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The evaluation of chronic obstructive pulmonary diseases by gender in Turkey: incidence, prevalence, and mortality

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ABSTRACT

Aim: The aim of this study was to evaluate the incidence and prevalence of chronic obstructive pulmonary disease (COPD) and COPD-related deaths by gender in Turkey.

Methods: The data used in the study, covering the years 1990-2019, were taken from the estimation data prepared for Turkey within the global burden of disease study by the Institute for Health Metrics and Evaluation (IHME). Mann-Whitney test was applied to compare the variables according to gender. Non-parametric Spearman rank correlation coefficient was calculated to determine the relationships between variables.

Results: The difference between the mean ranks of the total number of prevalences, the total number of incidences, and the total number of deaths by gender were statistically significant. A strong and linear association was found between the risk factors and deaths due to COPD.

Conclusion: Policies are needed to decrease the risk factors that lead to the development of COPD. The more risk factors can be controlled, the more lives can be saved.

Keywords: Burden of disease, COPD, risk factors

INTRODUCTION

Environmental and behavioral factors are among the determinants of health and consequently constitute important risk factors for chronic obstructive pulmonary disease (COPD).[1,2] Environmental influences such as smoking, exposure to cigarette smoke (passive smoking), dust, physical and chemical stimuli, and exposure to harmful gases and fumes are among the risk factors of COPD.[3] Aging and incomplete lung development are also risk factors for COPD.[4] The maximum function of the lungs occurs at approximately 20 years of age in women and 25 years of age in men, and it remains stable with little change between 20 to 35 years of age, after which it declines.[5] Interactions between risk factors and genetic traits contribute to the development of COPD.[2]

An approximately 3 million people die from COPD, the third leading cause of death globally,[6] and is prevalent in the middle- and low-income countries.[7] COPD ranked sixth in 2000 and fifth in 2004, rising to fourth between 2005 and 2019 and causing 30.08 deaths per 100,000 people.[8] This study aimed to investigate the incidence, prevalence and risk factors of COPD and deaths related to COPD in Turkey.

Smoking is reported to be the most important behavioral risk factor for COPD.[9-11] Environmental risk factors include exposure to cigarette smoke, even if the person does not smoke, and air pollution.[12] Occupational exposure to dust, chemicals (such as vapors, irritants, and fumes), and ambient air pollution are also prominent as work-related risk factors.[13]

METHODS

Ethics committee decision was not required since publicly accessible data were used in this study. All procedures were carried out in accordance with the ethical rules and the principles.

The data used in the study, covers the period from 1990 to 2019 years, were taken from the estimation data prepared for Turkey within the global burden of disease study by the Institute for Health Metrics and Evaluation (IHME- healthdata.org).14 Study data comprises the number of deaths due to COPD (number of deaths in the population), percentage (proportion of deaths from a specific cause compared to deaths from all causes), and rate (deaths per 100,000 population), as well as risk factors, prevalence, and incidence, by year, gender, and age group. Behavioral risk factors are primarily associated with tobacco and tobacco products, while environmental and occupational risk factors are associated with environmental and workplace air pollutants and inappropriate temperatures. Age 20 is the age at which the lungs reach maximum capacity, and hence the study was started in this age group.

The conformity of the number of deaths, frequency, and rate variables to the normal distribution was analyzed graphically using the Shapiro-Wilk test. Variables analyzed were skewed. Mann-Whitney test was applied to compare the variables according to gender. Non-parametric Spearman rank correlation coefficient was calculated to determine the relationships between variables. MS-Excel 2007 and IBM SPSS Statistics 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) software were used. In statistical decisions, the p<0.05 value was accepted as a sign of a significant difference.

RESULTS

The study's results are presented under three headings: the change in the number of COPD deaths according to years and age groups, the statistical results of the difference according to gender, and the relationship between risk factors.

Changes in the Number of COPD Deaths over Time and by Age Groups

In the study, deaths due to COPD between 1990 and 2019 were analyzed. Results showed that there were 620,041 deaths due to COPD, of which 216,231 were female and 403,810 were male. The distribution of cases according to years and gender is shown in **Figure 1**.

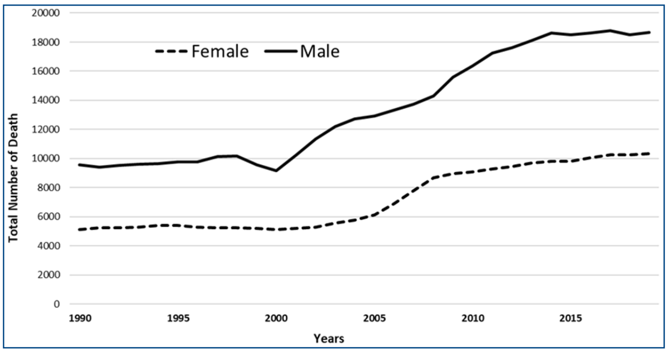

Figure 1. Initial evaluation chest radiograph

While **Figure 1** shows the number of deaths due to COPD, **Figure 2** shows the total number of COPD deaths by age group and sex for the years 1990 to 2019.

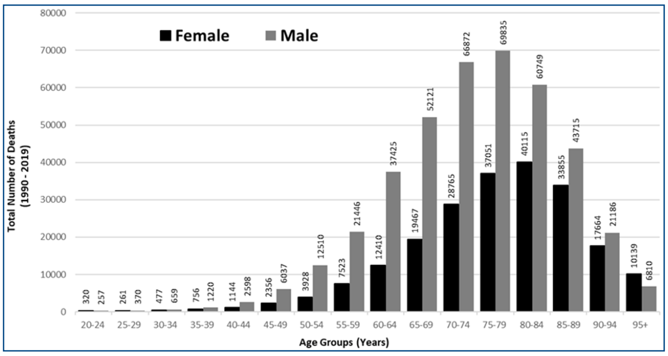

Figure 2. Number of deaths due to COPD by age groups and sex (1990-2019)

Statistical Findings of Difference According to Gender

The difference between the mean ranks of the total number of deaths according to gender was statistically significant (Z=5.603; p<0.001). The number of men who died due to COPD was higher than women. The difference between the mean ranks of the total percentage variable according to gender was also statistically significant (Z=6.553; p<0.001). For the rate of causes of death, COPD deaths in men were found to be higher than COPD deaths in women. The difference between the mean ranks of the total rate variable according to gender was also statistically significant (Z=3.951; p<0.001). The mortality rate of males per 100.000 due to COPD was higher than that of females. These findings are presented in **Table 1** according to the age groups.

The difference between the mean ranks of the prevalence variable according to gender was statistically significant (Z=4.371; p<0.001). The prevalence number was found to be higher in males than in females. The difference between the mean ranks of the incidence variable according to gender was also found to be statistically significant (Z=3.830; p<0.001). The incidence number was found to be higher in males than in females.

Table 1. Number, Percentages and Rates of COPD Deaths by Age Groups and Gender

Age groups (years)	Number *		Percent (%) **		Rate ***	
	Female	Male	Female	Male	Female	Male
20-24	320	257	0.008134	0.003246	0.3	0.3
25-29	261	370	0.006869	0.004590	0.3	0.4
30-34	477	659	0.010524	0.007714	0.6	0.8
35-39	756	1,220	0.012709	0.010650	1.1	1.6
40-44	1,144	2,598	0.014653	0.016886	1.8	4.0
45-49	2,356	6,037	0.021329	0.025485	4.4	10.7
50-54	3,928	12,510	0.025953	0.037844	8.5	26.9
55-59	7,523	21,446	0.035260	0.047488	19.7	55.0
60-64	12,410	37,425	0.040916	0.064759	37.4	118.2
65-69	19,467	52,121	0.047391	0.081380	73.0	220.2
70-74	28,765	66,872	0.054178	0.094378	146.6	390.4
75-79	37,051	69,835	0.060205	0.105840	264.2	611.0
80-84	40,115	60,749	0.061346	0.104377	433.7	857.7
85-89	33,855	43,715	0.061184	0.097732	692.1	1251.0
90-94	17,664	21,186	0.054214	0.086822	912.7	1711.6
95+	10,139	6,810	0.053647	0.065721	1,445.5	2,012.5
Total	216,231	403,810	3.553195	5.343191	4,041.9	7,272.4
Female vs male	Z=5.603; p<0.001		Z=6.553; p<0.001		Z=3.951; p<0.001	

*Number of deaths in the population
**Proportion of deaths for a particular cause relative to deaths from all causes
***Deaths per 100,000 population

Table 2. Mean, Incidence and Prevalence of COPD by Age Groups and Gender

Age groups (years)	Mean of prevalence		Mean of incidence	
	Female	Male	Female	Male
20-24	17,980	18,739	1,489	1,573
25-29	24,208	25,371	1,402	1,494
30-34	29,148	30,643	1,262	1,362
35-39	31,656	33,358	1,122	1,211
40-44	35,915	42,298	3,144	5,974
45-49	52,208	76,761	5,157	9,366
50-54	67,261	100,556	4,667	7,455
55-59	76,257	110,882	4,067	5,886
60-64	80,421	118,080	4,039	9,883
65-69	79,281	130,484	4,002	10,734
70-74	72,170	128,368	3,668	8,267
75-79	61,554	103,304	3,347	5,110
80-84	48,667	72,119	3,014	2,496
85-89	32,104	36,811	2,074	885
90-94	16,205	12,802	992	251
95+	7,196	3,497	402	69
Total	732,231	1,044,073	43,848	72,016
Female vs Male	Z=4.371; p<0.001		Z=3.830; p<0.001	

Risk Factor Relationship

A strong linear relationship (rho=0.969; p<0.001) was found between the number of deaths and the number of behavioral risk factors, as behavioral risks increased the number of deaths due to COPD increased. Similarly, a linear and very strong (rho=0.998; p<0.001) relationship was found between the number of deaths due to COPD and environmental and occupational risk. As the number of people exposed to environmental and occupational risks increased, the number of deaths due to COPD increased. These associations were also found for women (rho=0.972; p<0.001 and rho=0.998; p<0.001, respectively) and men (rho=0.999; p<0.001 and rho=0.999; p<0.001, respectively). For both genders, behavioral, environmental, and occupational risks were strongly linearly associated with deaths due to COPD.

Table 3. Association between Risk Factors and Mortality

Age Group	Death-Behavioral risk number		Death -Environmental and occupational risk	
	r	p	r	p
20-24	N/A	N/A	0.979*	<0.001
25-29	0.477***	<0.001	0.994*	<0.001
30-34	0.839*	<0.001	0.981*	<0.001
35-39	0.981*	<0.001	0.985*	<0.001
40-44	0.994*	<0.001	0.986*	<0.001
45-49	0.994*	<0.001	0.990*	<0.001
50-54	0.985*	<0.001	0.968*	<0.001
55-59	0.998*	<0.001	0.993*	<0.001
60-64	0.994*	<0.001	0.995*	<0.001
65-69	0.993*	<0.001	0.993*	<0.001
70-74	0.999*	<0.001	0.998*	<0.001
75-79	0.878*	<0.001	0.988*	<0.001
80-84	0.820*	<0.001	0.992*	<0.001
85-89	0.757**	<0.001	0.996*	<0.001
90-94	0.672**	<0.001	0.980*	<0.001
95+	0.463***	<0.001	0.995*	<0.001

*Very Strong Relationship, ** Strong Relationship, *** Moderate Relationship

DISCUSSION

According to the study findings, male deaths from COPD are higher than female deaths. Although studies conducted in the past have reported that the prevalence and mortality from COPD were higher in men, it was seen that the prevalence of COPD is almost equal in men and women, especially in developed countries.[13] Women hospitalized with COPD have a better outlook for survival and re-hospitalization than men due to women seeking early care and phenotypic differences between the sexes.[15] Differences in comorbidities in men and women and differences in sex hormones have been reported to be other reasons for gender differences in COPD mortality and prevalence.[16] In this respect, the total results of incidence and prevalence of COPD-related deaths differing in men and women supports the results of current study.

Risk factors appear to have more substantial impact on deaths in the 40-74 age range than in ages outside this range. There is a steady increase in deaths until 80 for men and 84 for women, after which there is a decline. The age range of 50-74 years depicted the highest number of deaths. Smoking, a behavioral risk factor for COPD, is responsible for many cases.[3] This has been attributed to a change in smoking habits, i.e. increased tobacco use in women.[13] On the effectiveness of COPD treatment, it has been reported that women who quit smoking permanently had over two-fold improvement in lung function within the first year compared to men.[17] Smoking habit is essential behavioral risk for COPD.18 In their study, which included 2,501 patients over 40 diagnosed with COPD, smoking was one of the factors associated with mortality in COPD.[19] Among 24,871 participants, 3,473 (7.6% of never-smokers with COPD) examined the COPD risk factors of never-smokers and identified occupational exposure as a risk factor. The described studies show that the relationship between behavioral and environmental risk factors and COPD mortality parallels our research findings.

Women's sensitivity to COPD risk factors differs from men's.[20] Eisner et al.[10] in 2010, reported that consistent associations had been observed between workplace agents and COPD because of occupational exposures through various consistent definitions such as respiratory symptoms, physician diagnosis of COPD and death from COPD. Indeed, exposure to harmful dust and gases is a risk factor for all respiratory diseases. The higher mortality, incidence, and prevalence of COPD in men may be explained by men being more exposed to harmful gases and dust than women. After all, men are more intensively employed in industry than women. Other risk factors for the development of COPD include smoking, occupation, low socioeconomic status, diet and possibly some environmental exposures early in life.[12]

CONCLUSION

Due to the high disease burden of COPD, it is necessary to reduce the negative environmental factors that cause the disease and to make the working environment and lifestyle characteristics healthier with public health policies. The risk of COPD is determined by environmental exposures such as air pollution and cigarette smoke or their interactions, which are exposed from childhood onwards. It is essential to keep children away from these exposures because prevention is better than a cure.

The incidence, prevalence and mortality of COPD are higher in men, with an increase in mortality with age. Deaths from COPD are common in the 50-74 age group and predominantly affect the productive population. Therefore, although it is impossible to eliminate risk factors, macro-level policies should be developed to reduce them. In this way, the adverse effects of death and disability will be prevented, and there will be no loss of productivity.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethics committee decision was not required since publicly accessible data were used in this study.

Informed Consent: Informed consent was not required since publicly accessible data were used.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors had no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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