ORIGINAL ARTICLE

# Gender-Age Association in Chronic Obstructive Pulmonary Disease (COPD): A Retrospective Cohort Study.

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**Abstract**

Chronic obstructive pulmonary disease (COPD) is a significant global public health concern, also prevalent in Malaysia, contributing substantially to morbidity and mortality. The objective is to investigate COPD's prevalence while exploring its correlation with gender and age groups. A retrospective cohort investigation encompassed patients undergoing PA chest x-rays for suspected COPD at Damai Service Hospital (DSH) HQ in Kuala Lumpur from January 1, 2020, to December 31, 2021. Patient data, drawn from the 2020-2021 patient records, included 120 individuals with suspected COPD. These subjects were categorized by gender (male and female) and age groups (0-20, 21-40, 41-60, 61-80, and 81-100 years). Retrieval of confirmed COPD cases relied on the Radiology Information System (RIS), yielding 63 patients. Males constituted 66.7% of the 63 confirmed COPD cases, while females comprised 33.3%. COPD prevalence was highest in the 41-60 age group (52.3%), followed by 30.1% in the 61-80 age group, 12.6% in the 21-40 age group, and 4.8% in the 81-100 age group; no cases appeared in the 1-20 age group. Notably, males aged 41-60 exhibited elevated COPD susceptibility. The study demonstrates a gender-age association in COPD patients, emphasizing males' heightened risk within the 41-60 age. The prevalence of COPD diagnosed from chest X-rays between 2020 and 2021 is 51.7%, predominantly among males (71.4%) and the 41-60 age group (52.3%). Notably, gender and age showed significant associations with COPD ($p < 0.004$, $p < 0.047$), highlighting crucial demographic factors.

**Keywords:** *age, association, COPD, gender, prevalence.*

## Introduction

Chronic obstructive pulmonary disease (COPD) exhibits a global prevalence, with extensive studies conducted across diverse nations and regions. However, the accuracy of COPD prevalence estimation remains uncertain due to variations in detection methods and criteria. The burden of COPD is notably substantial in Asia, surpassing that of developed Western countries, resulting in increasing mortality and disease-related disability [1].

COPD's prevalence displays notable disparities among countries. An Ethiopian study showcased elevated COPD prevalence, attributing factors like advanced age, smoking, biomass smoke exposure, and inadequate kitchen ventilation to its development [2]. Similarly, a meta-analysis integrating findings from 62 publications across 28 countries (1990-2004) revealed pooled COPD prevalence rates of 6.4%, 1.8%, and 9.2% for chronic bronchitis, emphysema, and airflow obstruction, respectively [3]. The American Lung Association (2018) [4] reported 16.4 million individuals (6.6% of adults) diagnosed with COPD, encompassing chronic bronchitis and emphysema.

While traditionally linked with the elderly, COPD diagnosis typically occurs post-45 years of age. Previously considered a predominantly male ailment, COPD's landscape has evolved, witnessing increased incidence among women. Over the last two decades, the prevalence, morbidity, and mortality of COPD in women have considerably risen [5]. However, COPD research in Malaysia remains limited, with inadequate public awareness. A study on COPD prevalence and its associated risk factors within a suburban Malaysian population, revealing a low COPD prevalence in Penang [6].

Therefore, this study aims to determine COPD's prevalence while exploring its correlation with gender and age.

## Methods

This study employed a retrospective design to gather data from the Radiology Information System (RIS). The investigation centred on patient information, specifically gender and age, and was conducted at the Radiology Department of Damai Service Hospital HQ in Kuala Lumpur. The study population included patients who had undergone a PA chest X-ray for suspected COPD, which includes chronic bronchitis and emphysema, between January 2020 to December 2021. Patients who were suspected of other diseases those who had undergone other chest projections, and cases with incomplete information were excluded from this study. Only patients who were diagnosed with COPD, based on radiologist reports were included in the final analysis. Patient information was subsequently categorized by gender (male and female) and age groups (0-20, 21-40, 41-60, 61-80, and 81-100 years old).

*Sample size calculation*
Sample size calculation relied on prior research, specifically the COPD prevalence of 6.2% reported in the study by Lim et al. (2015) [7]. Using a single proportion formula and considering a significance level of 5% and an absolute precision of ± 5%, the estimated sample size was 90 patients. Adjusting for a response rate of 75%, the required data collection sample was 120 patients suspected of COPD.

*Data analysis*
Data analysis was conducted using Microsoft Excel 2019 and IBM SPSS Statistics 21. Descriptive statistics were used to characterize demographic variables and established COPD prevalence percentages. COPD prevalence (%) was derived by dividing the number of confirmed cases by total number of suspected patients within the study's timeframe. Age and gender-related COPD prevalence (%) was calculated based on confirmed cases. Additionally, the Pearson chi-square test was conducted to assess the

associations between gender and age, in COPD patients. The odds ratio (OR) and 95% confidence intervals (CI) were presented as the measure of the strength of association and a p-value of less than 0.05 (p<0.05) was considered statistically significant.

## Results

*Patient Selection and Prevalence Analysis*
All patient data suspected with chronic obstructive pulmonary disease (COPD) between January 2020 and December 2021 were identified. A total of 120 patients, comprising both COPD and non-COPD cases, were selected for further analysis.

*Prevalence of COPD*
Among the 120 suspected COPD patients, 63 patients (51.7%) were confirmed to have COPD. The prevalence of COPD was calculated for each year. In 2021, there were 35 (55.6%) COPD cases, with 25 (71.4%) being males and 10 (28.6%) being females. In 2020, there were 28 cases (44.4%), including 17 (60.7%) males and 11 (39.3%) females. Figure 1 illustrates gender distribution over the two years.

*Prevalence of COPD in Relation to Gender*
In terms of gender, among the 63 confirmed COPD cases, 42 patients (66.7%) were males, and 21 patients (33.3%) were females, as depicted in Figure 2.

*Prevalence of COPD in Relation to Age Group*
Categorizing subjects into age groups, the mean age was 51.4, with a median age 51. The minimum age observed was 18, and the maximum age reached 92. The highest number of COPD cases occurred in the 41-60 age group, with 33 cases (52.3%). This was followed by 19 cases (30.1%) in the 61-80 age group, 8 cases (12.6%) in the 21-40 group, and 3 cases (4.8%) in the 81-100 group. No cases were found in the 1-20 age group, as summarized in Figure 3. Figure

3 also outlines gender distribution in relation to age groups.

*Association between gender and COPD*
Table 2 presents the distribution of genders among COPD and non-COPD patients. Pearson chi-square test revealed a p-value of <0.004 (Table 3), signifying an association between gender and COPD. A higher proportion of males were diagnosed with COPD compared to females. The 95% confident odds ratio for age groups ranged from 0.161 to 0.712 (Table 2).

*Association between age and COPD*
Table 3 displays the distribution of age groups among COPD and non-COPD patients. The Pearson chi-square test yielded a p-value indicating a significant difference between age groups and COPD. There is a significant difference between age groups and COPD (p-value <0.047). The proportion of patients diagnosed with COPD is higher in the older age group compared to the younger group. 95% confident odds ratio for the age group is not less than 0.988 and not more than 7.975.

## Discussion

*COPD Prevalence and Demographic Factors*
COPD remains a significant contributor to global morbidity and mortality, with an escalating incidence projected [8]. In Malaysia, COPD ranked as the seventh leading cause of mortality in 2010 [6]. The World Health Organization (WHO) highlighted COPD as the third leading cause of global death, responsible for 3.23 million deaths in 2019. This study observed a slight increase in COPD cases from 2020 to 2021.

*Gender-Related Findings*
Gender-based COPD prevalence varies across studies, with some favouring males and others favouring females. Swedish research demonstrated equal prevalence in both genders [9]. Our study revealed a higher prevalence among males within each group. A notable

association between COPD and gender emerged [95% CI 0.161 (0.161, 0.712), p=0.004], with males being more affected. This aligns with existing literature [8, 10, 13, 14].

Smoking plays a pivotal role in COPD prevalence among males, linked to high male smoking rates. Rotterdam study data reinforced higher COPD incidence in males and smokers [15]. Zhang et al. (2021) [10] noted that nearly 87% of male COPD patients were current or former smokers, compared to less than 17% of females. Environmental factors, anatomical differences, hormonal disparities, and treatment responses may also influence gender-based prevalence [11].

*Age-Related Patterns*
In our study, the 41-60 age group exhibited the highest COPD prevalence, followed by the 61-80 group. A significant association between age groups and COPD emerged [95% CI 2.81 (0.988, 7.975), p=0.047], indicating a higher COPD proportion among older individuals. This aligns with the previous study [10, 15], where COPD incidence increased with age. Age-related respiratory system changes, weakening functional resistance, progressive lung function decline, and delayed COPD recognition contribute to this pattern.

*Age Extremes and COPD Prevalence*
Interestingly, COPD prevalence diminished beyond 80 years old. A similar trend was reported in the previous study [16]. Healthy Survivor Effect theories attribute this to COPD patients not reaching age 80 due to their condition. This discrepancy underscores the intricate interplay of age, COPD, and survival.

*Implications and Future Directions*
While our study concentrated on gender and age, future research should include significant external COPD factors like smoking, air pollution exposure, occupational hazards, and respiratory infections. Longer exposure durations increase COPD risk, especially among those with an asthma history. Broader geographical representation and larger samples are pivotal for accurate Malaysian COPD prevalence estimations. Geographical and center-specific factors are vital in comprehending COPD patterns and risk factors in Malaysia.

## Conclusion

In summary, our study explored COPD prevalence and its links with gender and age. Among 120 suspected cases, 63 were confirmed, yielding a 51.7% prevalence. Notably, 2021 saw a 55.6% prevalence, predominantly among males (71.4%). The 41-60 age group had the highest prevalence (52.3%). Significant associations were found between gender and COPD (p < 0.004), and age groups and COPD (p < 0.047). Males displayed greater vulnerability, and older age groups had higher COPD likelihood. These findings contribute insights into COPD's demographic aspects, suggesting potential areas for further investigation and disease management strategies.

## Conflict of interest

The authors have no conflict of interest to declare.

## Ethical statement

This study was approved by Research and Human Ethics Committee of Unisza (UHREC: UniSZA / UHREC / 2021 / 302) and Damai Service Hospital (DSH) HQ.
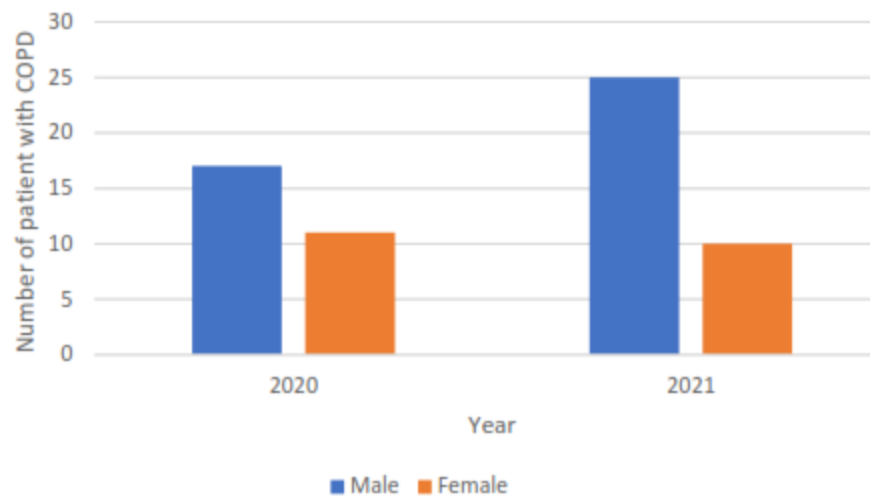
## Acknowledgement

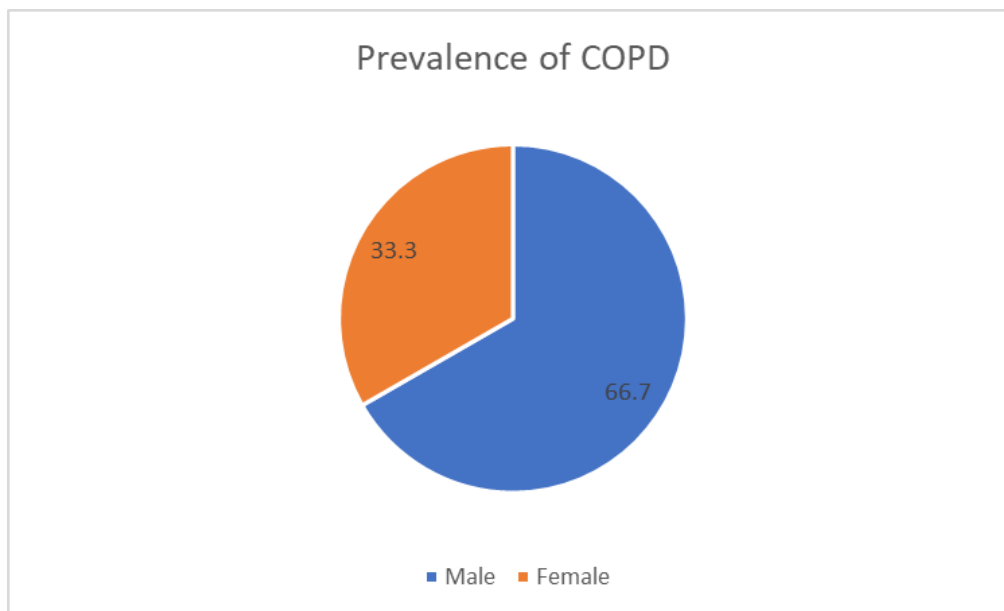Figure 1. The distribution of male and female based on range of year.



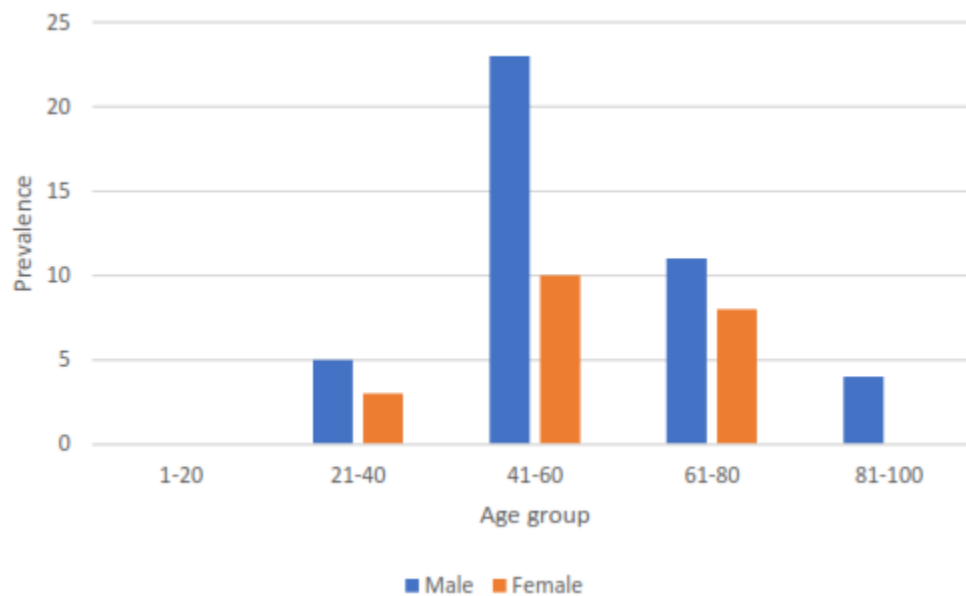Figure 2. The percentages of male and female on confirmed COPD

Figure 3. The differences between male and female based on age group.

Table 1. The frequencies and percentages of age groups and gender among confirmed COPD patients.

|  | *Number of patients (n)* | *Percentages (%)* |
|---|---|---|
| **Gender** |  |  |
| Male | 43 | 66.7 |
| Female | 21 | 33.3 |
|  |  |  |
| **Age group (years)** |  |  |
| 01-20 | 0 | NA |
| 21-40 | 8 | 12.6 |
| 41-60 | 33 | 52.3 |
| 61-80 | 19 | 30.1 |
| 81-100 | 3 | 4.8 |

Table 2. The association between COPD and gender (n=120)

| Gender | COPD n (%) | | OR (95% Cl) | p-value |
|--------|-----------|---------|-------------|---------|
| | Absent | Present | | |
| Male | 23 | 42 | 0.34 (0.161,0.712) | <0.004 |
| Female | 34 | 21 | | |

Table 3. Pearson chi-square test to assess the association between age and COPD.

| Age group (years) | COPD n (%) | | OR (95% Cl) | p-value |
|-------------------|-----------|---------|-------------|---------|
| | Absent | Present | | |
| <40 | 13 | 6 | 2.81 (0.988,7.975) | <0.047 |
| ≥40 | 44 | 57 | | |

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