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Prevalence of Chronic Obstructive Pulmonary Disease in Individuals Over 40 in Central Kayseri

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ABSTRACT

Objective: The present study aims to investigate the prevalence of COPD using spirometry and examine related risk factors, such as exposure to cigarette and biomass smoke, in individuals over the age of 40, in the provincial capital of Kayseri, Turkey.

Materials and Methods: In this cross-sectional study, factors related to the prevalence of COPD were examined in subjects ≥40 years. Patients with airway obstruction (FEV_1/FVC <0.70) were administered salbutamol inhaled at a dose of 400 mcg, and the test was repeated 15 minutes later. Research completed with 386/400, 96.5% participants.

Results: The average age was 53.3±10.9 years. The prevalence of COPD in this study was 17.6%. COPD was found in 13.0% of the women and in 22.0% of the men. The most common stage was GOLD Stage II at 70.6%. The rate of active smokers was 32.6% (27.7% of women and 37.7% of men). After multiple regression analysis, the COPD "at risk" levels for the following groups were determined: individuals with BMI <25, 3.33 times higher, individuals having suffered childhood pneumonia, 2.75 times higher, participants aged 50 and over were 2.41 times higher, patients with an education level of high school or lower were 2.38 times higher, and active smokers were 2.0 times higher.

Conclusion: Increasing health awareness and healthy lifestyles, more efforts to raise the general education level of the community are needed, "at-risk" patients 40 years and over should be screened for COPD, and studies aimed at smoking cessation should be conducted.

Keywords: COPD, GOLD, Kayseri, prevalence

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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD), which is generally characterized as the result of exposure to harmful particles or gasses and resulting in respiratory symptoms and permanent airflow limitation, is a widespread, preventable, and treatable disease (1). The Global Initiative for Chronic Obstructive Lung Disease (GOLD) is accepted as a general partner in the fight against COPD. According to GOLD, COPD is a "preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation." Progressive airflow limitation is seen along with abnormal lung inflammation in reaction to cigarettes, harmful particles, and gasses (2).

COPD is presently accepted as the third common cause of death in the world (3). Because COPD is both preventable and treatable, it is considered a significant public health problem. COPD is a major cause of chronic morbidity and mortality. Many people live with this disease for years and die at an early age as a result of this disease or its complications. Globally, because of the aging population and continued exposure to COPD risk factors, the burden of COPD is expected to increase over the next ten years (4). In 2015, COPD was responsible for more than 3 million deaths worldwide (5). It is estimated that due to the prevalence of cigarette use and the aging population in developed countries, the prevalence of COPD will continue to increase and by 2030, more than 4.5 million people will die annually from COPD and related conditions (6). According to the 2015 Health Statistics Almanac (Sağlık İstatistikleri Yıllığı), 11.1% of the deaths in Turkey were related to "Respiratory System Diseases". In Turkey, "Respiratory System Diseases" are the third most common cause of death, of which COPD constitutes a large portion (7). To clinically diagnose COPD, a spirometer should be used (8). The forced expiratory volume (FEV_1) and forced vital capacity (FVC) ratio (FEV_1/FVC <0.70) is measured one second after application of a bronchodilator. It is accepted that patients who have significant exposure to risk factors and with airflow limitations have COPD. The odds of COPD are increased for individuals over the age of 40 with the following conditions: chronic and progressive shortness of breath, especially during exercise, chronic cough or coughing up sputum, history of recurrent lower respiratory infection, history of exposure to cigarette or biomass smoke, and contact with dust or chemicals in the workplace (1, 9, 10).

In light of the following realities, COPD is considered a serious public health problem in Turkey. Also, COPD is seen as problems are the widespread use of cigarettes, which is one of the risk factors for COPD, insufficient use of spirometry, which is the gold standard for COPD diagnosis, at primary care health centers, observed inadequacies related to diagnosis and treatment of the disease, and insufficient awareness on the part of patients and their relatives (11, 12).

This study aims to develop a resource by confirming the prevalence of COPD in individuals 40 years and older, in the provincial capital of Kayseri, using spirometry and identifying the related risk factors.

MATERIALS and METHODS

Sample: COPD prevalence and related factors in individuals 40 and over, in the provincial capital of Kayseri, between April and June 2017, were examined in this community-based cross-sectional study. A minimum required sample size of 246 people was calculated based on previous studies in Turkey, which identified COPD prevalence as 20.0%, power 80%, α:0.05, and difference=0.05 (13). Exclusion criteria were defined as people who were younger than 40 years of age, had performed heavy physical activity 30 minutes before the test, individuals whose general condition was not sufficient to perform the pulmonary function test, and pregnant women. To attain this sample size, 400 people were gathered and administered a pulmonary function test. Because some individuals were unable to complete the test, the final participant number was 386. This study was approved by the Erciyes University Faculty of Medicine Ethics Committee on August 12, 2016, under resolution number 2016/471. This research was supported by the Erciyes University Scientific Research Project unit under code TTU-2016-7082.

Data Collection

To collect data, a consultation table was set up in three large shopping malls located in the provincial capital of Kayseri. Upon hearing an explanation of the research and giving their informed consent, individuals were added to this study.

Participants completed a 45-question survey. The survey, prepared by the researchers, was based on literature and inquired about the participants' sociodemographic characteristics, respiratory symptoms, and exposure to risk factors, which could be associated with COPD. Additionally, it included the Fagerstrom Test for Nicotine Dependence (FTND), spirometric measurements as recommended in the GOLD Handbook, and a modified version of the Burden of Obstructive Lung Disease (BOLD) COPD Prevalence Survey, originally created to standardize COPD prevalence research.

Spirometric Analysis

A pulmonary function test was administered to each of the research participants using a Vitalgraph ALPHA Touch rechargeable portable spirometer. All of the individuals performed the pulmonary function test while seated. The test was administered to each person at least three times, and the highest values were recorded. Individuals who were determined to have an obstruction (FEV_1/FVC <0.70) during the pulmonary function test were given 400 mcg Salbutamol (Ventolin) by inhaler and the test was repeated 15 minutes later.

Statistical Analysis

As defined by GOLD criteria, participants with FEV_1/FVC <0.70 following bronchodilation were diagnosed with COPD (1). Table 1 includes the frequency tables according to numbers and percentages. Since quantitative data did not conform to normal distribution during analysis, the Mann-Whitney U test was used. The chi-square test was used to compare categorical variables. Binary Logistic regression-backward wald analysis was performed on those variables, which were found to be significant following univariate analysis: sex, age, educational level, BMI, history of childhood pneumonia, cigarette use, and history of exposure to both secondhand smoke and dust in the workplace. The p-value ≤0.05 was considered significant. The data were analyzed using SPSS, version 22.0 software.

RESULTS

The average age of the 386 people who participated in this study was 53.3±10.9 (min: 40–max: 86), with 50.5% of women and 56.2% of men 50 years or older. 30.6% of the participants were housewives, and 40.2% had completed a middle school or lower education. In accordance with GOLD criteria, participants with FEV_1/FVC <0.70 following bronchodilation were diagnosed with COPD. In this study, the prevalence of COPD was 17.6%. Table 2 shows the stages of COPD according to airflow limitation. In this study, the stage with the highest number of patients was GOLD Stage II at 70.6% (Table 2).

32.6% of the total participants were active cigarette smokers: 27.7% of women and 37.7% of men. Table 1 includes the relationship between COPD and the history of cigarette usage. 23.8% of the active smokers, 20.6% of those who had quit smoking and 10.8% of the individuals who had never smoked were diagnosed with COPD. COPD was found to be significantly lower among individuals who had never smoked compared to active smokers and those who had quit smoking (p=0.011) (Table 1).

Among men 50 years and over, who had a history of childhood pneumonia, COPD frequency was found to be significantly high (p=0.001). An increase in the frequency of COPD was observed as participants' educational level decreased (p=0.014) (Table 1).

Upon analysis of the addiction levels of the active smokers in accordance with the FTND, of the women, 50.0% had low addiction, 16.7% had moderate addiction, 20.4% had high addiction, and 13.0% had very high addiction. Of the men, 22.2% had low addiction, 27.8% had moderate addiction, 37.5% had high addiction, and 12.5% had very high addiction.

The relationship between risk factors and the FEV_1/FVC ratio of the individuals who participated in the study are in Table 3. Given that no significant relationship was evident between the FEV_1/FVC ratio and history of exposure to biomass smoke and secondhand smoke, the relationship between the FEV_1/FVC ratio and history of dust in the workplace and cigarette use was significantly lower (Table 3).

Following multiple binary logistic regression analysis of potential risk factors, age, educational level, BMI, history of childhood pneumonia, history of dust in the workplace, and history of cigarette use were all found to be related to COPD. Accordingly, COPD was

Table 1. COPD frequency according to the research group characteristics

Characteristics	COPD diagnosis				Total		
	Positive		Negative				
	n	%	n	%	n	X^2	p
Sex							
Male	42	22.0	149	78.0	191	**4.98**	**0.026**
Female	26	13.3	169	86.7	195		
Age							
40–49	17	10.1	152	89.9	169	**11.83**	**0.001**
50 and over	51	23.5	166	76.5	217		
Educational level							
Middle school and lower[a]	35	22.6	120	77.4	155		
High school[a]	23	19.2	97	80.8	120	**8.50**	**0.014**
University and higher[b]	10	9.0	101	91.0	111		
Economic status							
Good	10	13.7	63	86.3	73	0.95	0.330
Not good	58	18.5	255	81.5	313		
BMI							
Normal[a]	31	32.0	66	68.0	97		
Overweight[b]	22	14.2	133	85.5	155	**18.80**	**0.001**
Obese[b]	15	11.2	119	88.8	134		
Cigarette use							
Active smoker[a]	30	23.8	96	76.2	126		
Quit smoking[a]	21	20.6	81	79.4	102	**9.07**	**0.011**
Never smoked[b]	17	10.8	141	89.2	158		
Childhood pneumonia							
History of pneumonia (+)	12	32.4	25	67.6	37	**4.98**	**0.026**
History of pneumonia (-)	56	16.0	393	84.0	349		

COPD: Chronic obstructive pulmonary disease; BMI: Body mass index; a, b: Groups with different letters are different from one another

Table 2. COPD stages according to FEV_1/FVC ratio

Stage	Number	Percentage
Stage I (mild COPD)	10	14.7
Stage II (moderate COPD)	48	70.6
Stage III (severe COPD)	8	11.8
Stage IV (very severe COPD)	2	2.9
Total	68	100.0

COPD: Chronic obstructive pulmonary disease; FVC: Forced vital capacity; FEV_1: Forced expiratory volume

seen 2.5 times more frequently in individuals aged 50 and over than those 40–49 years of age, twice more frequently in individuals with high school education or lower compared to university or higher, 3.2 times more frequently in individuals with <25 BMI, 2.7 times more frequently in individuals with a history of childhood pneumonia compared to individuals without, and close to twice

more frequently in individuals with a history of cigarette use compared to individuals who had never smoked (Table 4).

DISCUSSION

In this study, in accordance with GOLD criteria, participants with FEV_1/FVC <0.70 following bronchodilation were diagnosed as having COPD, resulting in a 17.6% prevalence of COPD in the population over 40 in the provincial capital of Kayseri. Other studies have shown the prevalence of COPD in Turkey to be between 10.2% and 19.1% (14–17). The results of this study are consistent.

In this study, of the patients diagnosed with COPD, the category with the highest number of patients was GOLD Stage II at 70.6%. In a study conducted by Arıkan et al. (18), 43.2% of the patients who were identified as having COPD were at GOLD Stage II, as were 58.8% of the total patients with COPD in a study by Örnek et al. (19). The high frequency of Stage II patients may be due to a few factors, namely patients at earlier stages might not consider their health complaints severe enough to consult with a doctor, and

Table 3. Relationship of the risk factors and FEV_1/FVC

Risk factors	n	FEV_1/FVC (Mean±SD) Median (min.–max.)	U	p
History of dust in the workplace (+)	74	74.68±12.02 77.5 (31.0–95.0)	9783	0.041
History of dust in the workplace (-)	312	77.23±8.90 79.0 (36.0–98.0)		
Exposure to biomass smoke (+)	102	77.59±9.55 78.0 (37.0–95.0)	14401	0.932
Exposure to biomass smoke (-)	284	77.55±9.79 79.0 (31.0–98.0)		
Exposure to secondhand smoke (+)	129	78.73±9.54 81.0 (43.0–97.0)	14600	0.056
Exposure to secondhand smoke (-)	257	76.97±9.77 78.0 (31.0–98.0)		
Cigarette use (+)	228	75.90±9.55 77 (31.0–97.0)	13074	0.001
Cigarette use (-)	158	79.95±9.50 80.5 (37.0–98.0)		
Total	386	77.56±9.72 79.0 (31.0–98.0)		

FVC: Forced vital capacity; FEV_1: Forced expiratory volume

the majority of cases are discovered by chance or through involvement in studies, such as this one. Additionally, due to limitations in mobility and difficulty related to leaving the house, given that our consultation tables were set up in shopping malls might have made it impossible for many Stage III and IV patients to participate.

In our study, 13.3% of the women and 22.0% of men in the study were identified as having COPD. In a study conducted in Izmir, using GOLD criteria, COPD prevalence was 10.2% (13.3% of men and 7.3% of women) (14). In a pre-diagnosis study examining the COPD risk factors conducted in the provincial capital of Isparta, 30.0% of participants presented with two or more COPD symptoms (40.0% of men and 23.0% of women) (20). In a study by Deveci et al. (16) in June–July 2007, conducted in line with BOLD protocol in Elazığ, the prevalence of COPD among individuals 45 and over was 11.5% (5.9% of women and15.1% of men). Similarly, in Kocaeli, in a study, including 946 people who utilized the BOLD survey and spirometry pulmonary function test, the prevalence of COPD of participants over 40 was 13.3% (8.7% of women and16.5% of men) (15).

While studies worldwide generally produce similar results, some studies have shown men and women to have similar levels of prevalence of COPD and still others have shown a higher prevalence among women. In a systematic meta-analysis study, it was reported that COPD prevalence was 5.6% in women and 9.8% in men (21). A US study with 18 years and older individuals found COPD prevalence in women to be higher, 6.1% in women and 4.1% in men (22). A Dutch study reported a decrease in COPD

prevalence over time; in 1980, COPD prevalence age 40 and over was 7.27%, and in 2006, it was 5.44% (23). In that study, it was suggested that the results could be related to a rapid decrease in cigarette use among men in Holland from 1960 to 1981, whereas the decrease in cigarette use among women was delayed. In an Austrian study utilizing the spirometry pulmonary function test, COPD prevalence age 40 and over was found to be equal for men and women, 26.1% (24). In our study, the lower level of cigarette use among women might be the reason that frequency of COPD was higher in men.

Upon close examination of studies in literature, a correlation can be seen between an increase in the frequency of COPD and age (15, 16, 18, 19). Following logistic regression analysis, it was seen that COPD in individuals 50 years and older was 2.5 times more frequent than individuals 40–49 years of age. Due to the increased length of exposure to lung irritants and risk factors related to advanced age, the possibility of COPD increases, Additionally, deficiencies in pulmonary defense mechanisms related to aging may provide a foundation for the development of COPD.

In individuals with university education and higher, COPD frequency was found to be lower. In the study by Deveci et al. (16), the level of COPD among the rural population was found to be significantly higher, while the educational level of the rural population was lower. In a study conducted in Finland, a low educational level was identified as a risk factor at a rate of 1.8 times (25). In a study in Sweden by Thorn et al. (26), a low educational level was linked to a 3.2 times increase in chronic bronchitis. In our study, COPD was observed twice more frequently among individuals with high school education or lower than those with a higher educational level. The higher frequency of COPD among people with a lower educational level may be due to their higher rate of cigarette use, their exposure to a more harmful workplace and environmental factors, and the relationship between low educational level and poorer living and working conditions.

In a study in Copenhagen, it was reported that the average BMI of individuals with COPD was lower (27). In a study by Quach et al. (28) in France, obese individuals were found to be at lower risk of COPD. The answer to the question of whether people with low BMI is more at risk for COPD or whether those with COPD have lower BMI is not yet clear (28). Similarly, in our study, COPD was seen more frequently in individuals with normal BMI. Since participants were not asked to indicate time periods related to bodyweight on the questionnaire, it is difficult to ascertain the relationship between COPD and BMI. In a study conducted by Blanc et al. (29), occupational exposure to dust, smoke, and gasses was determined to increase COPD risk 2.11 times. Our findings were similar. Dust and other particles present in the workplace can cause irritation and play a role in the development of COPD by damaging lung function. 32.4% of participants with a history of childhood pneumonia were diagnosed with COPD. In a study by Todisco T. et al. (30), it was seen that lung infections during childhood resulted in lower FEV_1 and FVC averages in adulthood and increased the risk of COPD. Lung infections during childhood, which result in the reduction of maximum lung function capacity when measured by spirometry, and low averages of FEV_1 and FVC, may contribute to the development of COPD.

Table 4. Univariate and Multiple Binary Logistic regression analysis of the factors that influence instances of COPD

Factors	Univariate Binary Logistic Regression		Multiple Binary Logistic Regression	
	Odds ratio 95% CI	p	Odds ratio 95% CI	p
Sex*				
Female	1	0.027		
Male	1.83 (1.07–3.13)			
Age				
40-49 years	1	0.001	1	0.005
≥50 years	2.74 (1.52–4.96)		2.51 (1.32–4.77)	
Educational level				
University and higher	1	0.006	1	0.043
High school and lower	2.70 (1.32–5.50)		2.19 (1.02–4.67)	
BMI				
≥25	1	0.001	1	0.001
<25	3.20 (1.84–5.54)		3.88 (2.13–7.06)	
Childhood pneumonia				
History of pneumonia (-)	1	0.015	1	0.019
History of pneumonia (+)	2.51 (1.19–5.29)		2.68 (1.17–6.11)	
History of dust in the workplace				
Dust in the workplace (-)	1	0.020	1	0.024
Dust in the workplace (+)	2.04 (1.12–3.70)		2.13 (1.10–4.11)	
Exposure to secondhand smoke*				
Second-hand smoke (-)	1	0.441		
Second-hand smoke (+)	1.25 (0.70–2.21)			
History of cigarette use				
Cigarette use (-)	1	0.004	1	0.041
Cigarette use (+)	2.39 (1.32–4.31)		1.93 (1.02–3.64)	

COPD: Chronic obstructive pulmonary disease; CI: Confidence interval; BMI: Body mass index; *: These variables are eliminated with the Backward: Wald method

Strengths of this Study

It is expected that the data that have been obtained through this initial prevalence study in accordance with the GOLD criteria in the provincial capital of Kayseri will lead the way for future studies. The results are objective due to the use of spirometry as criteria for diagnosis and repetition of measurements following bronchodilator.

Limitations of this Study

The results might be influenced by that data were only collected from individuals who approached our consultation sites at local shopping malls and agreed to be voluntarily measured. Because this study was carried out in the city, living conditions present in rural areas and factors found there that could influence development of COPD may have been overlooked.

CONCLUSION

The findings obtained in this study showed that the prevalence of COPD among people 40 years and over in the provincial capital of Kayseri was found to be 17.6%. One of the most sig-nificant risk factors for COPD is the history of cigarette use. In this study, the 75.0% of the individuals with a history of cigarette use, 27.7% of them were women and 37.7% of them were men, who were still active smokers. Based on these two conclusions, efforts to reduce smoking among both genders are recommended.

70.6% of the individuals diagnosed with COPD were at GOLD Stage II. In order for COPD to be diagnosed at earlier stages, people need to increase the frequency of their visits to health centers and more efforts should be organized to increase information and raise awareness about COPD among the general population. Because COPD was found two times more frequently in individuals with a history of exposure to dust in the workplace, it is thought that taking necessary precautions in the workplace will reduce the development of COPD. Future studies examining the relationship between COPD and body weight are needed.

REFERENCES

1. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2019. Available from: URL: http://goldcopd.org.

2. Anzueto A, Miravitlles M. Considerations for the Correct Diagnosis of COPD and Its Management With Bronchodilators. Chest 2018; 154(2): 242–8. [CrossRef]

3. World Health Organization. The top 10 causes of death. Available from: URL: https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death.

4. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 2006; 3(11): e442. [CrossRef]

5. GBD 2015 Chronic Respiratory Disease Collaborators. Global, regional, and national deaths, prevalence, disability-adjusted life years, and years lived with disability for chronic obstructive pulmonary disease and asthma, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Respir Med 2017; 5(9): 691–706.

6. World Health Organization. Projections of mortality and causes of death, 2015 and 2030. Available from: URL: https://www.who.int/healthinfo/global_burden_disease/projections2015_2030/en/. Geneva: WHO; 2014.

7. Republic of Turkey Ministry of Health General Directorate of Health Research. Republic of Turkey Ministry of Health Health Statistics Yearbook 2016. Ankara, 2017.

8. Buist AS, McBurnie MA, Vollmer WM, Gillespie S, Burney P, Mannino DM, et al; BOLD Collaborative Research Group. International variation in the prevalence of COPD (the BOLD Study): a population-based prevalence study. Lancet 2007; 370: 741–50. [CrossRef]

9. Kocabaş A, Atış S, Çöplü L, Erdinç E, Ergan B, Gürgün A, et al; Turkish Thoracic Society COPD Work Group. Chronic obstructive pulmonary disease (COPD), Preventive, diagnosis and therapy report 2014. Available from: URL: https://www.chiesi.com.tr/img/download/documenti/363_ttd-koah-tani-ve-tedav-C4-B0-raporu-2014.pdf.

10. Qaseem A, Wilt TJ, Weinberger SE, Hanania NA, Criner G, van der Molen T, et al; American College of Physicians; American College of Chest Physicians; American Thoracic Society; European Respiratory Society. Diagnosis and management of stable chronic obstructive pulmonary disease: a clinical practice guideline update from the American College of Physicians, American College of Chest Physicians, American Thoracic Society, and

European Respiratory Society. Ann Intern Med 2011; 155(3): 179–91. [CrossRef]

11. Doğanay S, Sözmen K, Kalaça S, Ünal B. How Has The Prevalence Of Smoking Changed in Turkey?. Turkish J Public Health 2012; 10(2): 93–115. [CrossRef]

12. Yıldız F, Bingöl Karakoç G, Ersu Hamutçu R, Yardım N, Ekıncı B, Yorgancıoğlu A. The evaluation of asthma and COPD awareness in Turkey (GARD Turkey Project-National Control Program of Chronic Airway Diseases). Tuberk Toraks 2013; 61(3): 175–82. [CrossRef]

13. Gunen H, Hacievliyagil SS, Yetkin O, Gulbas G, Mutlu LC, Pehlivan E. Prevalence of COPD: first epidemiological study of a large region in Turkey. Eur J Intern Med 2008; 19(7): 499–504. [CrossRef]

14. Abul Y, Özlü T. Epidemiology of COPD in Turkey. Güncel Göğüs Hastalıkları Serisi 2013; 1(1): 7–12.

15. Arslan Z, Ilgazlı A, Etiler N, Hamzaoğlu O. Prevalence of chronic obstructive pulmonary disease in kocaeli: an industrialised city in Turkey. Balkan Med J 2013; 30(4): 387–93. [CrossRef]

16. Deveci F, Deveci SE, Türkoğlu S, Turgut T, Kirkil G, Rahman S, et al. The prevalence of chronic obstructive pulmonary disease in Elazig, Eastern Turkey. Eur J Intern Med 2011; 22(2): 172–6.

17. Tutar N, Yeşilkaya S, Memetoğlu ME, Özel D, Boşnak E. The prevalence of chronic bronchitis in adults living in the center of Gumushane. Tuberk Toraks 2013; 61(3): 209–15. [CrossRef]

18. Arıkan İ. The Field Application of Turkey Chronic Airways Diseases Prevention and Control Program: Prevalence of Copd and Related Factors in the Burdur Population 40 Over Aged. Turkiye Klinikleri Archives of Lung 2014; 15(1): 8–17.

19. Örnek T, Tor M, Kıran S, Atalay F. Prevalence of chronic obstructive pulmonary disease in Zonguldak province of Turkey. Tuberk Toraks 2015; 63(3): 170–7. [CrossRef]

20. Akgün D. Prevalence of Pre-diagnosed COPD in Isparta Provience and the Related Factors. Turkish Thoracic J 2013; 14(2): 43–7. [CrossRef]

21. Halbert RJ, Natoli JL, Gano A, Badamgarav E, Buist AS, Mannino DM. Global burden of COPD: systematic review and meta-analysis. Eur Respir J 2006; 28(3): 523–32. [CrossRef]

22. Akinbami LJ, Liu X. Chronic obstructive pulmonary disease among adults aged 18 and over in the United States, 1998-2009. NCHS Data Brief 2011; (63): 1–8.

23. Bischoff EW, Schermer TR, Bor H, Brown P, van Weel C, van den Bosch WJ. Trends in COPD prevalence and exacerbation rates in Dutch primary care. Br J Gen Pract 2009; 59(569): 927–33. [CrossRef]

24. Schirnhofer L, Lamprecht B, Vollmer WM, Allison MJ, Studnicka M, Jensen RL, et al. COPD prevalence in Salzburg, Austria: results from the Burden of Obstructive Lung Disease (BOLD) Study. Chest 2007; 131(1): 29–36. [CrossRef]

25. Kanervisto M, Vasankari T, Laitinen T, Heliövaara M, Jousilahti P, Saarelainen S. Low socioeconomic status is associated with chronic obstructive airway diseases. Respir Med 2011; 105(8): 1140–6. [CrossRef]

26. Thorn J, Björkelund C, Bengtsson C, Guo X, Lissner L, Sundh V. Low socio-economic status, smoking, mental stress and obesity predict obstructive symptoms in women, but only smoking also predicts subsequent experience of poor health. Int J Med Sci 2006; 4(1): 7–12. [CrossRef]

27. Agustí A, Hogg JC. Update on the Pathogenesis of Chronic Obstructive Pulmonary Disease. N Engl J Med 2019; 381(13):

1248–56. [CrossRef]

28. Quach A, Giovannelli J, Chérot-Kornobis N, Ciuchete A, Clément G, Matran R, et al. Prevalence and underdiagnosis of airway obstruction among middle-aged adults in northern France: The ELISABET study 2011-2013. Respir Med 2015; 109(12): 1553–61. [CrossRef]

29. Blanc PD, Iribarren C, Trupin L, Earnest G, Katz PP, Balmes J, et al. Occupational exposures and the risk of COPD: dusty trades revisited. Thorax 2009; 64(1): 6–12. [CrossRef]

30. Todisco T, de Benedictis FM, Iannacci L, Baglioni S, Eslami A, Todisco E, et al. Mild prematurity and respiratory functions. Eur J Pediatr 1993; 152(1): 55–8. [CrossRef]