

Original Article

Lifestyle Changes and Exacerbation Frequency of COPD in Times of the Pandemic

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Abstract

OBJECTIVE: The objective of this study is to analyze chronic obstructive pulmonary disease exacerbation rates and the effect of patients' behavioral changes on the exacerbations during the pandemic.

MATERIAL AND METHODS: This study was conducted in a reference hospital for chest diseases and patients who were hospitalized with an exacerbation of chronic obstructive pulmonary disease between March 11, 2019, and March 11, 2020, were designated. Patients' chronic obstructive pulmonary disease exacerbations requiring emergency department visits and/or hospitalization were compared between the pre-pandemic and pandemic periods. Each patient was surveyed with 25 questions using telemedicine.

RESULTS: Of all the 256 patients, 203 (79%) were male and the mean age was 66 ± 10 years. Compared to the previous year, emergency department visits and hospitalizations in our hospital were significantly lower and less frequent ($P < .0001$, for both). Smoking habits decreased in 9% of patients, and 60% had hardly spent time outdoors. Only 3 patients reported to spend time indoors. The household mask-use rate while contacting the patient was 50%. As a chronic obstructive pulmonary disease patient, 33% expressed themselves as "feeling better." Overall, 92(36%) patients were recorded not to have any exacerbation, and 34 (13%) to have no attacks of worsening were managed at home. Novel exacerbation risk was found to independently correlate with younger age (odds ratio: 0.944, CI: 0.904-0.986, $P = .010$) and having more frequent episodes of exacerbation in the pre-pandemic period (odds ratio: 1.2, CI: 1.025-1.405, $P = .023$).

CONCLUSION: Chronic obstructive pulmonary disease patients specifically benefited from confinements, restrictions, and lifestyle changes. Further studies are needed to better identify the most critical factors leading to these positive outcomes. A permanent patient management guideline for chronic obstructive pulmonary disease patients could be formulated where the weight of lifestyle factors is elevated.

KEYWORDS: COPD, COVID-19, exacerbation, SARS-CoV-2

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a prevailing cause of mortality, constituting a leading cause of mortality, morbidity, and healthcare costs.¹ Acute exacerbation is defined as respiratory symptoms' acute deterioration signal, a worsening course of the COPD.^{2,3} Chronic obstructive pulmonary disease exacerbations are strongly related to previous and future exacerbations.⁴ An exacerbation history of 2 or more frequent episodes indicates a 6.7-fold increase of novel exacerbation risk and 7.6-fold increase in mortality.⁵

The outbreak of the novel coronavirus, severe acute respiratory syndrome coronavirus (SARS-CoV-2) was declared as a pandemic by World Health Organization (WHO) on March 11, 2020.⁶ Coronavirus disease-2019 (COVID-19) caused by the novel coronavirus raised alarming concerns for the follow-up and management of COPD patients. A non-exhaustive list of challenges and difficulties included were as follows: viral contagion risk of performing spirometer and routine follow-up and management of the patients for whom hospital visits were simply additional transmission risk.⁷ A number of studies have focused on the SARS-CoV-2 infection risk in patients with COPD or chronic respiratory diseases. The risk of being infected and suffering from a more severe course of the disease was reported to be both "increased" and "not increased".⁸⁻¹¹ Besides, hospital admissions of non-COVID diseases were another focus of interest because, during the course of the pandemic, non-COVID cases within total emergency department (ED) admissions have significantly decreased.¹² A similar declining trend was observed in COPD exacerbations.¹³⁻¹⁵ A study from China evaluating the trends of COPD patients in the period of December 2019 to March 2020 by comparing to 2016 data found that exacerbations and hospitalizations were rather rare during the pandemic.¹⁶ The influence of social distancing and community confinements on COPD patients was investigated in 153 patients and the study revealed that more than 70% of the patients have continued their pharmacological treatment without interruption and experienced less symptoms.¹⁷ In contrast, a recent

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study has reported a higher frequency of exacerbations in COPD patients within the first 6 weeks of the lockdown period, compared to the same period of the previous year.¹⁸

A group of 33 patients with frequent exacerbator phenotype of COPD and a history of hospitalization within the 8 months prior to the onset of the pandemic was investigated. No exacerbations were reported in 79% of the subjects, while of the remaining 7 patients, 3 were treated in the first step medical care and 2 in the ED to be discharged home.¹⁹ These declining trends have been attributed to various factors such as^{19,20}: changes in patients' exposure to tobacco, social isolation, prevention of infection by other viral and bacterial infectious agents due to continuous wearing of masks, and decreased outdoors pollution.²¹ The underlying reasons for changing the frequency of exacerbations have not been determined definitively.

The aim of the present study is to determine the alteration of the frequency of COPD exacerbations during the pandemic and to examine the effect of the behavioral and lifestyle changes on COPD exacerbations.

MATERIAL AND METHODS

The present study is a single-center retrospective survey study, designed and conducted in a reference center for chest diseases.

The hospital is a training and research hospital specialized in adult chest diseases and is located in the most crowded region of one of the most densely populated metropolitans. Our hospital has an ED unit served by 2 chest diseases residents and 1 specialist. During the pandemic, inpatient units were separated into COVID-19 and non-COVID clinics. Throughout the study duration, neither type of clinic experienced an over-capacity problem.

Patients hospitalized in our clinic with COPD exacerbation in the period of March 11, 2019 to March 11, 2020, were determined. Those patients who were alive on March 11, 2020, (the date when the first COVID-19 case was reported in our country), whose contact information was available, and who consented to participate in the survey, were included (Figure 1). The survival status of the patients was investigated and patients who died by the date of March 11, 2021, were

separately investigated in terms of the underlying cause of their death (Figure 1).

The study was performed in accordance with the ethical principles of the Helsinki Declaration and approved by the ethics committee of Health Sciences University, Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital (Approval No. 2021-68). The approval of the patients before the survey was obtained verbally by explaining the purpose of the study using telemedicine.

Study Design and Recorded Parameters

Patients hospitalized in our clinic between March 11, 2019, and March 11, 2020, with COPD exacerbation were selected. All patients' files were examined in order to confirm COPD diagnosis. Demographics, comorbid diseases, spirometric values of forced expiratory volume in 1% second (FEV1%) of the patients were recorded. The severity of airflow limitation was classified.²² Survival status was queried via National Death Registry System.

The patients who died after the onset of the pandemic (between March 11, 2020, and December 25, 2020) could not be questioned about their lifestyle changes and so they were excluded from the cohort. However, the underlying causes of death were also investigated to figure out whether COPD or COVID-19 was responsible for.

All patients who were alive on the date of December 25, 2020, and interviewed in-person, were included in the study. Their ED visits and hospitalizations were recorded individually for the following periods: March 11, 2019, to December 25, 2019 (pre-pandemic period) and March 11, 2020, to December 25, 2020 (pandemic period).

A comprehensive survey comprising 20 questions was conducted using telemedicine. First and foremost, patients were asked whether they and any household members were diagnosed with COVID-19. To investigate any irritant exposure at home, we learned about: the number of household members, whether any of them were going to work regularly, and whether household mask use behavior was routine while at home. In terms of lifestyle changes, we firstly queried about: the weekly frequency of walking and spending time outdoors (where "outdoors" were explained to cover areas such as parks and gardens), daily mask use habits, and the frequency of spending time indoors (where "indoors" were explained to cover non-house areas such as cafes, bars, and restaurants as well as other mass attendee places/events) (answers were selected as 0-1, 2-3 times, and ≥ 4 times). We also learned about each patient's height and weight, smoking habit status and alteration during the pandemic (as decreased/increased or same), bronchodilator use frequency, any occasion of interrupting the use of inhaler corticosteroids (ICS) including drugs and antibiotic use. Considering that the patients may have consciously avoided admission to our hospital due to perceived infection risk, we asked the patients whether they were admitted to or hospitalized in other centers with respiratory complaints. Finally, they were asked how they felt generally as a COPD patient and how they conceived their general medical condition and overall well-being.²⁸

MAIN POINTS

- During the pandemic, patients with chronic obstructive pulmonary disease (COPD) benefited in terms of exacerbations, from confinements, restrictions, and lifestyle changes.
- One-third of COPD patients expressed feeling better during the pandemic.
- Older age and less frequent exacerbation history in the previous year are the correlated factors with less frequent novel episodes of exacerbations during the pandemic.
- They hardly spent time indoors and avoided crowds, which may be another explanation for the overall decrease in exacerbation frequency.

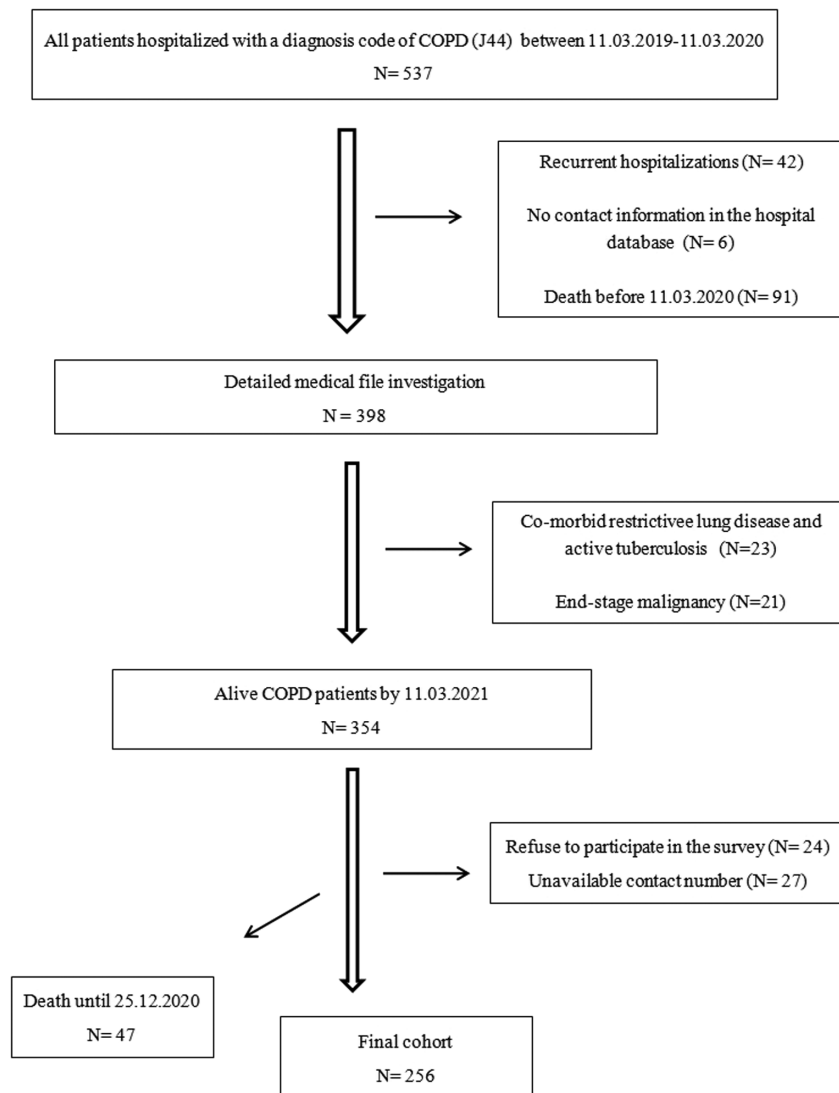


Figure 1. Flowchart of the patient inclusion.

After completing the survey, patients were grouped according to the presence of any new exacerbation requiring ED visits or hospitalization in any hospital during the pandemic. The probable reasons behind the decrease in hospital admission rates between the groups were analyzed.

Definitions

COPD exacerbation: acute deterioration of clinical symptoms such as increased cough, sputum, and sputum purulence, requiring any additional treatment.

ED visits: COPD exacerbations requiring an ED visit; the visit results in home discharge.

COPD exacerbations requiring hospitalization: acute deterioration requiring treatment and overnight; these patients are admitted to an inpatient clinic.

Previous year: as the baseline year, March 11, 2019, to March 11, 2020 (the first COVID-19 case reported from our country and the declaration of the pandemic). The study sample was selected from hospitalized patients in the previous year.

Pandemic period: the duration from March 11, 2020, until December 25, 2020.

Pre-pandemic period: in order to compare our pandemic period results and to exclude seasonal exacerbation frequency alteration, we took the previous year’s identical interval (March 11 to December 25) as the baseline period.

National COVID-19 Cases and Restrictions Imposed by the Government

The rapidly increasing number of COVID-19 cases throughout the globe and our neighboring countries has raised the consciousness of society about the importance of using protective facemasks and disinfectants. The very first case of COVID-19 was officially announced on March 11, 2020. Five days later, elementary, mid-school, and high-school face-to-face education turned into online education. On March 21, senior citizens aged over 65 were prohibited from leaving home. On March 22, circulated, flexible, and distance working modes were allowed to avoid crowded offices and thus contain the spread of the virus. On April 4, the government made wearing facemasks compulsory for attending collective

Table 1. Emergency Department Visits and Hospitalizations in Our Center During the Pandemic Compared to Previous Year

	Pre-pandemic period, March 11, 2019, to December 25, 2019	Pandemic period, March 11, 2020, to December 25, 2020	<i>P</i>
Patients with at least 1 ED visit (n, %)	224 (88)	86 (34)	<.0001
Average number of ED visits (mean \pm SD)	2.56 \pm 2.9 (0-16)	0.63 \pm 1.17 (0-9)	<.0001
Patients with at least 1 hospitalization (n, %)	198 (78)	24 (9)	<.0001
Average number of hospitalizations (mean \pm SD)	1.1 \pm 0.9 (0-5)	0.13 \pm 0.45 (0-3)	<.0001

ED, emergency department; SD, standard deviation.

gatherings and crowded areas such as supermarkets. On April 11, restrictions were intensified: total curfews/confinements were imposed on weekends and at national holidays. On May 4, restrictions started to be relaxed along with a flattened curve: for citizens aged over 65, the ban on leaving houses was lifted at certain hours of the day (4-6 hours a day). In June, restrictions were removed to a great extent until November when a series of new restrictions were re-imposed along with a progressive rise of cases.²³

Statistical Analysis

Quantitative data are expressed as mean \pm standard deviation and qualitative data are expressed as frequencies. Emergency department visits and hospitalizations between pre-pandemic and the pandemic periods were compared using the Student's *t*-test and chi-square tests. Logistic regression analysis was performed to find independent factors of hospital admissions in the pandemic period. All statistical analyses were carried out using a statistical software package (Statistical Package for Social Sciences for Windows, version 16.0; SPSS Inc.; Chicago, Ill, USA). A *P* value of <.05 was considered significant.

RESULTS

The study included 303 patients, 47 of them had died during the pandemic period and 256 of them had completed the survey. Of all the 256 patients, the mean age was 66 \pm 10 (41-89) years and 203 (79%) were male. The most frequent co-morbid diseases were hypertension (n = 91, 35%), diabetes mellitus (n = 52, 20%), congestive heart failure (n = 51, 20%), malignancy (n = 44, 17%), chronic renal failure (n = 6, 2%), and hypothyroidism (n = 6, 2%).

Compared to the pre-pandemic period, ratio of patients with any ED visit (34% vs. 88%, *P* < .0001) and the mean number of ED re-visit were lower (0.63 \pm 1.17 vs. 2.56 \pm 2.9, *p* < .0001) in the pandemic period (Table 1).

The mean BMI was 27.5 \pm 6.6 and the mean FEV1% was 44.3 \pm 12. Most of the patients (66%) were under ICS, a long-acting β_2 agonist (LABA), and a long-acting muscarinic antagonist (LAMA) treatment. In total, 24 (9.3%) patients had been treated with COVID-19 and 14 of them did not have the disease despite co-habiting with an infected household member. While contacting the patient, 33% of the households were using masks rigorously. Sixty percent of the patients had almost never had a walk-in outdoor space and only 3 patients had spent time indoors such as hospitality venues

and workplaces. While outdoors, 90% wore masks. Smoking habit decreased in 22 (9%) patients. Fifteen (6%) patients have reported less frequent ICS use for themselves, fearing the infection risk. An additional hospital ED visit was recorded in 74 (29%) patients and 35 (14%) patients had been hospitalized in a center other than ours. A closer analysis of patients who had been admitted to other hospitals revealed that 44 of the 74 patients had never been admitted to our center during this period. Out of 25 patients who had been hospitalized in other institutions, 8 were also hospitalized in our center during the course of the pandemic. Overall, 92 (36%) patients were recorded as having no exacerbations, and 34 (13%) were recorded as having symptoms of attack manageable at home (Table 2).

The correlative factors of having an exacerbation requiring an ED visit and/or hospitalization were examined. FEV1% values, airflow limitation severity class, number of households, the presence of any households working outside the home, and in-house mask use of households did not significantly alter exacerbation rates. Also, visiting outdoors, mask use when outdoors, and ICS treatment discontinuation did not correlate with exacerbations. Hospital admissions were detected to be higher in male gender (85% vs. 74%, *P* = .044), younger age (64 \pm 9.9 vs. 67 \pm 10, *P* = .031), more frequent pre-pandemic period exacerbation history (3.8 \pm 3.4 vs. 2.1 \pm 2.5, *P* < .0001), and increased smoking habit during the pandemic (4% vs. n.a., *P* = .031) (Table 3). In logistic regression analysis including gender, age, previous year's number of ED visits, and smoking habit increase, younger age (odds ratio (OR): 0.944, CI: 0.904-0.986, *P* = .010) and more frequent ED visits in the previous year (OR: 1.2 CI: 1.025-1.405, *P* = .023) were detected as independent predictors of hospital admissions in the pandemic period.

In terms of the 47 patients who died during the pandemic revealed that 46 (95%) were male and the mean age was 69 \pm 11 (46-90) years. Additional diseases were hypertension in 19 (22%), diabetes mellitus with malignancy in 18 (33%), coronary artery disease in 18 (33%), and congestive heart failure in 11 (20%) patients. Twelve of them had been diagnosed with COVID-19 and 11 of them died within 30 days and 1 of them died 4 months after the diagnosis with respiratory failure. Ten patients were transferred to the intensive care unit with non-COVID reasons (respiratory failure in 9 patients and acute renal failure in 1 patient), and 4 patients died with AECOPD and 1 with acute pulmonary embolism. Death causes of the remaining 20 patients (11 of them were under

Table 2. General Characteristics of the Patients and the Survey Results

Age (years)	66 ± 10 (41-89)	Smoking habit change	149 (58)
BMI	27.5 ± 6.6	Not smoking	80 (31)
FEV1 (%)	44.3 ± 12	Same	22 (9)
Airflow limitation severity	13 (5)	Decreased	5 (2)
GOLD 1	44 (17)	Increased	
GOLD 2	104 (41)	Frequency of bronchodilator use	169 (66)
GOLD 3	95 (37)	Same	72 (28)
GOLD 4		More frequent	15 (6)
Gender	53 (21)	Less frequent (ICS)	
Female	203 (79)	Antibiotic use	137 (53)
Male		None	89 (35)
Current use of long-acting bronchodilator	169 (66)	1-2 times	30 (11)
ICS+LABA+LAMA	44 (17)	≥3 times	
ICS+LABA	17 (7)	Any attacks of worsening symptoms	92 (36)
LABA+LAMA	26 (11)	None	34 (13)
Other		Yes, but not admitted to hospital	130 (51)
Survey questions		Admitted to hospital	
COVID-19 disease	12 (4.7)	Any hospital ED visit in another center	182 (71)
Yes, at home	12 (4.6)	None	74 (29)
Yes, hospitalized		ED	
COVID-19 disease at household except you	14 (5.4)	Any hospitalization in another center	220 (86)
Yes		No	35 (14)
Number of household members	11 (4)	Yes	
1	143 (56)	How did you feel as a COPD patient	131 (51)
2-3	81 (32)	Same as before	40 (16)
4-5	21 (8)	Worse	85 (33)
≥6		Better	
Any household working (regularly leaving home)	125 (49)	How did you feel about your general health situation	134 (52)
Yes	131 (51)	Same as before	40 (16)
No		Worse	82 (32)
Household mask use at home	84 (33)	Better	
Yes	43 (17)	Overall exacerbation rates	
Sometimes	129 (50.3)	Overall any attacks of worsening	34 (13)
Never		Yes, managed at home	130 (51)
Frequency of weekly spending time outdoors	155 (60)	Yes, admitted to hospital	92 (36)
0-1	90 (35)	No	
2-4	11 (5)	Overall: any exacerbation requiring ED visit	130 (51)
More than 4 times		Yes	126 (49)
Regular mask use while outdoors	229 (90)	No	
Yes	24 (9)	Any exacerbation requiring hospitalization	41 (16)
Sometimes	3 (1)	Yes	215 (84)
No		No	
Frequency of weekly indoor hospitality venue visits (restaurants, bars, cafes)	253 (99)	COPD, chronic obstructive pulmonary disease; ED, emergency department; FEV1, forced expiratory volume; ICS, inhaled corticosteroid; LABA, long-acting β2 agonist; LAMA, long-acting muscarinic antagonist; GOLD, global initiative for the diagnosis, management, and prevention of chronic obstructive lung disease.	
0	3 (1)		
A few times			

long-term non-invasive ventilation and/or long-term oxygen treatment) could not be identified, and the household members could not be reached by telephone.

DISCUSSION

The present study has revealed significantly less frequent ED visits and hospitalization requirements in COPD patients in

the pandemic period. Patients and household members were generally extra-careful to prevent the transmissibility of the disease. More than half of the patients limited their physical activities and time outside the home and felt uncomfortable about going outside. Almost none of them had spent time in hospitality venues such as restaurants and cafes. Exacerbation risk was found not to correlate with household contact, FEV1 values, frequency of leaving home, and mask use in open

Table 3. Comparison of the Patient Characteristics and Behaviours According to Any-Cause Hospital Admission During the Pandemic

	No Hospital Admissions (n = 126)	Any Hospital Admission (n = 130)	P
Male gender	93 (74)	110 (85)	.044
Age (years)	67 ± 10	64 ± 9.9	.031
FEV1 (%)	45.6 ± 14	42 ± 16	.324
GOLD 1	7 (54)	6 (46)	.820
GOLD 2	24 (55)	20 (45)	
GOLD 3	48 (46)	56 (54)	
GOLD 4	47 (49)	48 (51)	
BMI	27.8±6.9	26. ± 6.2	.224
Number of ED visit in 2019	2.1 ± 2.5	3.8 ± 3.4	<.0001
Household persons	3.4 ± 1.6	3.3 ± 1.8	.738
Any household member working outside home (%)	68 (54)	57 (44)	.148
Household no mask use	75 (54)	52 (40)	.147
Irregular mask use in outdoors (%)	14 (11)	13 (10)	.706
Frequent visiting of outdoors (%)	46 (37)	55 (42)	.736
Visiting indoors (%)	1 (1)	2 (1)	-
Increased smoking habit (%)	0	5 (4)	.031
Decreased ICS use (%)	8 (6)	7 (5)	.748
Feeling worse as a COPD patient (%)	18 (14)	23 (18)	.663

BMI, body mass index; COPD, chronic obstructive pulmonary disease; ED, emergency department; FEV1, forced expiratory volume; ICS, inhaler corticosteroid.

areas. The risk was found to independently correlate with younger age and more frequent episodes of exacerbation in the preceding year. This study, focusing on specifically COPD patients with a high risk of novel exacerbations, may shed light for further research to understand underlying reasons of changed exacerbation frequency during the pandemic.

During the pandemic, a number of studies have been published on the risk levels of COPD patients' SARS-CoV-2 infection. Global Initiative for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease (GOLD) reported that the risk of SARS-CoV-2 infection does not increase in COPD patients, while the risk of hospitalization requirement and severe COVID-19 disease may be higher.²⁴ In studies comprising a set of limited number of patients, total number of COPD patients among COVID-19 cases treated in hospitals were reported to be low compared to the COPD prevalence within the community.^{25,26} In the present study, 24 patients had COVID-19 and half of them were not hospitalized. Additionally, among those who died during the pandemic, 12 had COVID-19. Although the current study has not focused on the risk of infection and the outcome of these patients, we believe that strictly obeying mask use obligations and limited outdoors/indoors social activities may have contributed to relatively lower frequency of COVID-19 in COPD patients.

Exploring the influence of social distancing and community confinements on COPD patients, one study investigated 153 patients between January 25 and April 25, 2020, and concluded that 72% of the patients have continued their pharmacological treatment without interruption.¹⁷ The frequency

of the inhalers was reported to be the same in 71%, lower in 2.5%, and higher in 26%, during the lockdown period.¹⁸ In parallel, most of the patients in our cohort continued bronchodilator treatments. Most of the patients were under triple treatment with ICS, LABA, and LAMA, and only 6% of them used combinations containing ICS less frequently.

Sykes et al¹⁵ have evaluated asthma and COPD-related admissions in 2018, 2019, and 2020. Total admissions, COPD exacerbations, and the frequency of exacerbations were found to be significantly lower in 2020. An interview of 50 COPD patients revealed that 46% of the subjects reduced the amount of their daily exercise and 48% of them increased the use of reliever inhalers. Overall, 32% of the subjects reported worsening of their COPD control. Liang et al¹⁷ have reported that 76.5% of the COPD patients had less symptoms during the pandemic. Moreover, of 45 patients (29%) who described an increase in symptoms, 7 have applied to the hospital, while the rest of the patients self-managed the exacerbation. In a group of 33 frequent exacerbator phenotype of COPD, having a history of hospitalization within the 8-month period prior to the onset of pandemics, 79% reported no exacerbation. Of the remaining 7 patients, 3 were treated in the first step medical care and 2 in the ED to be shortly discharged to home.¹⁹ In our study, no general worsening of symptoms was recorded in 36% of the patients, and half of them did not require hospital admission. The discord in these proportions can be explained by the following factor: in the study by Liang et al¹⁷, exacerbation frequency in the preceding year was 16%, to begin with, whereas our study is focused specifically on patients who were hospitalized in

the pre-pandemic period. Because our study purposely covers cases with a high likelihood of exacerbation, divergence from studies with samples of a rather average risk of exacerbation is expected. Baeza-Martínez et al¹⁹ also focused on the patients with a high risk of exacerbation in parallel to our study design. On the other hand, because exacerbation risk is dependent on the duration, a 2-month-long follow-up duration may be the reason for less frequent exacerbation rates compared to our findings. Still, all the aforementioned studies have shown coherently a general decrease in exacerbation rates. In parallel, our study, with an 8-month follow-up duration, finds no exacerbation in more than one-third of the patients, and hospitalization requirements are rather low.

Rather interestingly, a recent study investigating COPD exacerbations and behavioral changes in 160 patients has signified more frequent exacerbations during the pandemic. The study compared exacerbations within the first 6 weeks of the pandemic to those in the same period of the previous year and contacted the patients by telephone calls. The authors reported that during the lockdown period, 40% of the patients underwent reduced levels of physical activity and 58% suffered from anxiety. Although the number of patients who experienced at least 1 episode of exacerbation remained stable, the total number of exacerbations was found to be higher during the lockdown compared to the same period of the previous year (126 vs. 99, $P = .026$). In contrast, total hospitalizations were lower in 2020 (5 vs. 9 times).¹⁸ In our study, 49% of the patients did not have any hospital admission. There may be a few reasons for such different results. First of all, the aforementioned study is designed to cover a very short period of 6 weeks. Second, the study has not explained how the exacerbations were managed. The authors make a comparison with the patients' exacerbation history in the previous year where the hospital admission rate had been 88% and only 9 hospitalizations had been recorded. In contrast, in our study, all patients had been hospitalized in the preceding year.

The identification of the underlying reasons for decreased rates of exacerbations carries immense potential to serve as a valuable guide in the management of these patients. The results we derived show that a higher rate of exacerbation risk is higher in younger age with more frequent ED visits in the previous year. It is obvious that the patients who experienced more frequent exacerbation in the previous year also bear the highest risk of new episode. In terms of the younger patients' higher risk, they are more vulnerable to be affected by physical activity limitations and social isolation. Additionally, muscle loss caused by immobilization is shown to be higher in younger patients.²⁷

We believe that due to the restrictions and patients' anxiety about getting infected, a change in physical contact within a family and also in physical activities would be beneficial. Since almost all patients avoided spending time in confined spaces and traveling, a strongly possible relationship may co-exist with their family avoiding indoors. However, we could not derive a statistical finding of spending time in indoor spaces since almost all our patients avoided visiting indoors. Further research in this respect is needed to enlighten the underlying reasons for decreased exacerbation rates.

In the current study, 47 patients died during the pandemic and death causes of 19 patients could not be identified. They did not have any recorded SARS-CoV-2 positivity. Still, their death causes may have been COVID-19, as well as non-COPD reasons, or COPD exacerbations while attempting to self-manage the attack at home. The study has revealed that some of the patients had been admitted to other institutions with respiratory symptoms. These patients may have simply avoided a chest diseases center admission, being anxious about amplified infection risk. Novel studies could cast light on the problem of anxiety and further explain the evolution of patient behaviors during a pandemic.

The current study has a few limitations. First, it was a single-center survey study questioning patients' behaviors retrospectively and the questionnaire employed is not a universally standardized one. Second, patients could not be evaluated with face-to-face interviews and we could not compare pre-pandemic period hospital admissions except those to our center and patients' physical and behavioral performance to that during the pandemic period. A number of COPD patients had to be excluded since they could not be reached by telephone; the number of such inaccessible patients is low though. Another limitation, of methodological nature, is that the interviewees would be motivated to over-estimate their wellness and tend to report rather desirable behavior. We, however, believe that we minimized such shortfall by pre-informing the patients about the aims of the study. Also, the subject matter of the study as well as the questions are not bias-prone, except the smoking question. Still, contacting the patients by telephone has been helpful in retrieving objective responses from the patients since distance provides a certain degree of anonymity. On the other hand, the strength of this study is that patients were selected from a reference center for chest diseases in a city whose demographics generate high work load, maximizing the probability of studying severest cases with a risk of re-exacerbation. Amidst such environment, all patient files have been carefully evaluated and followed by pulmonologists.

In conclusion, generally, ED visits and hospitalization requirements have significantly decreased in number and frequency during the pandemic period. Most patients reported to have continued their medical treatments and expressed that they generally obeyed the confinement measures set by the formal authorities. The patients themselves and their families were found to be conscientious to prevent infection according to interview results. The most relevant factors related to exacerbations are detected as younger age and previous year's more frequent exacerbation history. Although we believe that physical contact and activity patterns were important, avoiding indoor hospitality venues such as cafes and restaurants had a strikingly positive impact on decreased exacerbations. Further research with larger study samples can better explore and serve as a guide to profit from the exacerbation-lifestyle link.

Ethics Committee Approval: The study was approved by Ethics committee of Health Sciences University, Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital, (Approval No: 2021-68).

Informed Consent: Verbal informed consent was obtained from the patients who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

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