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# Prevalence of Chronic Obstructive Pulmonary Disease and Associated Comorbidities in Urban West Bengal

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## ABSTRACT

Chronic obstructive pulmonary disease is a preventable and treatable disease with some significant extra-pulmonary effects that may contribute to the severity in an individual patient. The prevalence of COPD in the general population across all ages rises steeply to above 10% amongst people who are aged over 40 years. A population-based cross-sectional survey of the prevalence of COPD in urban West Bengal was carried out and the spirometry testing was performed according to the guidelines prescribed in American Thoracic Society (ATS) and ERS guidelines. Overall, 18.5% of study participants had evidence of GOLD stage 1 or higher COPD. Hypertension was the most common comorbidity prevalent both in normal individuals and in subjects with COPD, followed by osteoporosis.

***Key words:*** Chronic obstructive Pulmonary Disease, prevalence, risk factors

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality across the globe. No other disease that is responsible for comparable burden worldwide is neglected by healthcare providers as much as COPD [1,2]. Chronic Obstructive Pulmonary Disease (COPD) was the sixth-most common cause of death worldwide in 1990, but is projected to become the third-most common cause by the year 2030 [3]; it is already ranked fourth in developed countries [4-7].

Most of the information available on COPD prevalence, morbidity and mortality comes from high-income countries. Even in those countries, accurate epidemiologic data on COPD are difficult and expensive to collect. However, it is known that low and middle income countries already shoulder much of the burden of COPD with almost 90% of COPD deaths taking place in these countries. [8,9]

COPD prevalence across the world varies considerably, due to differences in methodologies, sampling and diagnostic criteria for COPD, and also to differences in patterns of cigarette smoking. Recent population-based surveys of chronic obstructive pulmonary disease (COPD) prevalence carried out in many countries have confirmed the long-held view that COPD is under diagnosed and undertreated. [10,11] The prevalence of COPD in the general population across all ages rises steeply to above 10% amongst people who are aged over 40[4].

Few epidemiological studies have addressed the prevalence of COPD in West Bengal. The reported prevalence estimates have ranged in males as the chronic bronchitis prevalence of 7.68% in a rural community in individuals above 50 years of age [12] and 5.7% in the urban population of above 30 years of age [13]. These studies are

old and have used unvalidated questionnaire based data, supplemented on occasion by measurement of peak flows. The latest available data from West Bengal revealed that estimated population prevalence of COPD GOLD stage 1 or above by age and sex in Kolkata is 19.3% overall with prevalence in males as 23.7% as against females where in it was 14.5% [14]. Accurate prevalence studies are needed to guide future projections of the burden of this disease in each country, and to assist public health officials in the planning to meet the growing demand for health care resources [10].

The aim of our study was to estimate the prevalence of COPD based on a representative sample of non institutionalized adults/ general population aged 40 years and over, carried out in Kolkata city of West Bengal and to assess the prevalence of co morbidities in COPD patients. To achieve both maximum accuracy and completeness of the survey as well as high-quality postbronchodilator spirometry, the Burden of Obstructive Lung Disease (BOLD) protocol and study design were implemented [15].

## MATERIALS AND METHODS

### Study population

It was a population-based cross-sectional survey of the prevalence of COPD in West Bengal. A cross section of population from one of the Ward of Kolkata city has been taken as an area of sampling. A sample size of 400 subjects was taken from three different electoral wards based on random table method. Door to door survey was conducted for each area. All participants gave a written informed consent to participate in the study. The study was approved by the medical ethical committee of Nil Ritan Sircar Medical College and Hospital Kolkata.

### Spirometry

The spirometer used during the study was NDD EasyOne spirometer made by NDD Medizintechnik AG, Zurich, Switzerland. The spirometer fulfilled ATS and ERS criteria for accuracy and precision. The spirometry testing was performed according to the guidelines prescribed in American Thoracic Society (ATS) and ERS guidelines. A maximum forced exhalation was carried out for a minimum of 6 seconds, while the subjects were in a sitting position. Testing was repeated until a minimum of three acceptable flow volume loops with a FEV1 and FVC within 5% were obtained. After at least 3 acceptable and 2 reproducible maneuvers, two puffs (200 µg) of salbutamol from a metered dose inhaler through a spacer were administered to the participant. Post-bronchodilator test was done after 15 minutes using the same criteria of at least 3 acceptable and 2 reproducible maneuvers. Patients were diagnosed and categorised as per standard GOLD guidelines.

To assess the prevalence of co morbidities in COPD patients, we included in the analysis participants' responses to the questions "Has a doctor or other health-care provider ever told you that you have heart disease; diabetes; hypertension; asthma; chronic bronchitis; emphysema; COPD?" or physician documented proof of various medical disorders. We used the height and weight to calculate the body mass index (BMI). Finally, we classified subjects as current smokers, former smokers, or never-smokers based on self reported history.

## RESULTS

A total of 487 subjects selected for recruitment signed the informed consent. Acceptable postbronchodilator spirometry and full data were collected from 400 participants (212 male and 188 female subjects with a male to female ratio of 1.12), which comprised the final study population. Mean age of the studied population was 51.64±9.84 yrs which was comparable in males (51.9±9.4 yrs) and females (50.6±9.09 yrs). Most (61.7%) of the subjects in our studied population belonged to the age group of 40 to 50 years.

Overall, 18.5% of study participants had evidence of GOLD stage 1 or higher COPD (Table 1). As would be expected, the prevalence was higher among older subjects, current or former smokers. The proportion of men and women with obstruction was similar (17.9% vs 19.1%). With the exception of underweight subjects where 5 out of 9(55.5%) had COPD, the general trend appeared to be an increase in prevalence of COPD with an increase in BMI.

According to the severity criteria of GOLD, the prevalence of stage I (mild), stage II (moderate), stage III (severe), and stage IV (very severe) COPD was 1%, 9.2%, 4.7%, and 3.5%, respectively. Later stages of COPD were more frequent in higher age groups.

**Table 1:** ***Characteristics of study population and distribution of respiratory impairment by age, sex, smoking and BMI***

| Characteristics | Number of subjects | Percentage (%) | COPD FEV1<.7 | GOLD Stage 1 | GOLD Stage 2 | GOLD Stage 3 | GOLD Stage 4 |
|---|---|---|---|---|---|---|---|
| **Age group in yrs** | | | | | | | |
| 40 to 50 | 249 | 61.7 | 25(10) | 1(0.4) | 17(6.8) | 3(1.2) | 4(1.6) |
| 51 to 60 | 79 | 19.7 | 15(19) | 1(1.3) | 8(10.1) | 4(5.1) | 2(2.5) |
| 61 to 70 | 52 | 13 | 23(44.2) | 2(3.8) | 8(15.4) | 8(15.4) | 5(9.6) |
| >70 | 20 | 5 | 11(55) | 0 | 4(20) | 4(20) | 3(15) |
| **Sex** | | | | | | | |
| Male | 212 | 52.9 | 38(17.9) | 3(1.4) | 17(8) | 10(4.7) | 8(3.8) |
| Female | 188 | 47.1 | 36(19.1) | 1(0.5) | 20(10.6) | 9(4.8) | 6(3.2) |
| **Smoking status** | | | | | | | |
| Current | 49 | 12.2 | 11(22.4) | 0 | 1(2) | 4(8.2) | 6(12.2) |
| Never | 311 | 10 | 40(12.9) | 1(0.3) | 23(7.4) | 10(3.2) | 6(1.9) |
| Former | 40 | 77.8 | 23(57.5) | 3(7.5) | 13(32.5) | 5(12.5) | 2(5) |
| **BMI** | | | | | | | |
| <18.5 | 9 | 2.2 | 5(55.5) | 2 | 3 | 0 | 0 |
| 18.5-24.9 | 308 | 77 | 42(13.6) | 1 | 24 | 11 | 6 |
| 25-29.9 | 70 | 17.5 | 22(31.4) | 1 | 9 | 6 | 6 |
| >30 | 13 | 3.3 | 5(38.5) | 0 | 1 | 2 | 2 |
| **Total** | **400** | **100** | **74(18.5)** | **4** | **37** | **19** | **14** |

The estimated prevalence of current smoking was 12.2% with a significant difference between males (21.7%) and females (1.6%).The prevalence of ever smokers (overall 22.2%) was higher in men (36.8%) than in women (5.8%). The prevalence of current smokers was higher in older age groups (individuals >60 years). Also the prevalence of ever smokers was highest (70%) in individuals >70 years of age.

**Table 2:** ***Smoking status of studied population***

| Characteristics | Total number | Never smokers | Ex smokers | Current smokers |
|---|---|---|---|---|
| **Age in years** | | | | |
| 40-50 | 249 | 217(87.2) | 8(3.2) | 24(9.6) |
| 51-60 | 79 | 54(68.3) | 16(20.3) | 9(11.4) |
| 61-70 | 52 | 34(65.4) | 7(13.5) | 11(21.1) |
| >70 | 20 | 6(30) | 9(45) | 5(25) |
| **Sex** | | | | |
| Male | 212 | 134(63.2) | 32(15.1) | 46(21.7) |
| Female | 188 | 177(94.2) | 8(4.2) | 3(1.6) |
| Total | 400 | 311 | 40 | 49 |

**Table 3:** ***Comorbidities in relation to respiratory status***

| Variables | No. Of patient | Heart disease | HTN | Diabetes | Anxiety/ Depression | OA | RA | Osteoporosis | Malignancy |
|---|---|---|---|---|---|---|---|---|---|
| Normal | 326 | 32(9.8) | 84(25.8) | 36(11) | 39(12) | 30(9.2) | 11(3.4) | 43(13.2) | 16(4.9) |
| COPD | 74 | 25(33.8) | 42(56.8) | 18(24.3) | 24(32.4) | 12(16.2) | 7(9.5) | 31(41.9) | 7(9.5) |
| GOLD 1 | 4 | 1(25) | 2(50) | 0 | 1(25) | 0 | 0 | 0 | 0 |
| GOLD 2 | 37 | 14(37.8) | 20(54.1) | 5(13.5) | 9(24.3) | 4(10.8) | 4(10.8) | 12(32.4) | 3(8.1) |
| GOLD 3 | 19 | 6(31.6) | 9(47.4) | 8(42.1) | 6(31.6) | 5(26.3) | 0 | 11(57.9) | 2(10.5) |
| GOLD 4 | 14 | 4(28.6) | 11(78.6) | 5(35.7) | 8(57.1) | 3(21.4) | 3(21.4) | 8(57.1) | 2(14.3) |

The prevalence of various comorbidities and their relationship with respiratory impairment is displayed in Table 3. Hypertension was the most common comorbidity prevalent both in normal individuals and in subjects with COPD, followed by osteoporosis. The prevalence of all comorbidities was higher in subjects with COPD as compared to normal subjects and difference in prevalence of Hypertension, heart disease and anxiety/depression between the two groups was statistically significant (p value < .001).

## DISCUSSION

Our study revealed that 18.5% of urban population in West Bengal had evidence of chronic obstructive pulmonary disease (COPD). This is higher than the expected range of 4% to 10% from international review of COPD prevalence based on spirometry [16]. S K Jindal et al[17]in a multi centric study found the prevalence of COPD in India to be 4.1%. Compared with studies using the same diagnostic criteria (GOLD criteria) in the same age groups (adults > 40 yr of age), the prevalence in our study was higher than that in China (8.2%) [18], Japan (10.9%) [19] and Poland (10.7%) [20]. The prevalence is higher in our study than what has been reported in other studies, the reason possibly being the geographic location, life style, smoking habits, occupational exposure and domestic smoke exposures. The studies carried out in four cities of Latin America (11), however demonstrated a COPD prevalence (12.1-19.7%) comparable to our study. The most recent available data from Kolkata revealed the estimated population prevalence of COPD GOLD stage 1 or above in Kolkata to be 19.3%, comparable to the prevalence in our study [14]. The figures revealed from our study are also somewhat different from the older data from Kolkata city which reveals a prevalence of chronic bronchitis in males as 7.68% in a rural community in individuals above 50 years of age [12] and 5.7% in the urban population of above 30 years of age [13]. Thus the COPD prevalence in Kolkata City has not only increased considerably over the past two decades but also appears to be higher than the rest of the country and most parts of the world.

The prevalence rate of COPD in our study among males was 17.9% and in the females was 19.1%. This higher prevalence of COPD in females may be a result of biomass exposure, which is being considered the most important risk factor in women and still exists as a source of fuel in some urban households, apart from passive exposure to smoking in the family. The trends are different in most of the studies from the world. Kim et al (2005) [21] reported a prevalence of 10.8% and 4.9% in males and females respectively in Korea, Menezes et al (2005)reported a prevalence of 29.3% and 12.8% from Santiago, 11.0% and 5.6% from Mexico city, 27.1% and 19.5% from Montevideo, 15.7% and 10.2% from Caracas, 18.0% and 14.0% from Sao Paulo respectively. Qureshi (1994)[12] has reported the prevalence of 8.39% and 12.21% in Gujjar men and women respectively and 6.62% and 3.62% in non-Gujjar men and women respectively. The higher prevalence in women in Gujjars has been attributed to domestic smoke exposure.

Smoking is a well known risk factor that contributes substantially to COPD [22-25]. COPD was seen in 22.4% of current smokers and 57.5% of former smokers compared to 12.9% of nonsmokers in our study which implies that never smokers are considerably less likely to have COPD than ever smokers. Similar trends i.e. increased prevalence in current smokers have been reported by Kim et al (2005)[21], Shahab et al (2006) [26] and Zhong et al (2007) [18]. Our study also revealed a higher COPD prevalence among ex smokers compared to current smokers. Similar findings were reported by Zhong et al [18] who attributed the same to lifetime bias (ex-smokers possibly lived longer than current smokers). However 54% of COPD patients in our study were nonsmokers, indicating the role

of risk factors other than smoking in the causation of COPD.

Data from epidemiological studies have shown that the prevalence of COPD is higher in those patients with lower BMI [11,18]. In our study, the prevalence of COPD was highest in the underweight group. However the prevalence showed an increasing trend from the normal to the obese group.

The prevalence of co morbidities in our study was significantly higher in individuals with COPD compared to non-COPD subjects. These findings suggest that either the development of respiratory impairment leads to other diseases or that risk factors may lead to the development of both diseases [27,28]. These prevalence values are relatively consistent with those found in previous studies [29,30,31]. This study indirectly indicates that comorbidities have been found to be an important aspect of quality of life in COPD individuals. In addition comorbidities increase the risk of hospitalization and mortality in COPD patients and significantly increase the cost of COPD. In our study we have found that stage 2 of COPD as per GOLD classification has more prevalence of co morbidities, although statistically insignificant, it may be because most COPD individuals in our study fall in this stage.

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