

Prevalence, Risk Factors, and Seasonal Patterns of Chronic Obstructive Pulmonary Disease in Kabul, Afghanistan: A Cross-Sectional Study

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality worldwide, with significant public health implications, particularly in low-resource settings. The purpose of this study is to assess the prevalence, demographic trends, and risk factors of COPD among patients in Kabul, Afghanistan. Cross-sectional study was done on patients admitted to the Aqsa medical Complex and Bayazi rokhan hospital, Kabul, Afghanistan. COPD diagnosis was made through chest X-rays, pulmonary function tests, and spirometry. A prevalence rate of 14.1% was identified, predominantly affecting older, married, and lower-educated women. Seasonal trends showed a peak in exacerbations during winter months, emphasizing the influence of cold weather. Non-smoking-related factors, such as passive smoking and indoor air pollution, were significant contributors, alongside comorbidities like hypertension (71.3%) and familial respiratory diseases (53.5%). These findings highlight the need for targeted public health strategies to mitigate COPD risks, focusing on environmental exposures, comorbid conditions, and improving healthcare access for vulnerable populations. In Kabul, where air pollution and urbanization exacerbate respiratory health challenges, future research should validate these findings across broader populations to enhance COPD prevention and management.

Background

Chronic Obstructive Pulmonary Disease (COPD) is a prevalent, preventable, and treatable condition characterized by persistent airflow limitation that is typically progressive and associated with an amplified chronic inflammatory response in the lungs and airways due to exposure to harmful particles or gases (1). Globally, COPD ranks among the top five leading causes of mortality and imposes a substantial health and economic burden, contributing to increased hospital admissions and work absenteeism (2, 3). In the United States alone, COPD is estimated to affect over 24 million individuals (4). While tobacco smoking and occupational exposure are the primary risk factors for COPD in high-income countries, the use of biomass fuels (such as wood, dung, crop residues, and charcoal) for cooking and domestic heating remains a major contributor to COPD and childhood respiratory infections in low- and middle-income countries. The most commonly observed symptoms of COPD include chronic cough, with or without sputum production, and breathlessness during physical exertion, the latter often prompting individuals to seek medical attention (5).

The correlation between symptoms and underlying pulmonary function abnormalities is weak. A considerable portion of ventilatory capacity is often lost before a patient seeks medical attention (6). In approximately 75% of individuals with COPD, a persistent cough either precedes or coincides with the onset of breathlessness (7). Acute exacerbation of COPD (AE-COPD) is marked by a sudden worsening of symptoms beyond the usual daily variations, requiring additional medical treatment (8). Various risk factors and contributing elements have been identified, including an altered inflammatory response to cigarette smoke in the terminal airways, heightened airway sensitivity to bronchoconstrictor agents, a family history of COPD, low socioeconomic status, respiratory infections during childhood, atopy, and exposure to occupational dust (9, 10).

Although cigarette smoking is the most extensively researched risk factor for COPD, epidemiological studies reveal that non-smokers can also develop chronic airflow obstruction (11). Some individuals experience persistent respiratory symptoms despite normal spirometry results, while a significant proportion of smokers without airflow obstruction exhibit structural lung damage, such as emphysema, thickened airway walls, and gas trapping (12, 13). While smoking cessation alleviates respiratory symptoms and decelerates lung function decline, it does not entirely eliminate the risk of progressive lung disease (14).

The prevalence, incidence, and mortality rates of COPD tend to increase with age and are generally higher in men than women, as well as in white populations compared to nonwhite groups. Additionally, COPD incidence and mortality rates are typically greater among blue-collar workers than white-collar professionals and are higher in individuals with lower levels of formal education (15, 16). The coexistence of COPD and heart failure is linked to increased morbidity, mortality, and a diminished quality of life (17). The prevalence of COPD among women differs across countries; however, most studies suggest that men and women have similar rates of the disease (18, 19).

Several studies suggest that women may be more vulnerable to lung damage than men when exposed to similar risk factors, possibly due to differences in lung size and the influence of sex hormones (20, 21). To confirm a COPD diagnosis and initiate appropriate treatment, full spirometry with bronchodilator testing is recommended (22, 23).

This study is the first comprehensive investigation into the prevalence and risk factors of Chronic Obstructive Pulmonary Disease (COPD) in Kabul, Afghanistan. Its primary objective is to assess the disease's prevalence within a specific regional framework, exploring its association with demographic variables such as age, gender, marital status, and educational background. Additionally, the study examines the impact of environmental exposures, particularly air pollution, on the development and exacerbation of COPD. By analyzing seasonal patterns and associated comorbidities, the research aims to generate valuable insights for public health strategies and healthcare planning, ultimately improving outcomes for at-risk populations in Kabul, Afghanistan.

Methodology

Study Design

This retrospective observational study was conducted to evaluate the prevalence, risk factors, and seasonal trends of COPD among patients admitted with respiratory diseases in Aqsa medical Complex and Bayazid Rokhan Teaching Hospital, Kabul.

Inclusion and exclusion Criteria

The study utilized manually recorded hospital data from the years 2022 to 2023. The study included all patients aged 40 and above who were admitted with any respiratory disease during this period. A total of 900 patient records were reviewed, including both male and female patients to ensure gender-based analysis.

Patients with incomplete or missing medical records and those diagnosed with respiratory diseases unrelated to COPD, such as tuberculosis or lung cancer, were excluded. The diagnosis of COPD was confirmed using chest X-rays to evaluate structural lung abnormalities and rule out other conditions, as well as spirometry tests to assess lung function. COPD was diagnosed based on the presence of persistent airflow limitation, defined as an FEV1/FVC ratio of less than 0.70 after bronchodilator use.

Data Collection

Data was manually extracted from hospital archives, including demographic information such as smoking, education level, marital status, comorbidities, seasonal trends categorized by winter, spring, summer, and autumn, and COPD severity classification based on spirometry results. The primary outcome of the study was to determine the prevalence of COPD among hospitalized respiratory patients, while secondary outcomes included identifying risk factors such as smoking, environmental exposure, and comorbidities, as well as analyzing seasonal trends in COPD hospitalizations.

Ethical consideration:

Ethical approval

for this study was obtained from the institutional ethics review committee of Bayazid Rokhan University, Kabul, Afghanistan (2021-ERC-06). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (25).

Statistical analysis:

Data analysis involved the use of descriptive statistics such as mean, standard deviation, and percentages to assess patient demographics. Chi-square tests were applied to determine associations between COPD prevalence and risk factors. Seasonal variation was analyzed through time-series analysis to identify peaks in COPD admissions. All statistical analyses were performed using SPSS software, version 26.

Indoor and outdoor air pollution in the Ahmad Shah Baba Mina, Kabul Afghanistan

Monthly average concentrations of key air pollutants and their associated Air Quality Index (AQI) values were retrieved from the National Environmental Protection Agency (NEPA) dataset for Solar Year 1401

(March 2022 to March 2023) as shown in Table 1.

Table 1

Monthly average levels of major ambient air pollutants and the corresponding Air Quality Index (AQI) during the Afghan calendar year 1401 (March 2022–March 2023)

Afghan Month (1401)	Approx. Gregorian Period	O ₃	NO ₂	SO ₂	CO	PM ₁₀	PM _{2.5}	AQI
Hamal	21 Mar – 20 Apr 2022	—	—	—	—	—	—	—
Sawr	21 Apr – 21 May 2022	46	79	2.6	0.9	89	44	122
Jawza	22 May – 21 Jun 2022	48	79	0.7	1.0	101	63	156
Saratan	22 Jun – 22 Jul 2022	—	—	—	—	—	—	—
Asad	23 Jul – 22 Aug 2022	32	67	1.4	1.4	67	39	110
Sunbula	23 Aug – 22 Sep 2022	36	82	1.8	1.6	84	31	92
Mizan	23 Sep – 22 Oct 2022	61	75	10	2.5	111	25	81
Aqrab	23 Oct – 21 Nov 2022	94	53	11	2.7	97	30	90
Qaws	22 Nov – 21 Dec 2022	133	34	102	5.1	166	74	164
Jaddi	22 Dec 2022–20 Jan 2023	180	29	107	6.5	198	109	189
Dalwa	21 Jan – 19 Feb 2023	180	6.7	25	5.3	172	87	173
Hoot	20 Feb – 20 Mar 2023	109	35	6.02	3.3	168	77	166

Air quality in Kabul exhibits stark seasonal fluctuations, with the winter months from October to March being the most polluted. During this period, PM_{2.5} concentrations spike dramatically due to increased burning of materials for heating, with December reaching hazardous levels of 196 µg/m³ and January following at 145 µg/m³. In contrast, the summer months, particularly June, experience significantly cleaner air, achieving WHO-recommended safe levels with readings as low as 9.6 µg/m³. This seasonal variation underscores the severe air quality challenges faced during colder months, making winter the most hazardous time for respiratory health in Kabul.

Results

A total of 900 patients diagnosed with respiratory diseases were selected for this study, covering the period from 2022 to 2023 (Table 2). Of these, 129 patients (14.1%) were confirmed to have chronic obstructive pulmonary disease (COPD) based on diagnostic criteria. The dataset comprises 129 individuals, with a notable predominance of female patients (74.4%) compared to males (25.6%). The age distribution analysis indicates that the majority of COPD cases (51.2%) were observed in the 56–70

age group, followed by 25.6% in the 71–85 age category, while only 5.4% of cases were identified in individuals aged 86 years or older.

An assessment of marital status within the study cohort revealed that 89.1% of the individuals were married, whereas 10.9% were single. Regarding educational background, 52.7% of the patients had attained primary education, 24.8% had no formal education, and 22.5% held a diploma. These sociodemographic characteristics suggest that COPD predominantly affects an older population with relatively low levels of formal education, which may have implications for disease awareness, healthcare accessibility, and overall management strategies. The findings provide valuable insights into the demographic and clinical characteristics of COPD patients within the studied population, contributing to a deeper understanding of the disease burden and its associated risk factors.

Table 2: Socio-Demographics of COPD Patients

Parameters		n	n%
Age groups	40-55	18	14.0
	56-70	66	51.2
	71- 85	33	25.6
	86-100	7	5.4
	100-140	5	3.9
	Total	129	100.0
Gender	Male	33	25.6%
	Female	96	74.4%
Education	Primary	68	52.7%
	Diploma	29	22.5%
	NO	32	24.8%
Marital Status	Single	14	10.9%
	Married	115	89.1%

n=size of population.

Smoking history analysis (figure:1) among the study participants revealed that the majority, comprising 92 individuals (71.3%), reported no history of smoking, while 37 participants (28.7%) indicated a prior history of smoking. These findings suggested that a relatively smaller proportion of the study cohort had engaged in smoking. In terms of passive smoking exposure, 60 participants (46.5%) reported a history of exposure to passive smoking, whereas 69 participants (53.5%) had no such exposure. These results indicate a near-equal distribution, with a slightly higher proportion of individuals reporting no history of passive smoking exposure. Overall, the findings highlight a higher prevalence of non-smoking individuals within the sample, both in terms of active smoking and passive exposure. This distribution suggested

that factors beyond direct tobacco use, such as environmental and occupational exposures, may contribute to the burden of COPD within the studied population.

Table 3
Prevalence and Percentages of Comorbidities

Factors	Response	n	n %
Family History of Respiratory Diseases	Yes	69	53.5%
	NO	60	46.5%
Hypertension	Yes	92	71.3%
	NO	37	28.7%
Diabetes mellitus	Yes	29	22.5%
	NO	100	77.5%
Cerebrovascular accidents	Yes	8	6.2%
	NO	121	93.8%
Heart failure	Yes	7	5.4%
	NO	122	94.6%

However, significant associations were observed between several demographic factors (Table 3) and clinical outcomes. Gender showed a strong relationship with smoking history ($\chi^2 = 61.207, p < 0.001$), with a markedly higher prevalence among males, reflecting socially patterned tobacco use in the study setting. In contrast, females demonstrated greater exposure to passive smoking ($\chi^2 = 4.683, p = 0.030$), likely due to household exposure to indoor smoking, highlighting the role of secondhand smoke as an important gender-specific risk factor (Tables 4 and 5).

Gender was also significantly associated with cerebrovascular accidents ($\chi^2 = 6.106, p = 0.013$) and heart failure ($\chi^2 = 3.873, p = 0.049$), with both conditions occurring more frequently in males. (Tables 6 and 7) These patterns are likely driven by a higher burden of modifiable risk factors in men, including smoking, hypertension, and occupational stress, suggesting a need for targeted cardiovascular risk reduction strategies in this group.

Age demonstrated a significant association with heart failure ($\chi^2 = 14.514, p = 0.006$), with increasing prevalence observed in older age groups. This finding reflects the cumulative impact of aging and long-term exposure to comorbid conditions such as hypertension and diabetes, emphasizing the importance of routine cardiovascular monitoring in elderly populations (Table 8).

Marital status was significantly associated with smoking behavior ($\chi^2 = 9.732, p = 0.002$), with higher prevalence observed among married individuals. This may reflect psychosocial stressors and lifestyle

pressures associated with family responsibilities. Additionally, a strong association was found between marital status and cerebrovascular accidents ($\chi^2 = 13.510, p < 0.001$), suggesting that married individuals may carry a higher cumulative burden of cardiovascular risk, potentially related to age and associated comorbidities. (Tables 9 and 10).

Table 4
Association between Gender and History of Smoking

Variable	Yes	No	Total	χ^2 (df)	p-value
Male	27	6	33		
Female	10	86	96		
Total	37	92	129		
Pearson Chi-Square				61.207 (1)	0.000

Table 5
Association between Gender and Passive Smoking

Variable	Yes	No	Total	χ^2 (df)	p-value
Male	10	23	33		
Female	50	46	96		
Total	60	69	129		
Pearson Chi-Square				4.683 (1)	0.030

Table 6
Association between Gender and Cerebrovascular Accident (CVA)

Variable	Yes	No	Total	χ^2 (df)	p-value
Male	5	28	33		
Female	3	93	96		
Total	8	121	129		
Pearson Chi-Square				6.106 (1)	0.013

Table 7
Association between Gender and Heart Failure (HF)

Variable	Yes	No	Total	χ^2 (df)	p-value
Male	4	29	33		
Female	3	93	96		
Total	7	122	129		
Pearson Chi-Square				3.873 (1)	0.049

Table 8
Association between Age and Heart Failure (HF)

Variable	Yes	No	Total	χ^2 (df)	p-value
40–55	0	18	18		
56–70	2	64	66		
71–85	2	31	33		
86–100	1	6	7		
100–140	2	3	5		
Total	7	122	129		
Pearson Chi-Square				14.514 (4)	0.006

Table 9
Association between Marital Status and Smoking History

Variable	Yes	No	Total	χ^2 (df)	p-value
Single	9	5	14		
Married	28	87	115		
Total	37	92	129		
Pearson Chi-Square				9.732 (1)	0.002

Table 10
Association between Marital Status and Cerebrovascular Accident (CVA)

Variable	Yes	No	Total	χ^2 (df)	p-value
Single	4	10	14		
Married	4	111	115		
Total	8	121	129		
Pearson Chi-Square				13.510 (1)	0.000

The seasonal variation in COPD exacerbations is evident, with the highest frequency occurring during the winter months (Figure: 2). The peak incidence was observed in January, accounting for 18.6% of cases, followed by December with 15.5% and February with 13.2%. In contrast, a significant decline was noted during the spring, with exacerbations decreasing to 5.4% in March and reaching the lowest level at 3.1% in April. During the summer and early fall, the proportion of exacerbations remained relatively stable, ranging between 7.0% and 7.8% from May to July. The fall months, including September, October, and November, exhibited moderate fluctuations, with cases ranging from 4.7% to 6.2%. These findings suggested a pronounced seasonal trend, with exacerbations peaking in colder months and declining significantly in the spring. This pattern highlights the potential impact of environmental and climatic factors, such as temperature fluctuations, air pollution, and increased respiratory infections, on COPD exacerbation rates.

Discussion

The global prevalence of chronic obstructive pulmonary disease continues to rise, with the World Health Organization (WHO) identifying it as a leading cause of mortality worldwide. The disease imposes a substantial burden on healthcare systems due to its chronic nature, high treatment costs, and significant impact on patients' quality of life. This burden is particularly pronounced in developing countries, where healthcare infrastructure may be inadequate, and exposure to major risk factors, including tobacco smoke and air pollution, remains widespread (24). Effective prevention and management strategies are crucial to addressing the growing impact of COPD, particularly in resource-limited settings.

This study provides valuable epidemiological insights into COPD by examining its prevalence, demographic distribution, and associated risk factors among patients admitted to Aqsa Medical Complex and Bayazi Rokhan Hospital between 2022 and 2023. The findings highlight the characteristics of a patient population primarily composed of older adults with relatively low educational attainment, the majority of whom were married females. These demographic patterns are consistent with existing literature on COPD but also emphasize region-specific variations that warrant further exploration.

The study found a COPD prevalence of 14.1% among hospitalized respiratory patients, aligning with global estimates reported by Adeloye (25), who emphasized the significant burden of COPD in low- and

middle-income countries. Notably, the predominance of female patients (74.4%) contrasts with global trends, where COPD has historically been more prevalent in males due to higher smoking rates (26). This shift may reflect the increasing exposure of women to indoor pollutants, such as biomass fuel combustion, which has been widely recognized as a major COPD risk factor in developing nations (27). These findings suggest that COPD prevention efforts should extend beyond tobacco control to address environmental exposures that disproportionately affect women.

Age-related trends in COPD prevalence were also observed, with the highest incidence (51.2%) occurring in individuals aged 56–70 years. This is consistent with evidence indicating that COPD risk increases with age due to cumulative exposure to environmental risk factors and the progressive decline in lung function (28). These findings underscore the importance of early screening and intervention strategies tailored to aging populations, particularly in high-risk groups.

A particularly significant finding of this study is that the majority of COPD patients (71.3%) reported no history of smoking, suggesting the presence of additional risk factors contributing to disease development. Passive smoking exposure was reported by 46.5% of participants, reinforcing its role as a significant contributor to COPD, particularly among non-smokers (29). Additionally, growing evidence suggests that factors such as indoor air pollution and occupational exposures play a crucial role in increasing COPD risk in non-smoking populations (30). These findings emphasize the need for comprehensive COPD prevention strategies that address both smoking and non-smoking-related risk factors.

The study also identified seasonal variations in COPD exacerbations, with the highest frequency observed in the winter months, particularly in January (18.6%) and December (15.5%). This pattern aligns with findings by Donaldson et al. (31), who reported an increased frequency of exacerbations during colder months, likely due to higher exposure to respiratory infections and environmental stressors. These results highlight the necessity of seasonal intervention strategies, including vaccination programs, enhanced respiratory care, and increased healthcare resource allocation during high-risk periods (32).

In terms of comorbidities, hypertension (71.3%) and a family history of respiratory diseases (53.5%) were the most prevalent conditions among the study population. These findings align with the work of Vanfleteren et al. (33), which identified cardiovascular diseases as frequent comorbidities in COPD patients. Other conditions, including diabetes mellitus (22.5%), cerebrovascular accidents (6.2%), and heart failure (5.4%), were also present, reinforcing the importance of integrated disease management. The well-documented association between COPD and hypertension may be attributed to shared inflammatory pathways and hemodynamic changes that exacerbate both conditions (34). Similarly, a familial history of respiratory diseases may suggest genetic predisposition or shared environmental exposures contributing to disease development.

Furthermore, the study found that 52.7% of participants had only primary education, while 24.8% had no formal education. Lower educational attainment has been linked to delayed diagnosis, poorer disease management, and higher COPD-related mortality (35). These findings highlight the importance of

community-based educational initiatives aimed at raising awareness of COPD risk factors, early symptoms, and management strategies, particularly in underserved populations with limited access to healthcare information.

Overall, this study underscores the multifactorial nature of COPD and the need for comprehensive public health interventions that address both traditional and non-traditional risk factors. The observed seasonal trends in exacerbations suggest the importance of proactive resource allocation during winter months, while the high prevalence of comorbidities emphasizes the necessity of integrated care models. Future research should further explore the role of indoor air pollution and occupational exposures in COPD development, particularly among women, to better understand and address gender disparities in disease prevalence.

Conclusions

The findings of this study provide valuable insights into the epidemiology of COPD within a regional context, highlighting key demographic and clinical patterns. The results indicate that COPD primarily affects older, married, and lower-educated individuals, with a higher prevalence among women, likely due to increased exposure to indoor air pollution and passive smoking. The observed seasonal trend, with exacerbations peaking in colder months, underscores the need for targeted preventive measures, such as vaccination programs and enhanced respiratory care during high-risk periods. The high prevalence of comorbidities, particularly hypertension and familial respiratory diseases, further reinforces the necessity of an integrated healthcare approach.

The study also emphasizes the significant contribution of non-smoking-related risk factors to COPD development, particularly in regions like Kabul, where exposure to biomass fuel combustion and poor air quality remains a public health concern. Addressing these challenges requires a multifaceted approach, including increased public awareness, improved access to healthcare services, and policy interventions aimed at reducing environmental risk factors. Given the ongoing urbanization and deteriorating air quality in Kabul, future research should expand to both urban and rural populations to validate these findings and explore gender-specific differences in COPD prevalence and disease progression. By bridging these knowledge gaps, healthcare policymakers can develop targeted, culturally relevant strategies to enhance prevention, early diagnosis, and treatment, ultimately improving patient outcomes in Afghanistan and similar settings.

Abbreviations

COPD

Chronic Obstructive Pulmonary Disease

FEV1

Forced Expiratory Volume in 1 second

FVC

Forced Vital Capacity

NEPA

National Environmental Protection Agency

AQI

Air Quality Index

PM_{2.5}

. Fine particulate matter with a diameter of $\leq 2.5 \mu\text{m}$

PM₁₀

Particulate matter with an aerodynamic diameter of $\leq 10 \mu\text{m}$

O₃

Ozone

NO

Nitrogen dioxide

SO₂

Sulfur dioxide

CO

Carbon monoxide

WHO

World health organization

Declarations

Ethical approval

Ethical approval for this study was obtained from the institutional ethics review committee of Bayazid Rokhan University, Kabul, Afghanistan (2024-ERC-06). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Consent to participate

Not applicable.

Consent for Publication

Not applicable.

Availability of data and materials

The datasets generated during the current study are not publicly available due patient confidentiality and privacy reasons but are available from the corresponding author on reasonable request.

Competing Interests

The authors declare no competing interests.

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Clinical Trial Number

Not applicable.

Authors' contributions

IS conceptualized the main theme of the study and was responsible for data collection. WUH contributed to the literature review, developed the methodology, performed data analysis, and prepared the final manuscript write-up. KN contributed to the literature review and critically reviewed and proofread the final manuscript. SY performed the statistical analysis and contributed to the interpretation of the statistical findings. All authors read and approved the final manuscript.

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Figures

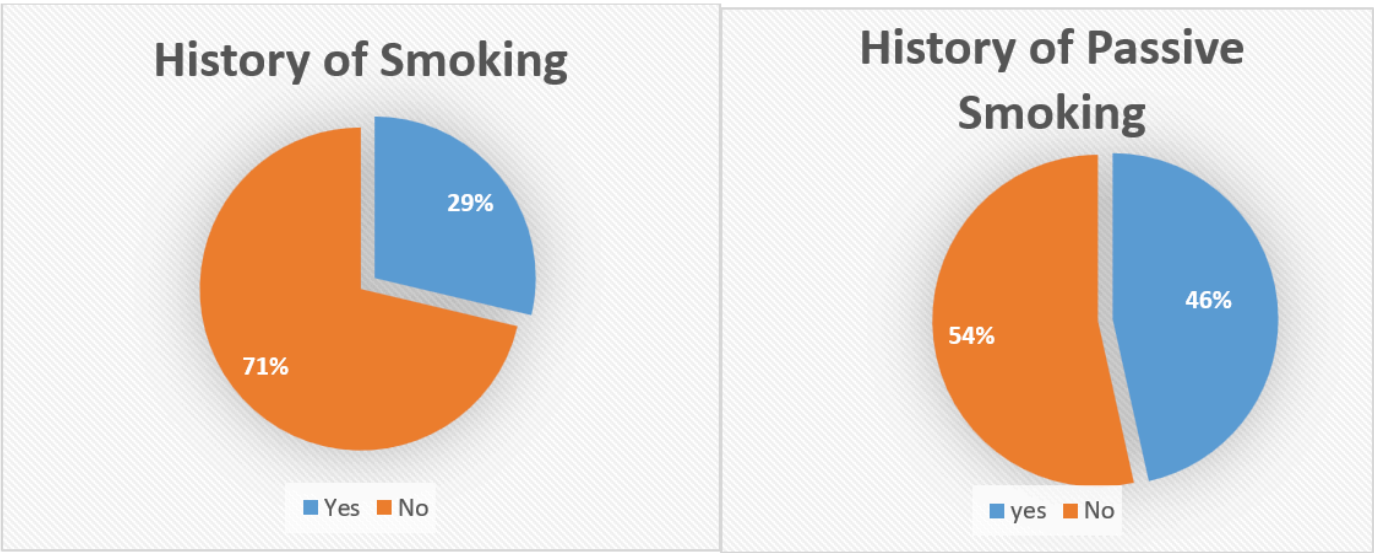


Figure 1

History of Smoking and Passive Smoking

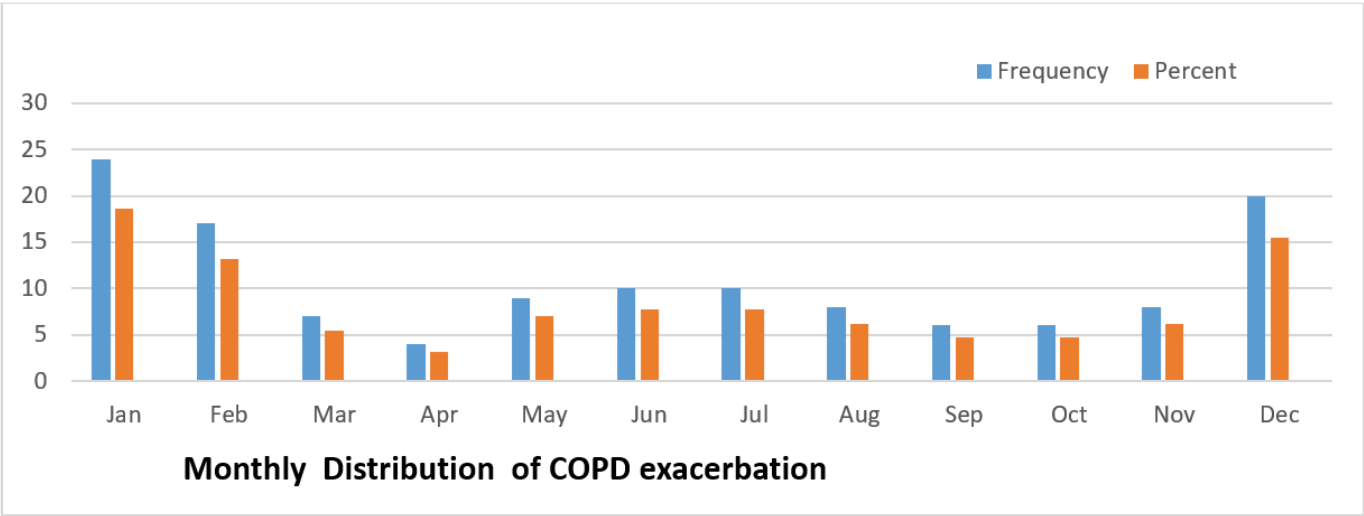


Figure 2

Monthly Distribution of COPD Patients