdown period were also significantly less with only 17 (25%) against 58 (85.3%) during the pre-lockdown period. Adherence to measures such as donning of masks, hand hygiene, and social distancing was observed among COPD patients with good compliance to the health practices promulgated in the pandemic.

**Discussion:** A significant reduction in exacerbation rates among AECOPD patients during the period of lockdown was observed compared to a similar period the year prior. Noticeable were the findings that both community-based milder exacerbations and severe exacerbations necessitating hospitalizations showed a reduction during the period of lockdown. Adaptability, compliance and acceptance to usage of masks, hand hygiene measures, and norms such as physical distancing were observed in the majority of COPD patients.

**Keywords:** COPD, exacerbation, pandemic, physical distancing, face masks

## Introduction

The coronavirus disease 2019 (COVID-19) pandemic has affected millions of people around the world since the beginning of 2020. During the spate of this pandemic, there has been a lot of focus on its impact on those with comorbidities, as adverse outcomes in terms of hospitalizations and mortality were significantly higher in this group. However, surprisingly contrary to the general perception, prevalence of COPD and bronchial asthma among the COVID as a comorbidity is quite low<sup>1,2</sup> compared to the quantum of their disease burden.<sup>3</sup>

COPD is the third leading cause of death worldwide.<sup>4</sup> Most COPD deaths are due to acute exacerbation. Besides, acute exacerbations among COPD play a crucial role in disease progression, hospitalizations, morbidity, and health burden from the disease. Several risk factors and triggers are identified as acute exacerbations. These include smoking, air pollution, severe airflow limitation, bronchiectasis, prior exacerbations, comorbidities, high blood eosinophil counts and infections, both bacterial and viral.<sup>5</sup>

There has been a common clinical observation shared by pulmonologists worldwide on reduced acute exacerbation of COPD (AECOPD) and asthma in the last quarter, a juncture when the pandemic wreaked havoc in health care. This has not been backed by verifiable data as yet from scientific studies due to contextual limitations on account of acuteness of the COVID pandemic.

There is a likelihood that the basic measures practiced widely during this pandemic such as government-mandated lockdown, quarantine, hand washing and donning of face masks could be the reasons for better control of exacerbations in this pandemic season.

## Aim

To assess the impact of the coronavirus 2 pandemic on AECOPD rates and assess the role of preventive measures practiced during the lockdown phase of the pandemic.

## Objectives

1. To measure hospitalization rates due to acute exacerbation of COPD during the lockdown period in comparison with similar rates during the previous year period pre-lockdown.
2. To estimate mild to moderate exacerbation of COPD treated as outpatients during the lockdown period in comparison with similar rates during the previous year period pre-lockdown.
3. To assess the adherence, attitude, practice and perception of our COPD patients to the practices during the pandemic, of donning of masks, hand hygiene, and physical distance.

## Methods

### Study Design

The study was a hospital-based descriptive cross-sectional study carried out at a tertiary care teaching hospital in Mangalore, a coastal town in the state of Karnataka, southern India.

**Ethics:** The study was initiated after requisite approval from the research committee and institutional ethics committee Kasturba Medical College Mangalore on January 22, 2021. An information sheet with study details was provided to the patients and they were enrolled in the study after providing written informed consent for study participation.

Patients diagnosed with COPD who were being treated at the department of Pulmonary Medicine were enrolled for the study. The database was reviewed and patients who met the inclusion criteria for COPD and exacerbation states confirmed by clinical, radiological and spirometry criterion as per the global initiative of lung disease (GOLD) were included in the study. COPD patients with significant respiratory comorbidities such as bronchiectasis, lung malignancy, lung abscess, empyema, pleural effusions, active tuberculosis were excluded from the study.

Acute exacerbation among known COPD patients during 5 months of lockdown from April 2020 to August 2020 was captured and compared with similar exacerbation rates in the corresponding period of 5 months from April 2019 to August 2019. Outpatient exacerbations were defined as those resulting in a prescription for oral corticosteroids, increased use of rescue inhalers and/or antibiotics, but without hospital admission. Hospitalized exacerbations were defined as admissions to hospital with a documented discharge summary. We also assessed the awareness, practices, and compliance of our COPD patients to preventive strategies advocated for COVID-19 like usage of masks, hygiene, and social distancing.

Baseline data was collected in person from the patients attending as outpatients and in those hospitalized with exacerbations. Follow-up data was collected by a scripted periodic telephone survey. Data abstraction forms were used for collecting the data from the study subjects. It consisted of three sections.

Section 1 – Sociodemographic details

Section 2 – Clinical indicators for exacerbation

Section 3 – Awareness, practices and compliance to preventive strategies practiced during the pandemic

## Statistical Analysis

Data were analyzed using SPSS version 25. Quantitative data were summarized as mean and SD while qualitative data were summarized as proportions. As a test of significance the chi-squared test was used to study the association. A *P*-value of 0.05 was considered a statistically significant difference.

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Results

Sixty-eight patients with COPD were included in the study with baseline characteristics (Table 1). Baseline COPD status assessment revealed that, 38 (60.3%) of patients were classed as GOLD 3 or 4 stage airflow obstruction and the remaining 25 (39.6%) were categorized as GOLD stage 1 and 2 airflow obstruction. Sixteen patients (23.5%) subjects were frequent exacerbators with a history of  $\leq 2$  admissions while 52 (76.5%) patients had 0–1 admission over the last one year. Thirty-two patients (47.1%) had COPD for more than 10 years, 27 (39.7%) had grade 3 and 4 mMRC scale of dyspnea, 7 (10.3%) patients were on domiciliary oxygen, and 17 (33.3%) had associated pulmonary hypertension (Table 2).

## Acute Exacerbations

Acute exacerbation of COPD during 5 months of lockdown (from April 2020 to August 2020) requiring hospital admissions were significantly reduced with only 7 (10.3%) reporting admissions compared to 50 (73.5%) during the corresponding period of 5 months' pre-lockdown the previous year (April 2019 to August 2019). This difference observed in severe exacerbations requiring hospitalization assumed statistical significance ( $<0.0001$ ) (Table 3).

Mild to moderate severe exacerbations treated as outpatients requiring antibiotics was also significantly less with only 17 (25%) against 58 (85.3%) in pre-lockdown.

Unsurprisingly, the majority of the exacerbations around 17 (25%) during the lockdown period were managed on an outpatient basis against 7 (10.3%) cases requiring admission.

Symptomatic grading of dyspnea on mMRC was not significantly different irrespective of COPD severity across both the groups in pre- and post-lockdown period.

**Table 1** Baseline Characteristics of Study Population (n=68)

Baseline Characteristics	Number (%)
<b>Mean Age in Years (Mean <math>\pm</math>SD)</b>	67.38 $\pm$ 7.14
<b>Gender</b>	
Male	47 (69.1)
Female	21 (30.9)
<b>Mean BMI (Mean <math>\pm</math> SD)</b>	21.30 $\pm$ 5.22
<b>Smoking</b>	
Current smoker	10 (14.7)
Ex-smoker	35 (51.5)
Never smoked	23 (33.8)
<b>Smoking Index Category</b>	
<150	7 (15.9)
151–300	5 (11.4)
>300	32 (72.7)
<b>Open Fire Cooking</b>	51 (75)

**Table 2** Disease Characteristics of COPD Patients (n=68)

Disease Characteristics	Number (%)
<b>Duration of COPD in Years</b>	
<5	36 (52.9)
5–10	14 (20.6)
>10	18 (26.5)
<b>M MRC Grade of Breathlessness</b>	
Grade 1	06 (8.8)
Grade 2	35 (51.5)
Grade 3	21 (30.9)
Grade 4	6 (8.8)
<b>Spirometry (n=63)</b>	
GOLD 1	04 (06.3)
GOLD 2	21 (33.3)
GOLD 3	24 (38.1)
GOLD 4	14 (22.2)
<b>Six Minute Walk Test (n=61) median (IQR)</b>	
Saturation drop	01 (0, 3)
Change in heart rate	18 (8.75, 27.25)
Mean distance covered in meters (mean $\pm$ SD)	267.52 $\pm$ 71.52
Pause	1 (1.6)
Reason for pausing	Breathlessness
<b>ABG (n=40)</b>	
Normal	19 (47.5)
Type 1 respiratory failure	11 (27.5)
Type 2 respiratory failure	10 (25.0)
<b>COPD Phenotype On Chest X-Ray (n=68)</b>	
Chronic bronchitis	21 (30.9)
Emphysema	47 (69.1)
<b>H/O Exacerbation in Last One Year</b>	
Admission for COPD in last one year	
0–1	52 (76.5)
$\leq 2$	16 (23.5)
Antibiotics, oral corticosteroids usage in last one year	
0–1	37 (54.4)
$\leq 2$	31 (45.6)
<b>Comorbidities</b>	
Diabetes Mellitus	16 (23.5)
Hypertension	27 (39.7)
Old Pulmonary Tuberculosis	03 (4.4)
Angina	03 (4.4)
Heart failure	01 (1.5)
GERD	05 (7.4)
Cancer	02 (2.9)
<b>2D ECHO</b>	
<b>Pulmonary Arterial Hypertension</b>	
Yes	17 (25.00)
No	51 (75.0)

**Table 3** Pre and Post Lockdown Comparison (n=68)

Characteristics	Pre-lockdown n (%)	Post-lockdown n (%)	P-value
<b>No. of Exacerbations Requiring antibiotics</b>			
None	10 (14.70)	51 (75.0)	<0.0001
Once	29 (42.65)	14 (20.6)	
Two or more	29 (42.65)	03 (4.40)	
<b>Requiring hospitalisation</b>			
None	18 (26.5)	61 (89.7)	<0.0001
Once	41 (60.3)	07 (10.3)	
Two or more	09 (13.2)	0 (0)	
<b>Dyspnoea Grading (mMRC)</b>			
Grade 1	01 (01.5)	06 (08.8)	0.183
Grade 2	53 (77.9)	48 (70.6)	
Grade 3	14 (20.6)	13 (19.1)	
Grade 4	0 (0)	01 (01.5)	

### Face masks, physical distancing, hygiene and health-care access

We assessed the adherence, attitude, practice and perception of our COPD patients to the recent and widely promulgated practices (during the pandemic) of donning of masks, hand hygiene, and physical distance. The majority of the COPD patients (97%) were compliant with face mask usage and most patients (80.3%) were comfortable with the new habit of regular mask usage in most settings whereas a minority (13%) were not comfortable with donning masks – the reason often reported was a feeling of suffocation. Unsurprisingly none of the COPD patients from our database had used face masks before and this was a novel habit for them. The most preferred face masks were cloth masks (78.8%) followed by surgical masks (19.7%) while only a few (1.5%) used N95 masks. Usage of masks was practiced mainly in an outdoor setting (95%) and masks offered most of the COPD patients (84%) a sense of well-being and attributed better COPD control to habit of mask usage.

All patients practiced frequent hand washing, while a minority used alcohol-based sanitizers (11.8%), soap and water solutions were preferred by most (88.2%). Interestingly all the COPD patients followed the norms of outdoor social distancing and avoided large and community gatherings whereas only a few (23.5%) followed physical distancing at homes.

Around half of our patients (52.8%) contacted health-care facilities during the lockdown period of 5 months with the majority of contacts being with the tertiary centers (58.3%) and some (41.7%) accessing local health care. On the contrary, only a few (18.2%) experienced difficulty in accessing health care while the majority (81.8%) had no difficulties in health-care access. Most patients preferred an in-person visit and only a few (5.56%) used video-consultations (Table 4).

**Table 4** COVID Appropriate Behaviour Among Study Participants (n=68)

COVID Appropriate Behaviour	n (%)
<b>1. Mask Usage (n=68)</b>	
Yes	66 (97.1)
No	02 (02.9)
If no, reason	Does not feel the necessity to wear a mask
<b>2. Type of mask used (n=66)</b>	
N95 mask	01 (01.5)
Surgical mask	13 (19.7)
Cloth mask	52 (78.8)

(Continued)

Table 4 (Continued).

COVID Appropriate Behaviour	n (%)
<b>3. Comfort while wearing a mask</b>	
Yes	53 (80.3)
No	13 (19.7)
Reason given for discomfort	Suffocation
<b>4. Wears the mask</b>	
At home	01 (01.5) <sup>a</sup>
Only while going out	63 (95.5)
Both	02 (03.0)
<b>5. Usage of a mask before lockdown</b>	
Yes	0 (0)
No	68 (100)
<b>6. Subjective feeling of wellness after wearing a mask</b>	
Yes	56 (84.8)
No	10 (15.2)
<b>7. Hand wash practised frequently</b>	
Yes	68 (100)
No	0 (0)
<b>8. Hands washed using</b>	
Soap and water only	60 (88.2)
Soap and water and alcohol-based sanitiser	08 (11.8)
<b>9. Social distancing followed</b>	
Yes	68 (100)
No	0 (0)
<b>10. Avoidance of large gatherings</b>	
Yes	68 (100)
No	0 (0)
<b>11. Health-care facility contacted when health issues arose (n=36)</b>	
Our institute	21 (58.3)
Local doctor	15 (41.7)
<b>12. Difficulty in contacting health-care provider when in need (n=44)</b>	
Yes	08 (18.2)
No	36 (81.8)
If yes, reason:	
Bad weather	01 (01.5)
Fear of contracting COVID-19	07 (10.3)
<b>13. Mode of contact (n=36)</b>	
Visit	36 (100)
Audio call	0 (0)
Video call	02 (05.6) <sup>b</sup>

Notes: <sup>a</sup>Subject does not leave the house post-lockdown. <sup>b</sup>Subjects who contacted via video call followed up with hospital visit on the doctor's advice.

## Discussion

The COVID-19 pandemic has had a telling impact on health care globally. Apart from the direct effect unleashed by the disease itself, there has been untold collateral damage specifically on the population suffering from chronic diseases. Presently, it is a known fact that comorbidities along with age are a definitive risk factor for COVID outcome. However, the impact of COVID on those with chronic respiratory comorbidities is shrouded by lack of clarity. The Global Initiative for Chronic Obstructive Lung Diseases (GOLD)<sup>5</sup> has recently recognized that COPD patients are among the worst

affected by COVID-19, but gives no mention of their infection rate. The Global Initiative for Asthma (GINA),<sup>6</sup> however, has advised asthmatics to continue regular medications and avoid nebulization. The Center for Disease Control and Prevention (CDC)<sup>7</sup> have recently noted that patients with COPD and a history of smoking are definitely at a higher risk, whereas patients with asthma might be at a higher risk for severe COVID-19 disease. Surprisingly COPD as a comorbidity has a lesser prevalence factoring in its disease burden compared to other comorbidities such as cardiovascular and systemic in those infected with COVID-19. In a systematic review by Emami et al, the incidence rate of COPD in hospitalized COVID-19 patients was only 0.95%.<sup>1</sup> A slew of theories have been proposed, ranging from protective effects of inhaled corticosteroids, a different immune response in patients with chronic respiratory diseases, underdiagnosis of COPD, to the possible benefits due to better hygiene and isolation measures.<sup>8</sup> However, emerging data reveals that mortality is much higher among COPD patients if infected with COVID-19.<sup>9</sup> A meta-analysis carried out by Zhao et al showed that the risk of severe COVID-19 in a patient with pre-existing COPD was 4-fold higher than in patients without COPD.<sup>10</sup> As per the existing data, though the mortality, severity and outcome among COPD patients when infected with COVID-19 is higher, the irony is the overall incidence rates of COPD among those infected with COVID-19 is less compared to its disease burden. A reduction in seasonal influenza due to certain community mitigation measures such as face mask wearing has led to the CDC considering that these might be useful adjuncts to influenza vaccination during influenza seasons, particularly for populations at highest risk for severe disease.<sup>11</sup>

The effect of COVID-19 and the indirect effects imposed by measures such as the lockdown, masks, hygiene, and social distancing on COPD patients has evoked interest and merits serious consideration. There has been a general perception among physicians of marked reduction in non-COVID-19 respiratory infections related exacerbations during the period of the pandemic. On the contrary, one recent study showed an increased number of community managed exacerbations in COPD attributed as due to likely behavioral changes while exacerbations requiring hospital admission showed a decline.<sup>12</sup> A meta-analysis of nine pooled studies showed a 50% reduction in admissions for COPD exacerbations during the COVID-19 pandemic period compared to pre-pandemic times, those likely to be associated with a reduction in respiratory viral infections that trigger exacerbations.<sup>13</sup> Concurrent with the available data, our observational study showed a significant reduction in exacerbation rates during the 5 months of lockdown compared to the corresponding 5-month period of the pre-pandemic year. These reductions were seen both among those with severe exacerbations requiring hospitalizations (10.3% lockdown v73.5% pre-lockdown) and in those with milder exacerbations managed on an outpatient basis (25% lockdown vs 85.3% pre-lockdown). Our study showed a significant proportion of severe COPD patients with GOLD stage 3 and 4 disease (60%) and some (10%) were on domiciliary oxygen. In spite of a subset of patients with high risk COPD in our study group, a reduction in overall exacerbation rates was a significant observation in our study.

A few extraneous factors may have possibly contributed to the marked low exacerbation rates reported during the lockdown period compared to the pre-lockdown period. These include difficulty in accessing health care and hesitancy in visiting hospitals due to the fear of contracting COVID-19. However as our patients were monitored by telephone and video-consultation services provided during this period it is unlikely that the impact of these factors are of great significance.

These unusual times have led to markedly better air quality partly on account of reduced pollution levels, decrease in the cross infections due to travel, crowd and movement restrictions imposed. It is plausible to assume that these may have contributed to reduction of exacerbation reported due to CRDs unrelated to COVID-19. Another possible explanation for reduced exacerbation rates is due to improved adherence to asthma and COPD medications by the patients as observed by the clinicians during this period of pandemic. Apprehensions over accessibility to health care and awareness among patients that optimized treatment of their lung disease lowers their risk of COVID-19 complications probably were factors leading to good adherence to prescribed medications.

Studies on adaptability, attitude and practices among COPD patients to widely imposed and practiced measures like social distancing, hygiene and face mask usage have been scarce. Our study addressing the behavioral aspects, attitude and the practices followed by the COPD patients also revealed some positive outcomes. The majority of the patients followed hand hygiene even though the methods varied. Social norms advocated during the pandemic such as physical distancing were met with good compliance. Surprisingly, as against the general perception, most of the COPD patients

were comfortable with norms of face mask usage and only a minority complained of feeling suffocated. Reassuringly, most patients felt that the mask offered them a sense of protection and well-being that resulted in better control of their baseline COPD disease state. This perhaps ensured good compliance to the usage of face masks especially in outdoor and community settings. The pandemic with the lockdown and travel restrictions also opened up new avenues in health care, in a country like India where tele-medicine and medical informatics were still in their infancy. Patients were able to access health care both virtually and physically in spite of the restrictions and few used tele-consultations too. However, the majority still preferred an in-person visit to a tele-consult.

The conclusions derived from this study are limited by a relatively small sample size. Although the dataset of 68 patients provided adequate power for statistically significant differences in exacerbation between the two groups, a multicenter study with a larger dataset is essential, to validate the results from our study. Since the quantum of stringency of lockdown and compliance to usage of masks, social distancing and hygiene is not uniform across states and countries this may have influenced our study outcome. It warrants substantiation with multicenter studies with a larger representative patient database. Another limitation was the inability to document the reduced exacerbations with supporting evidence like baseline spirometry across both groups. The effect of these mitigation measures is intertwined and assessing their individual effect is a complex exercise beyond the scope of this study. In addition, assessing the individual efficacy of different types of mask on infective exacerbations will lead to meaningful practice recommendations. The study duration of 5 months is too short for a genuine assessment of exacerbations. Since the lockdown was imposed for that period, the study was time constrained. However, since data from correspondingly similar periods were drawn for both phases of the study, the seasonal impact was somewhat nullified.

Systematic review and meta-analysis support the evidence for physical distancing and provide quantitative estimates for models. Robust randomized studies are, however, needed to gauge and substantiate the quantum of evidence for these interventions. It is rational to presume that reduced respiratory infections causing exacerbations among patients with COPD and asthmatics over the last quarter is largely attributable to the current day practices being judiciously followed with use of masks, hygiene, and physical distancing. This pandemic has led to insightful evidence as shown with the decisive results of our study justifying the effectiveness of physical distancing, the safety net provided by the use of masks, and utility of hand hygiene practices. The landmark guidelines GOLD and GINA over the years, have been silent on general and respiratory hygiene measures in patients with chronic obstructive airway diseases. They have largely overlooked the role and utility of masks in certain specific settings. Recommendation on the use of masks in specified high-risk groups like COPD and in certain settings such as mass gathering may be judicious and a productive step that might have an impact on exacerbation rates among COPD patients. It would be prudent to include these basic lifestyle modification and preventive measures among the nonpharmacological interventions for COPD and asthma.<sup>14</sup>

A study on similar lines in the UK revealed that lockdown was associated with 48% pooled reduction in emergency admissions for COPD relative to the 5-year average. However, no statistical significant change in deaths due to COPD was observed. Lockdown was also associated with 39% reduction in primary care consultations for acute exacerbation of COPD.<sup>15</sup>

Our study is one of the few studies to assess both community and hospital exacerbations during the lockdown period in compared with the same corresponding period the previous year, pre-lockdown. The study revealed a significant reduction in exacerbation rates during the period of lockdown compared to the corresponding period pre-pandemic. This reduction in exacerbation was significant as study subjects had a higher proportion of patients with moderate to severe COPD state. A reduction in exacerbation rates across the spectrum, both in patients with severe exacerbation requiring hospitalization and mild exacerbation was noticed. A novel attribute of our study was that it was conducted on stratified COPD severity groups and integrated with health approaches like adaptability, attitude and practices to the mitigation measures imposed during the lockdown. Data from the current pandemic-like findings from our study might help answer critical questions on the effect of community mitigation measures on transmission of infections and reduction in exacerbation rates in stable COPD and asthmatics. In addition, assessing acceptability, optimizing the stringency of these measures, and advocating these practices in special groups could pave the way for novel lifestyle interventions with impactful gains in COPD management.

## Declaration

Our study complies with the Declaration of Helsinki.

## Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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## Disclosure

None of the authors has anything to disclose and there is no conflict of interest in any form.

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